

বাংলা (সাম্মানিক) পাঠ-ওয়ান পাঠ-টু এবং পাঠ-থ্রি পরীক্ষার জন্য প্রস্তুত পাঠ্যসূচি

১। কলিকাতা বিশ্ববিদ্যালয় থেকে প্রকাশিত পাঠ্যসূচিতে যে-ভাবে নম্বর ভাগ করা হয়েছে তা অনুসরণ করতে হবে।

২। পাঠ্যতালিকা বহির্ভূত প্রশ্ন কোনোভাবেই করা চলবে না। এ বিষয়ে সতর্কতা বিশেষভাবে কাম্য।

৩। প্রত্যেক পত্রে বড়ো বা রচনাধর্মী প্রশ্নের মান ১০, ১৫ অথবা ২০। তবে এক্ষেত্রে দুটি বা তিনটি অন্তর্বিভাগ থাকতে পারে। যেমন, ১০-এর ক্ষেত্রে $২+৩+৫=১০$, কিংবা ২০-এর ক্ষেত্রে

$১০+১০=২০$ ।

৪। প্রত্যেক পত্রে বিষয় অনুযায়ী ৫ নম্বর মানের ছোট প্রশ্ন থাকবে। এক্ষেত্রে প্রধানত প্রশ্নের উৎস ও প্রসঙ্গ উল্লেখসহ তাৎপর্যধর্মী উত্তর অভিপ্রেত।

৫। পাঠ্য রচনা থেকে উদ্ধৃতিসহ প্রশ্ন যেমন থাকবে তেমনি তুলনামূলক, আলোচনাধর্মী প্রশ্নও রাখা হবে। উদ্ধৃতি অবশ্যই বিশ্ববিদ্যালয় নির্ধারিত পাঠ্যগ্রন্থ থেকে গ্রহণীয়।

৬। টীকা অথবা ব্যাখ্যামূলক পাঁচ নম্বরের ছোট প্রশ্নের জন্য কমবেশী একশো শব্দ, দশ নম্বরের মাঝারি প্রশ্নের জন্য দুশো শব্দ, পনেরো বা ষোল নম্বরের বড়ো প্রশ্নের জন্য তিনশো শব্দ, এবং (যদি থাকে) কুড়ি নম্বরের প্রশ্নের জন্য তিনশো পঞ্চাশ শব্দের মাপ আদর্শ বিবেচিত হতে পারে।

বাংলা - সাম্মানিক

পার্ট - ১

প্রথম পত্র - ১০০

বাংলা সাহিত্যের ইতিহাস

মোট নম্বর - ৭০

বড়ো প্রশ্ন

- ১৫ x ৩ = ৪৫ প্রাক্ আধুনিক = ১৫ (দুটি প্রশ্ন থাকবে, একটি উত্তর করতে হবে)
উনিশ শতক = ১৫ (দুটি প্রশ্ন থাকবে, একটি উত্তর করতে হবে)
বিশ শতক = ১৫ (দুটি প্রশ্ন থাকবে, একটি উত্তর করতে হবে)

মাঝারি প্রশ্ন

- ১০ x ১ = ১০ (তিনটি যুগ থেকে তিনটি প্রশ্ন থাকবে, একটি উত্তর করতে হবে)

টীকা

- ৫ x ৩ = ১৫ (তিনটি যুগ থেকে নয়টি টীকা থাকবে)

ক) বাংলা সাহিত্যের ইতিহাস

প্রাচীন ও মধ্যযুগ :

ভূমিকা : আর্থ-সামাজিক ও রাজনৈতিক পটভূমিকায় বাংলা ভাষা, জাতি, সাহিত্য ও সংস্কৃতির সংক্ষিপ্ত পরিচয় ।

চর্যাপদ [দেশ-কাল-ভাষা-সাহিত্য-সমাজ-সংস্কৃতির চিত্র] ।

তুর্কি আক্রমণ ও তার প্রতিক্রিয়া [সমাজ ও সাহিত্যে]

বড়ু চণ্ডীদাস ও শ্রীকৃষ্ণকীর্তন

অনুবাদ সাহিত্য : রামায়ণ, ভাগবত ও মহাভারত ।

বৈষ্ণব পদাবলী : পদাবলীর বৈশিষ্ট্য এবং বিশেষ গুরুত্ব সহ বিদ্যাপতি চণ্ডীদাস বলরাম দাস জ্ঞানদাস

গোবিন্দদাস চর্চা ।

চৈতন্যজীবন ও জীবনী সাহিত্য : চৈতন্য জীবনকথা, সাহিত্য ও সমাজে চৈতন্য প্রভাব, জীবনী সাহিত্য [

বিশেষ গুরুত্ব সহ পাঠ : বৃন্দাবন দাস, লোচন দাস, জয়ানন্দ, কৃষ্ণদাস কবিরাজ] ।

মঙ্গলকাব্যের উদ্ভব ও বিবর্তন : সংজ্ঞা, বৈশিষ্ট্য, সমাজ [মনসামঙ্গল চণ্ডীমঙ্গল ধর্মমঙ্গল শিবায়ন ও

অন্নদামঙ্গল], বিশেষ গুরুত্ব সহ পাঠ : নারায়ণ দেব, বিজয় গুপ্ত, বিপ্রদাস পিপিলাই, কেতকাদাস ক্ষেমানন্দ,

দ্বিজমাধব, কবিকঙ্কণ মুকুন্দ চক্রবর্তী, রূপরাম চক্রবর্তী, ঘনরাম চক্রবর্তী, রামেশ্বর ভট্টাচার্য, রায়গুণাকর

ভারতচন্দ্র ।

প্রণয়োপাখ্যান : দৌলত কাজী, আলাওল ।

শাক্ত পদাবলী : উদ্ভবের পটভূমি ও সাধারণ পরিচয় । বিশেষ গুরুত্ব সহ পাঠ : রামপ্রসাদ সেন ও

কমলাকান্ত ভট্টাচার্য ।

উনিশ-বিশ শতকের আর্থ-সামাজিক পটভূমি ।

গদ্য ও প্রবন্ধ : বাংলা গদ্যের বিকাশে শ্রীরামপুর মিশন ও ফোর্ট উইলিয়াম কলেজের অবদান , রাজা রামমোহন রায়, ঈশ্বরচন্দ্র বিদ্যাসাগর, অক্ষয়কুমার দত্ত, প্যারীচাঁদ মিত্র, কালীপ্রসন্ন সিংহ, বঙ্কিমচন্দ্র চট্টোপাধ্যায়, মীর মসাররফ হোসেন, রবীন্দ্রনাথ ঠাকুর, বিবেকানন্দ, রামেন্দ্রসুন্দর ত্রিবেদী, অবনীন্দ্রনাথ ঠাকুর, প্রমথ চৌধুরি, গোপাল হালদার, বুদ্ধদেব বসু ।

সাময়িক পত্র : আবির্ভাব, পরিচিতি, অবদান, দিগ্‌দর্শন থেকে কৃষ্ণিবাস [বিশেষ অভিনিবেশ সহ পাঠ : সমাচার দর্পণ সংবাদ প্রভাকর তত্ত্ববোধিনী বঙ্গদর্শন ভারতী সবুজপত্র কল্লোল পরিচয় কৃষ্ণিবাস] ।

কাব্য ও কবিতা : ঈশ্বরচন্দ্র গুপ্ত, রঙ্গলাল বন্দ্যোপাধ্যায়, মধুসূদন দত্ত, হেমচন্দ্র বন্দ্যোপাধ্যায়, নবীনচন্দ্র সেন, বিহারীলাল চক্রবর্তী, রবীন্দ্রনাথ ঠাকুর, সত্যেন্দ্রনাথ দত্ত, যতীন্দ্রনাথ সেনগুপ্ত, মোহিতলাল মজুমদার, নজরুল ইসলাম, জসীমউদ্দীন, জীবনানন্দ দাশ, সুধীন্দ্রনাথ দত্ত, প্রেমেন্দ্র মিত্র, অমিয় চক্রবর্তী, বিষ্ণু দে, সমর সেন, সুভাষ মুখোপাধ্যায়, বীরেন্দ্র চট্টোপাধ্যায়, সুকান্ত ভট্টাচার্য, নীরেন্দ্রনাথ চক্রবর্তী ।

নাটক-প্রহসন : সূচনা, বাংলা নাটকের উদ্ভব ও বিকাশ, রামনারায়ণ তর্করত্ন, মধুসূদন দত্ত, দীনবন্ধু মিত্র, গিরিশচন্দ্র ঘোষ, দ্বিজেন্দ্রলাল রায়, রবীন্দ্রনাথ ঠাকুর, বিজন ভট্টাচার্য, তুলসী লাহিড়ী, মন্থাথ রায়, দিগিন্দ্রচন্দ্র বন্দ্যোপাধ্যায়, উৎপল দত্ত ।

উপন্যাস ও ছোটগল্প : উদ্ভব : বঙ্কিমচন্দ্র চট্টোপাধ্যায়, রবীন্দ্রনাথ ঠাকুর, প্রভাত মুখোপাধ্যায়, শরৎচন্দ্র চট্টোপাধ্যায়, বিভূতিভূষণ বন্দ্যোপাধ্যায়, তারাশঙ্কর বন্দ্যোপাধ্যায়, জগদীশ গুপ্ত, মানিক বন্দ্যোপাধ্যায়, পরশুরাম, প্রেমেন্দ্র মিত্র, সতীনাথ ভাদুড়ী, আশাপূর্ণা দেবী, সুবোধ ঘোষ, সোমেন চন্দ, সৈয়দ ওয়ালিউল্লাহ, সমরেশ বসু ।

খ) বাংলা ভাষার ইতিহাস :-

১৫X ২ = ৩০

নিম্নলিখিত বিষয় সমূহ :

১) প্রাচীন ভারতীয় আর্য ভাষা থেকে আধুনিক ভারতীয় আর্য ভাষার বিবর্তন ।

২) বাংলা ভাষার উদ্ভব এবং প্রাচীন বাংলা , আদি-মধ্য ও অন্ত-মধ্য বাংলা ভাষার ভাষাতাত্ত্বিক লক্ষণ ।

৩) সাধু ও চলিত ভাষার সংজ্ঞা, বৈশিষ্ট্য ও দৃষ্টান্ত সহ পার্থক্য ।

৪) ভাষা-উপভাষা -- কয়েকটি বাংলা উপভাষার বৈশিষ্ট্য ।

৫) বাংলা ভাষার ধ্বনি পরিবর্তনের রীতি ও প্রকৃতি ।

৬) বাংলা ভাষার শব্দভাণ্ডার ও শব্দ-বিবর্তন ।

৭) শব্দার্থ পরিবর্তন ।

দ্বিতীয় পত্র - ১০০

ক) কথা সাহিত্যের রূপভেদ : (রোমান্স, উপন্যাস : ঐতিহাসিক, সামাজিক, রাজনৈতিক, আঞ্চলিক, মনস্তাত্ত্বিক ও চেতনাপ্রবাহরীতি এবং ছোটগল্প) ।

$$20/02 (10+10)=20$$

খ) উপন্যাস :

$$20 \times 8 = 80$$

১) চন্দ্রশেখর -- বঙ্কিমচন্দ্র চট্টোপাধ্যায়

$$15 + 5 = 20$$

২) শেষের কবিতা - রবীন্দ্রনাথ ঠাকুর

$$15 + 5 = 20$$

৩) শ্রীকান্ত (১ম পর্ব) -- শরৎচন্দ্র চট্টোপাধ্যায়

$$15 + 5 = 20$$

৪) হাঁসুলী বাঁকের উপকথা - তারাশঙ্কর বন্দ্যোপাধ্যায়

$$15 + 5 = 20$$

পার্ট - ২

তৃতীয় পত্র - ১০০

ক) ছন্দ :

$$12+8 = 20$$

দল/অক্ষর । কলা, মাত্রা । যতি, যতিলোপ । পর্ব । পঙক্তি/চরণ । ছত্র । পদ । বাংলা ছন্দের ত্রিধারা -- মিশ্রকলাবৃত্ত / মিশ্রবৃত্ত / তান প্রধান / অক্ষরবৃত্ত । সরলকলাবৃত্ত / কলাবৃত্ত / ধ্বনি প্রধান / মাত্রাবৃত্ত । দলবৃত্ত / শ্বাসাঘাত প্রধান / বলবৃত্ত । স্বরবৃত্ত / ছড়ার ছন্দ / লৌকিক ছন্দ ।

ছন্দোলিপি / ছন্দ বিশ্লেষণের নিয়ম / বাংলা ছন্দের কয়েকটি রূপবন্ধের পরিচয় ও উদাহরণ সহ আলোচনা (পয়ার, সনেট, অমিত্রাক্ষর, মুক্তক, গদ্যছন্দ) ।

খ) অলংকার :

$$12+8 = 20$$

শব্দালঙ্কার : অনুপ্রাস, শ্লেষ, যমক, বক্রোক্তি, অর্থালঙ্কার : উপমা, রূপক, সমাসোক্তি, উৎপ্রেক্ষা, অপহৃতি, দৃষ্টান্ত, ব্যতিরেক, বিরোধ, অর্থান্তরন্যাস, ব্যাজস্ততি, (সংজ্ঞা, উদাহরণ, অলংকার নির্ণয়) ।

গ) বৈষ্ণব পদাবলী (ক.বি. সংস্করণ)

$$15+5 = 20$$

নিম্নলিখিত পদ সমূহ :

১) নীরদনয়নে নীর ঘন সিঞ্চনে ২) আজু হাম কি পেখলুঁ নবদ্বীপ চন্দ ৩) দাঁড়াইয়া নন্দের আগে গোপাল কান্দে অনুরাগে ৪) ঘরের বাহিরে দণ্ডে শতবার ৫) রূপলাগি আঁখি বুঝে গুণে মন ভোর ৬) এমন পিরীতি কভু নাহি দেখি গুনি ৭) সখি কি পুছসি অনুভব মোয় ৮) কণ্টক গাড়ি কমল-সম পদতল ৯) মন্দির বাহির কঠিন কপাট ১০) কি মোহিনী জান বঁধু কি মোহিনী জান ১১) বঁধু তুমি যে আমার প্রাণ ১২) এ সখি হামারি দুখের নাহি ওর ১৩) অক্ষুর তপন তাপে যদি জারব ১৪) বছদিন পরে বঁধুয়া এলে ১৫) তাতল সৈকত বারি-বিন্দুসম ।

ঘ) শাক্ত পদাবলী (ক.বি. সংস্করণ)

$$15+5 = 20$$

নিম্নলিখিত পদসমূহ :

বাল্যলীলা : ১) গিরিবর, আর আমি পারি নে হে, প্রবোধ দিতে উমারে (২) , সংখ্যক

আগমনী : * ২) গিরি, এবার আমার উমা এলে (৭)

৩) কবে যাবে বল গিরিরাজ (১৮)

৪) বারে বারে কহ রাণি, গৌরী আনিবারে (২৯)

৫) ওহে হর গঙ্গাধর , কর অঙ্গীকার (৩৬)

* ৬) গিরিরাণি, এই নাও তোমার উমারে (৩৮)

বিজয়া : * ৭) ওরে নবমী নিশি, না হইওরে (৮৭)

* ৮) ওহে প্রাণনাথ গিরিবর হে (৯৭)

ভক্তের আকৃতি : ৯) কেবল আসার আশা , তবে আসা (১৫৭)

১০) মাগো তারা ও শঙ্করি (১৬৩)

- ১১) মা আমায় ঘুরাবে কত (১৬৫)
 ১২) আমি কি দুখে ডরাই ? (১৮১)
 ১৩) আমায় দেও মা তবিলদারী (২০১)
 ১৪) এমন দিন কি হবে তারা (২১৩)
 ১৫) যশোদা নাচাতো গো মা বলে নীলমণি (২২১)

ঙ) মুকুন্দ চক্রবর্তী -- চণ্ডীমঙ্গল ১ম খণ্ড (ক.বি. সংস্করণ) ১৫+৫ = ২০
 (মুকুন্দের গ্রহোৎপত্তির কারণ ও আত্মবিবরণী এবং কালকেতু-ফুল্লরার উপাখ্যান)।

চতুর্থ পত্র -১০০

- ক) নাটকের রূপভেদ :- ২০ ০২, ১০+১০ = ২০
 (ট্রাজেডি, কমেডি, প্রহসন, মেলোড্রামা, রূপক, সাংকেতিক, পৌরাণিক, ঐতিহাসিক, সামাজিক, অ্যাবসার্ড, একাঙ্ক)
- খ) বঙ্গরঙ্গমঞ্চের ইতিহাস [সূচনা থেকে নাট্য-নিয়ন্ত্রণ বিল (১৮৭৬, মার্চ) পর্যন্ত] ২০
 নিম্নলিখিত বিষয় সমূহ :-
 লেবেডফ ও বেঙ্গলী থিয়েটার, নবীনচন্দ্র বসুর শ্যামবাজার থিয়েটার, বেলগাছিয়া নাট্যশালা, জোড়াসাঁকো নাট্যশালা, বাগবাজার অ্যামেচার থিয়েটার(শ্যামবাজার নাট্যসমাজ) , ন্যাশনাল থিয়েটার (প্রতিষ্ঠা, তাৎপর্য - প্রথম ও দ্বিতীয় পর্ব), নাট্য নিয়ন্ত্রণ বিল ।
- গ) একেই কি বলে সভ্যতা ও বুড়ো শালিখের ঘাড়ের রৌ - মধুসূদন দত্ত ১০ + ১০ = ২০
 (দুটি থেকেই উত্তর লিখতে হবে)
- ঘ) মুক্তধারা - রবীন্দ্রনাথ ঠাকুর ১৫ + ৫ = ২০
- ঙ) টিনের তলোয়ার - উৎপল দত্ত ১৫ + ৫ = ২০

পার্ট - ৩
পঞ্চম পত্র - ১০০

ক) কাব্যের রূপভেদ (আখ্যানকাব্য-গাথাকাব্য, মহাকাব্য, গীতিকাব্য, পত্রকাব্য ও সনেট) 2001-2012=20

খ) বীরাজনা - মধুসূদন দত্ত ১৬

নিম্নলিখিত পত্রসমূহ :

দুঃস্বপ্নের প্রতি শকুন্তলা, সোমের প্রতি তারা, দশরথের প্রতি কৈকেয়ী, লক্ষ্মণের প্রতি শূর্ণনখা, নীলধ্বজের প্রতি জনা ।

গ) সোনারতরী - রবীন্দ্রনাথ ঠাকুর ১৬

নিম্নলিখিত কবিতা সমূহ :

সোনারতরী, বৈষ্ণব কবিতা, যেতে নাহি দিব, বসুন্ধরা, নিরুদ্দেশ যাত্রা ।

ঘ) সখিগতা - নজরুল ইসলাম ১৬

নিম্নলিখিত কবিতা সমূহ :

বিদ্রোহী, অভিশাপ, আমার কৈফিয়ৎ, দারিদ্র্য, গানের আড়াল ।

ঙ) একালের কবিতা সংকলন (ক.বি. সংস্করণ) ১৬

নিম্নলিখিত কবিতা সমূহ :

১) সুচেতনা - জীবনানন্দ দাশ

২) রবীন্দ্রনাথের প্রতি - বুদ্ধদেব বসু

৩) দামিনী - বিষ্ণু দে

৪) বধু - সুভাষ মুখোপাধ্যায়

৫) বোধন - সুকান্ত ভট্টাচার্য

৬) বাবরের প্রার্থনা - শঙ্খ ঘোষ

৭) যেতে পারি কিন্তু কেন যাব ? - শক্তি চট্টোপাধ্যায়

৮) আমার নাম ভারতবর্ষ - অমিতাভ দাশগুপ্ত

৯) মালতীবালা বালিকা বিদ্যালয় - জয় গোস্বামী

১০) নিভে যাওয়া দীপগুলি আজ জ্বালিয়ে যাব - মহাদেবী বর্মা (প্রতিবেশী কবিতা)

চ) কবিতার কাব্যশৈলীর বিষয়ে প্রাথমিক আলোচনা করে পাঠ্য কবিতার শৈলী বিচার : ১৬

[কবিতার শৈলীবিচার প্রসঙ্গটি যতো না বিষয়গত, তার চেয়ে অনেক বেশি আঙ্গিকগত বিশ্লেষণ প্রত্যাশা করে । যদিও শেষ বিচারে আঙ্গিক বা ফর্মের বিশ্লেষণ কবিতাকে বুঝতেই, কাব্যসৌন্দর্য নির্ণয় করতেই - তা বলা বাহুল্য ।

শৈলী বিচারের ক্ষেত্রে এইসব বিষয়গুলি স্মরণে রাখা উচিত :

১। কবিতার বাক্য ও শব্দের বিন্যাসের চমকপ্রদ সৌন্দর্য, তার শৈল্পিক সুসমা ও শব্দকে আশ্রয় করে শব্দাতীত ব্যঞ্জনার ব্যবহার ।

২। চিত্রকল্প বা বাকপ্রতিমার ব্যবহার নৈপুণ্য ।

৩। শব্দপ্রয়োগের বৈশিষ্ট্য : যা কবির পক্ষপাত কিংবা মেজাজের স্বাক্ষর হয়ে ওঠে ; রস-পরিণাম লাভ করে ।

৪। শব্দের ধ্বনিগত মাধুর্য, শব্দার্থের অভিনব ব্যবহারে কবির মৌলিকতা । শব্দ ও ধ্বনির পারস্পরিক নির্ভরতা ।

৫। ছন্দ ও অলংকার ব্যবহার, স্তবক ও পংক্তি নির্মাণের সচেতন আভিপ্রায়িক প্রয়োগ, যতিচিহ্ন এমন কি দুটি শব্দ অথবা দুটি পংক্তির মধ্যে জমিয়ে রাখা শূন্যস্থানের পরিকল্পিত ব্যবহার - ইত্যাদি ।]

ষষ্ঠ পত্র - ১০০

- ক) পুতুল নাচের ইতিকথা - মানিক বন্দ্যোপাধ্যায় ১৫ + ৫ = ২০
 খ) অরণ্যের অধিকার - মহাশ্বেতা দেবী ১৫ + ৫ = ২০
 গ) ছোটগল্প :
 ১) রবীন্দ্রনাথ ঠাকুর : ১৫ + ৫ = ২০
 নিশীথে, একরাত্রি, অতিথি, শুভা, পয়লা নম্বর, হালদার গোষ্ঠী, ক্ষুধিত পাষণ ও ল্যাবরেটরী ।
 ২) অ) একালের গল্প সংকলন (ক.বি. সংস্করণ) ১৫ + ৫ = ২০
 পয়োমুখম্ , মহানগর, ফসিল, টোপ, অবতরণিকা (নরেন্দ্রনাথ মিত্র) , চরণ দাস এম.এল.এ.
 (সতীনাথ ভাদুড়ী) , মেঘমল্লার (বিভূতিভূষণ বন্দ্যোপাধ্যায়) এবং অন্তঃসলিলা (সাবিত্রী রায়) ।
 আ) স্বাধীনতা পরবর্তী ছোটগল্প ১৫ + ৫ = ২০
 চূয়াচন্দন : শরদিন্দু বন্দ্যোপাধ্যায় , মতিলাল পাত্রী : কমলকুমার মজুমদার , চোর : জ্যোতিরিন্দ্র নন্দী ,
 আদাব : সমরেশ বসু , অশ্বমেধের ঘোড়া : দীপেন্দ্রনাথ বন্দ্যোপাধ্যায় , স্টীলের চক্ষু : সাধন চট্টোপাধ্যায় , এখন
 প্রেম : তপোবিজয় ঘোষ এবং দাহ : ফণীশ্বরনাথ রেণু (প্রতিবেশী গল্প) ।

সপ্তম পত্র - ১০০

- ক) প্রবন্ধ-নিবন্ধের রূপভেদ : ১০ + ১০ = ২০
 (প্রবন্ধ, রম্যরচনা, পত্রসাহিত্য, ডায়েরী, ভ্রমণ সাহিত্য, সমালোচনা সাহিত্য)
 খ) কমলাকান্তের দপ্তর - বঙ্কিমচন্দ্র চট্টোপাধ্যায় ১৫
 নিম্নলিখিত রচনা সমূহ :
 (একা -কে গায় ওই , আমার মন, পতঙ্গ, বিড়াল)
 গ) ছিন্নপত্র - রবীন্দ্রনাথ ঠাকুর ১৫
 নিম্নলিখিত পত্রসমূহ -
 পত্রসংখ্যা - ১০ (শিলাইদহের অপর পারে....)
 ১৮ (ঐ যে মস্ত পৃথিবীটা চূপ করে)
 ৩০ (আমাদের ঘাটে একটি নৌকা ...)
 ৬৪ (রোজ সকালে চোখ চেয়েই)
 ৬৭ (এখন একলাটি আমার সেই ...)
 ৭৭ (ভ্রমণের গোলমালের মধ্যে ..)
 ৮১ (ইতিমধ্যে দেখছি খুব ..)
 ১০২ (এদিকে গরমটাও বেশ পড়েছে ..)
 ১০৬ (কাল থেকে হঠাৎ আমার ..)
 ১০৮ (সন্ধ্যাবেলায় পাবনা শহরে ..)

- ঘ) একালের প্রবন্ধ সংকলন (ক.বি. সংস্করণ) ১৫
 নিম্নলিখিত প্রবন্ধ সমূহ : -
 ১) পটুয়া শিল্প - যামিনী রায়
 ২) শিক্ষা ও বিজ্ঞান - সত্যেন্দ্রনাথ বসু
 ৩) যে দেশে বহু ধর্ম বহু ভাষা - অনুদাশঙ্কর রায়
 ৪) কৃষিসমস্যা ও আমরা - অশোক মিত্র

ঙ) একালের সমালোচনা সংকলন (ক.বি. সংস্করণ)

১৫

নিম্নলিখিত রচনাসমূহ :-

১) আধুনিক সাহিত্য - গোপাল হালদার

২) রবীন্দ্রনাথ ও উত্তর সাধক - বুদ্ধদেব বসু

৩) ঈশ্বরচন্দ্র গুপ্ত - বিষ্ণু দে

৪) রূপকথা - শ্রীকুমার বন্দ্যোপাধ্যায়

চ) বাংলা সাহিত্য বিষয়ে একটি প্রবন্ধ রচনা ।

২০

অষ্টম পত্র - ১০০

ক) সংস্কৃত সাহিত্যের ইতিহাস

১৫ + ৫ = ২০

(কালিদাস - কবি ও নাট্যকার, ভবভূতি, বাণভট্ট, শূদ্রক, জয়দেব)

খ) ইংরাজি সাহিত্যের ইতিহাস

১৫ + ৫ = ২০

(শেকসপিয়ার - কবি ও নাট্যকার, মিলটন, ওয়ার্ডসওয়ার্থ, শেলি, কীটস, এলিয়ট, স্কট, চার্লস ডিকেন্স, বার্নার্ড শ')

গ) প্রতিবেশী সাহিত্যের ইতিহাস : হিন্দী (পঠন-পাঠন হবে বাংলায়) (১৫x১ = ১৫, ৫x২ = ১০) = ২৫

[পাঁচ জন লেখক : ভারতেন্দু হরিশ্চন্দ্র, শ্রেমচাঁদ, মহাদেবী বর্মা, নিরলা, ফণীশ্বরনাথ রেণু]

ঘ) কাব্য জিজ্ঞাসা - অতুলচন্দ্র গুপ্ত

১৫ + ৫ = ২০

ঙ) সাহিত্য - রবীন্দ্রনাথ ঠাকুর

১৫

(সাহিত্যের তাৎপর্য, সাহিত্যের বিচারক, সৌন্দর্যবোধ)

ত্রি-বার্ষিক স্নাতক পর্যায়ে (সাধারণ ও সাম্মানিক) পাঠ্যসূচি

আধুনিক ভারতীয় ভাষা

বাংলা

পার্ট -১

(পুনর্বিদ্যুত পাঠ্যসূচি ২০০৫)

পূর্ণসংখ্যা - ৫০

১। ভাষা ৩০

ক) বোধ পরীক্ষণ ১৫

নিম্নোক্ত প্রবন্ধগুলি শিক্ষার্থীদের পাঠ ও পরীক্ষার জন্য নির্বাচিত হল -

- | | |
|----------------------------|--------------------------------|
| ১. জমীদার - বঙ্গদেশের কৃষক | : বঙ্কিমচন্দ্র চট্টোপাধ্যায় |
| ২. স্বদেশী সমাজ | : রবীন্দ্রনাথ ঠাকুর |
| ৩. বাঙ্গালা ভাষা | : স্বামী বিবেকানন্দ |
| ৪. অপবিজ্ঞান | : রাজশেখর বসু |
| ৫. স্ত্রী জাতির অবনতি | : বেগম রোকেয়া শাখাওয়াত হোসেন |
| ৬. শিল্প প্রসঙ্গ | : নন্দলাল বসু |

খ) প্রতিবেদন রচনা (সংবাদপত্রে প্রকাশের উপযোগী করে কোন ঘটনার প্রতিবেদনের খসড়া রচনা)
..... ১০

অথবা

পুনর্নির্মাণ (সংবাদপত্রে প্রকাশিত কোন প্রতিবেদন থেকে নিজস্ব অভিমত কমবেশি ৫০ শব্দ)

গ) পরিভাষা ৫
(নির্ধারিত ২৫০ টি)

২। সাহিত্য ২০

ক) কবিতা : কাব্য-সৌন্দর্য বিশ্লেষণ ১০

রবীন্দ্রনাথ ঠাকুর - নৈবেদ্য (নিম্নোক্ত কবিতাগুলি নির্বাচিত হল)

১. শতাব্দীর সূর্য আজি (৬৪নং)
২. স্বার্থের সমাপ্তি অপঘাতে (৬৫নং)
৩. তোমার ন্যায়ের দণ্ড প্রত্যেকের করে (৭০নং)
৪. চিত্ত যেথা ভয়শূন্য , উচ্চ যেথা শির (৭২নং)

খ) ছোটগল্প ১০

রবীন্দ্রনাথ ঠাকুরের নিম্নলিখিত গল্পসমূহ (নব নির্বাচিত)

১. ছুটি
২. পোস্টমাস্টার
৩. মণিহারী
৪. ধ্বংস

পার্ট - ১

প্রথম পত্র - ১০০

ক) বাংলা সাহিত্যের ইতিহাস : আধুনিক যুগ $(১৮ \times ৩ = ৫৪) + (৪ \times ৪ = ১৬) = ৭০$

১. গদ্যরীতি ও প্রবন্ধ : শ্রীরামপুর মিশন , ফোর্ট উইলিয়াম কলেজ , রামমোহন রায় , ঈশ্বরচন্দ্র বিদ্যাসাগর , অক্ষয়কুমার দত্ত , প্যারীচাঁদ মিত্র , কালীপ্রসন্ন সিংহ , বঙ্কিমচন্দ্র চট্টোপাধ্যায় , রবীন্দ্রনাথ ঠাকুর ।

২. কাব্য কবিতা : ঈশ্বরচন্দ্র গুপ্ত , রঞ্জলাল বন্দ্যোপাধ্যায় , মধুসূদন দত্ত , হেমচন্দ্র বন্দ্যোপাধ্যায় , নবীনচন্দ্র সেন , বিহারীলাল চক্রবর্তী , রবীন্দ্রনাথ ঠাকুর ।

৩. নাটক : মধুসূদন দত্ত , দীনবন্ধু মিত্র , গিরিশচন্দ্র ঘোষ , রবীন্দ্রনাথ ঠাকুর , দ্বিজেন্দ্রলাল রায় , বিজন ভট্টাচার্য ।

৪. উপন্যাস ও ছোটগল্প : প্যারীচাঁদ মিত্র , বঙ্কিমচন্দ্র চট্টোপাধ্যায় , রবীন্দ্রনাথ ঠাকুর , শরৎচন্দ্র চট্টোপাধ্যায় , বিভূতিভূষণ বন্দ্যোপাধ্যায় , তারাশঙ্কর বন্দ্যোপাধ্যায় , মানিক বন্দ্যোপাধ্যায় ।

৫. সাময়িক পত্র : দিগ্‌দর্শন থেকে বঙ্গদর্শন ।

খ) অলঙ্কার :

 $৫ \times ২ = ১০$

অনুপ্রাস , যমক , শ্লেষ , বন্দোক্তি , উপমা , রূপক , উৎপ্রেক্ষা , সমাসোক্তি , ব্যাজস্ততি , ব্যতিরেক - সংজ্ঞা ও উদাহরণ ।

গ) সাহিত্যের রূপভেদ :

 $(১০ + ১০) = ২০$

গীতিকবিতা , মহাকাব্য , ট্রাজেডি , কমেডি , পৌরাণিক - ঐতিহাসিক - সামাজিক নাটক । রোমাঞ্চ , সামাজিক - ঐতিহাসিক - পারিবারিক উপন্যাস , ছোটগল্পের সংজ্ঞা , ছোটগল্পের সঙ্গে উপন্যাসের তুলনা , প্রবন্ধ ও রম্যরচনা ।

পার্শ্ব -২
দ্বিতীয় পত্র - ১০০

- ক) বৈষ্ণব পদাবলী (ক.বি. সংস্করণ) (১৫+৫) = ২০
নিম্নলিখিত পদসমূহ (প্রথম পংক্তি) :
(১) নীরদনয়নে নীর ঘন সিম্বনে (২) আজ হাম কি পেখলু নবদ্বীপ চন্দ (৩) দাঁড়াইয়া নন্দের আগে গোপাল কান্দে
অনুরাগে (৪) ঘরের বাহিরে দণ্ডে শতবার (৫) রূপলাগি আঁখি বুয়ে গুণে মন ভোর (৬) এমন পিরীতি কভু নাহি দেখি শুনি
(৭) সখি কি পুছসি অনুভব মোয় (৮) কষ্টক গাড়ি কমল-সম পদতল (৯) মন্দির বাহিরে কঠিন কপাট (১০) কি মোহিনী
জান বঁধু কি মোহিনী জান (১১) এ সখি হামারি দুখের নাহি ওর (১২) অঙ্কুর তপন তাপে যদি জারব (১৩) বহুদিন পরে
বঁধুয়া এলে ।
- খ) মেঘনাদ বধ কাব্য (প্রথম সর্গ) - মধুসূদন দত্ত (১৫+৫) = ২০
- গ) পুনশ্চ - রবীন্দ্রনাথ ঠাকুর (১৫+৫) = ২০
নিম্নলিখিত কবিতা সমূহ :
ছেলেটা , সাধারণ মেয়ে , বাঁশি , প্রথম পূজা ।
- ঘ) একালের কবিতা সংকলন (ক.বি. সংস্করণ) (১৫+৫) = ২০
নিম্নলিখিত কবিতা সমূহ :
নষ্টনীড় (সময় সেন) , আমার ভারতবর্ষ (বীরেন্দ্র চট্টোপাধ্যায়) , দেশ দেখাছ অঙ্ককারে (নীরেন্দ্রনাথ চক্রবর্তী) , কেউ
কথা রাখেনি (সুনীল গঙ্গোপাধ্যায়) ।
- ঙ) ছন্দ : (১২+৮) = ২০
১. অঙ্কুর , দল , কলা , মাত্রা , যতি , পর্ব , পদ , পংক্তি , চরণ - সংজ্ঞা ও উদাহরণ সহ প্রতিটির বিস্তারিত আলোচনা ।
২. বাংলা ছন্দের ত্রিধারা : উদাহরণ ।
৩. ছন্দোলিপি ।

তৃতীয় পত্র - ১০০

- ক) সংকলন - রবীন্দ্রনাথ ঠাকুর (১৫+৫) = ২০
পাঠ্য শ্রবণ সমূহ : শিক্ষার মিলন , পূর্ব ও পশ্চিম , মেঘদূত , কেকাধরনি ।
- খ) কপালকুণ্ডলা - বঙ্কিমচন্দ্র চট্টোপাধ্যায় (১৫+৫) = ২০
- গ) পল্লীসমাজ - শরৎচন্দ্র চট্টোপাধ্যায় (১৫+৫) = ২০
- ঘ) একালের ছোটগল্প সংকলন (ক.বি. সংস্করণ) (১৫+৫) = ২০
নিম্নলিখিত গল্প সমূহ :
পুঁই মাচা (বিভূতিভূষণ বন্দ্যোপাধ্যায়) , না (তারাশঙ্কর বন্দ্যোপাধ্যায়) , হারানের নাতজামাই (মানিক বন্দ্যোপাধ্যায়) ,
চড়াই-উৎসাহ (নরেন্দ্রনাথ মিত্র) ।
- ঙ) রাজা ও রাণী - রবীন্দ্রনাথ ঠাকুর (১৫+৫) = ২০

চতুর্থ অংশ

কর্ণসংখ্যা - ১০০

১। পরিভাষা (সাহিত্য - মৌলিকত্ব বিষয়ক নির্দিষ্ট ২০০টি পরিভাষা)
(২০০ টি পরিভাষার তালিকা এই সঙ্গে অনুলিপি বিতরণ) ১x১০ = ১০

২। প্রথম অংশের (সংস্কৃত বা বাংলা ভাষাভেদে) বাস্তব বিশিষ্ট অনুবাদে) ১০

৩। আনুচ্ছেদ রচনা (জনশিক্ষা ২০০ শব্দের মধ্যে ওখর বা সাহিত্য বিষয়ক
পুস্তক রচনা জনশিক্ষা ১০০০ শব্দের মধ্যে) ১৫

৪। ভাষাতত্ত্ব : ২x৫ = ১০

ক) উদাহরণ সহ সংস্কৃত লিখন -

আদি - যথ - অন্য পুরাণয় : আদি - যথ - অন্য ব্যঞ্জনাগর :

স্বরলোপ : স্যাক্ষর লোপ : স্বরব্যয়ভঙ্গ : পকার - ভবন : রকার :

উবন : ^{বিপর্যয়}পাদৃশ্য : বিয়োগ / যিগুণ : জোড় কবচ শব্দ : সংকল শব্দ : ~~সংস্কৃত~~

লোক বিবৃতি : অনুবাদ : উপভাষা ।

খ) শব্দদ্বৈত

৫। আন্তর্জাতিক বর্ণমালায় (IPA) চিহ্ন ব্যবহার করে
লিখন নথীকরণ (Phonetic Transcription) ১০

৬। সাক্ষরকার / রিপোর্টকার লিখন ১৫

৭। বিজ্ঞাপন / প্রচিন্তনিক পত্রিকা ১৫

৮। ইংরেজি থেকে বাংলায় অনুবাদ ১৫

T
E
P
R
B
π

Paper - II Theoretical 50 Marks
(Code - 121102)

1. Bryophyta 10 Marks [10 Periods]
2. Pteridophyta 15 Marks [15 Periods]
3. Gymnosperms..... 15 Marks [15 Periods]
4. Palaeobotany..... 10 Marks [10 Periods]

Bryophyta

1. General account: - 1.1 Characteristic features; 1.2 Amphibian nature; 1.3 An outline idea of classification system following Proskauer (1957) upto class.

2. Hepaticopsida: - 2.1 Class characters; 2.2 Characteristic features of gametophytes and sporophytes of *Marchantia*:

3. Anthocerotopsida: - 3.1 Class characters; 3.2 Gametophytic and Sporophytic features of *Anthoceros*. 3.3 Development of sporophyte.

4. Bryopsida: - 4.1 Class characters; 4.2 Characteristic features of gametophytes and sporophytes of *Sphagnum* and *Funaria*.

5. Specialized topics: - 5.1 Origin of Bryophytes; 5.2 Alternation of generations in different classes and Evolution of Sporophytes (Progressive and Regressive concepts). 5.3 Roles of Bryophytes in plant succession and pollution monitoring.

Pteridophyta

1. General account: - 1.1 Characteristics; 1.2 Classification (Sporne, 1975) - upto class with characters and examples.

2. Morphology and Anatomy of vegetative body, and reproductive organs of sporophytes, and alternation of generations in - *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum* and *Dryopteris*.

3. Fossil study: - 3.1 Characteristic features of *Rhynia*; 3.2 Structural and anatomical features of *Lepidodendron* and *Calamites*.

4. Progymnosperms: - 4.1 Diagnostic features of the group; 4.2 Vegetative and reproductive features of *Archaeopteris*.

5. Specialized topics: - 5.1 Life cycle patterns in Homosporous and Heterosporous forms; 5.2 Alternation of generations and origin of sporophyte (Antithetic & Homologous theories); Telome concept (Zimmermann's hypothesis) and its

significance in the origin of Psilopsida, Lycopside, Sphenopsida and Pteropsida. 5.3
Heterospory and seed habit

Gymnosperms

1. General characters and Classification (Sporne, 1975) upto class with characters and examples.
2. Distribution, vegetative and reproductive morphologies of sporophytes, wood anatomy, structures of ovules, development of gametophytes and embryogeny of - *Cycas*, *Pinus* and *Gnetum*.
3. Fossil Gymnosperms: - 3.1 General characters of Pteridospermales, Cordaitales and Bennettitales; 3.2 Structural features of *Lyginopteris oldhamia* and *Cordaites*; 3.3 Reconstruction of *Williamsonia Sewardiana*.
4. Economic importance of Gymnosperms with reference to wood, resin, essential oil, fatty acid & drugs

Palaeobotany

1. Fossils: - 1.1 Definition, Types and Mode of Preservation (Schoff 1975); 1.2 Conditions for fossilization; 1.3 Palaeopalynology - a brief idea about its application.
2. Geological time scale and major events of plant life through geological ages.
3. Indian Gondwana system with major mega-fossil assemblages.

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Bryophytes

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3. Vashishta, B.R.Bryophyta [S. Chand & Co.]
4. Ganguly, H.C. & Kar, A.K.College Botany Vol. II [New Central Book Agency]
5. Chopra, R.N. & Kumar, P.K.Biology of Bryophyte [Wiley Eastern]
6. Puri, P.Bryophyte [Atmaram & Sons]

Pteridophytes

1. Sporne, K.R.The morphology of Pteridophytes [Hutchinson & Co.]
2. Vasishta, P.C.Pteridophyta [S. Chand & Co.]
3. Gifford, E.M. & Foster, A.S.Morphology and Evolution of Vascular Plants [Freeman & Co.]
4. Mukherjee, R.N. & Chakraborty, K.An Introduction to Vascular Cryptogams (Pteridophytes) [Kalyani Publishers]
5. Ganguly, H.C. & Kar, A.K.College Botany Vol. II [New Central Book Agency]

Paper - III Practical 50 Marks [5 hr.]
(Code - 121103)

1. Algae (work out)	10 Marks
2. Fungi (work out)	10 Marks
3. Microbiology (work out)	6 Marks
4. Plant Pathology (work out)	6 Marks
5. Identification..... [3 specimens x 3 marks each.].....	9 Marks
[Not more than one from Algae/Fungi/Lichen/Plant Pathology]	
6. Laboratory Note Books [No Slide].....	4 Marks
7. Viva Voce	5 Marks
[Laboratory Note Book (no slide submission) of each section, signed by the respective teachers with date, must be submitted at the time of examination]	

Algae

1. [Work out] Staining (no permanent slide preparation). Free Hand Drawing and drawing under Drawing - Prism with Magnification of the following genera with reproductive structures - *Nostoc*, *Oedogonium* & *Vaucheria*.
2. Study from permanent slides of the following genera - *Gloeotrichia*, *Chara*, *Coleochaete*, Pennate diatom, *Laminaria* & *Polysiphonia*.

Fungi & Lichen

1. [Work out] Staining (no permanent slide preparation), Drawing and Microscopic Measurement of the following genera with reproductive structures - *Rhizopus* (asexual) & *Ascobolus*.
2. Study from permanent slides of the following - Zygosporangium of *Rhizopus*, Conidiophores & Conidia of *Penicillium*, conidia of *Fusarium* and trama, hymenium, subhymenium, basidia & basidiospores of *Agaricus* in the V. L. S. of gills.
3. Morphological study of foliose & fruticose Lichens, *Polyporus* and *Cyathus*.

Microbiology

1. [Work out] Preparation of NA, sterilization and sub-culturing
2. [Work out] Simple staining (Ziel's Carbol Fuchsin stain) from curd sample and Gram Staining from culture.

Plant Pathology

1. [Work out] Preparation of PDA and Czapek-Dox Agar (CDA), sterilization and sub-culturing.
2. [Work out] Isolation of pathogen from diseased leaf.
3. [Work out] Inoculation of fruit
4. Identification: - Pathological specimens (diseased plant) of Bacterial blight of rice and late blight of potato; Slides showing uredial, telial, pycnidial & aecial stages of *Puccinia graminis* (any variety).

PART - II : 200 Marks

Paper - IV Theoretical 100 Marks (Code - 121104)

1. Morphology & Palynology	20 Marks [15 Periods]
2. Taxonomy of Angiosperms	50 Marks [45 Periods]
3. Ecology & Plant geography	30 Marks [25 Periods]

Morphology & Palynology

1. Inflorescence: - 1.1 Types with examples; 1.2 Concept of advance and primitive types.
2. Flower: - 2.1 Types with examples; 2.2 Aestivation; 2.3 Floral parts – various types of Cohesion and Adhesion with examples; 2.4 Carpel – Types, advance and primitive types and Placentations.
3. Fruit: - Types with examples.
4. Palynology: - 4.1 Spore & Pollen; 4.2 Pollen wall – chemical nature, stratification & ornamentation; 4.3 NPC classification; 4.4 Basic concepts of Aeropalynology & Melissopalynology.

Taxonomy of Angiosperms

1. Introduction: - 1.1 Components and Objectives of Plant Systematics; 1.2 Alpha and Omega Taxonomy; 1.3 Data source in plant taxonomy – anatomy, cytology, Phytochemistry, Palynology etc. 1.4 Phases and Functions of taxonomy; 1.5 Phenetics – Definition, Character-state, Phenogram and OTU; 1.6 Cladistics – Definition, Cladogram, concept of monophyletic, polyphyletic & paraphyletic groups; 1.7 Plesiomorphy & Apomorphy; 1.8 Principles of Parsimony.
2. Nomenclature: - 2.1 Elementary knowledge of ICBN [Vienna code 2005 (updated 2006-07)] – Principles, Valid names [Binomial, Authors' Citation, Legitimate & Correct names, Homonym, Basionym, Autonym, Synonyms], Typification, Principle of Priority, Effective and Valid Publication, Retention and Rejection of names.
3. Herbaria & Botanical Gardens: - 3.1 Their Roles/Functions; 3.2 Important Indian Botanical Gardens & CNH-India;
4. Identification: - 4.1 Use of Floras, Monographs, Manuals and Dichotomous Keys.
5. Systems of Classification: - 5.1 Broad outline of the system [upto series/cohorts] of Bentham & Hooker (1863) with merits and demerits; 5.2 Cronquist's system (1988) [upto sub-class with characters & showing affinities] - with merits and demerits.
6. Diagnostic features, systematic positions (as in B&H, and Cronquist's system) and economically important plants (parts used & uses) of the following families:-

- 6.1 Dicotyledonous families – Magnoliaceae, Malvaceae, Leguminosae (subfamilies), Euphorbiaceae, Solanaceae, Verbenaceae, Scrophulariaceae, Acanthaceae, Lamiaceae, Apiaceae, Rosaceae, Cucurbitaceae, Rubiaceae & Asteraceae.
- 6.2 Monocotyledonous families – Alismataceae, Araceae, Poaceae, Liliaceae, Zingiberaceae & Orchidaceae.

Ecology & Plant Geography

1. Plant and Environment: - 1.1 Niche (multidimensional, fundamental & realized niche); 1.2 Ecotype (Ecotone, Ecads & Ecoelins); 1.3 Microclimate.
2. Population Ecology: - 2.1 Unitary and Modular organisms, Ramets & Genets (clone); 2.2 Age pyramid; 2.3 Population growth (density dependent & independent); 2.4 Carrying capacity; 2.5 Simple population growth models (difference & logistic equations).
3. Community Ecology: - 3.1 Plant succession (primary & secondary) and Seral stages (with reference to Hydrosere); 3.2 Autogenic and Allogenic succession; 3.3 α , β , γ - diversity & diversity index (Simpson index)
4. Conservation: - 4.1 Biodiversity hot spots in India; 4.2 *in situ* & *ex situ* - conservation, seed bank and Cryopreservation.
5. Plant Geography: - 5.1 Phytogeographical regions in India (Chatterjee 1960); 5.2 Dominant flora of Eastern Himalayas, and Sunderban; 5.3 Endemism - types & factors; 5.4 Geographical Information System (GIS) - a brief idea.

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Morphology of Angiosperms

1. Mitra, D., Guha, J. & Chowdhury, S.K....Studies in Botany, Vol.I [Moulik Library]
2. Eames, A.J.Morphology of Angiosperms [McGraw Hill]
3. Lawrence, G.H.M..... (Glossary in) Taxonomy of Vascular Plants [Oxford & IBH]

Palynology

1. Mehra, P.N.Evolution of spore through the ages [Palynological Society of India, National Botanic Garden, Lucknow]
2. Nair, P.K.K.Pollen Morphology of Angiosperms [Scholar Publication]
3. Erdtman, G.Pollen Morphology and Plant Taxonomy [Ielden: E.G. Brill]
4. Faegri, K. & Iverson, J.Text Book of Pollen Analysis [Oxford: Blackwell Scientific Publication]

Paper - V Theoretical 50 Marks
(Code - 121105)

1. Anatomy & Embryology 25 Marks [25 Periods]
2. Biochemistry 25 Marks [25 Periods]

Anatomy & Embryology

1. Cell Wall & Stele: - 1.1 Ultrastructure, chemical composition and functions of Cell wall and middle lamella; 1.2 Ontogeny of Trachea and Sieve tube; 1.3 Types & Evolution of Stellar forms; 1.4 Concept of Floral Anatomy.
2. Stomata: - 2.1 Types of Stomata (Metcalfe and Chalk, Stebbins and Khush).
3. Cambium: - 3.1 Distribution & structure; 3.2 Secondary growth.
4. Specialized Growth & Tissue organization: - 4.1 Mechanical Tissues and their distribution; 4.2 Anomalous secondary growth - in the stems of *Bignonia*, *Boerhaavia*, *Tecoma* and *Dracaena*, -and in the root of *Tinospora*; 4.3 Parastichy, Plastochrone & Leaf - trace.
5. Development: - 5.1 Organization of Shoot Apex and Root Apex (Tunica-Corpus & Körper-Kappe); 5.2 Floral Meristem and Ontogeny of Floral Parts (Primary concept).
6. Embryology: - 6.1 Sporogenesis & Gametogenesis - 6.1.1 Microsporogenesis & Microgametogenesis; 6.1.2 Megasporogenesis & Megagametogenesis (monosporic - 8 nucleate type); 6.2 Fertilization; 6.3 Development of Embryo in *Capsella bursa-pastoris* (Brassicaceae); 6.4 Development of Endosperms.

Biochemistry

1. Fundamentals: - 1.1 Covalent, non - covalent & hydrogen bonds, van der Waals interactions; 1.2 Structure & properties of water; 1.3 pH and buffer, Henderson - Hasselbalch equation; 1.4 Isoelectric point.
2. Biomolecules: - 2.1 Nucleic acids - nucleosides, nucleotides, oligo- & poly - nucleotides, different forms of DNA and RNA, nucleic acids derivatives; 2.2 Proteins - structure and classification of amino acids; Primary, Secondary, Tertiary & Quaternary structures of proteins; 2.3 Carbohydrates - structures of mono-, di-, oligo- & poly- saccharides; stereoisomers, enantiomers, epimers and anomers; sugar derivatives; 2.4 Lipids - structures of triglycerides, phospholipids and glycolipids; saturated and unsaturated fatty acids.
3. Bioenergetics and oxidation-reduction reaction: - 3.1. Laws of thermodynamics, 3.2 Open and closed system; 3.3 Exergonic and endergonic reactions; 3.4 Standard free energy (G°) change and actual free energy (ΔG) change; 3.5 Relation between ΔG° and K_{eq} ; 3.6 Coupling of biochemical reaction (with example) and its significance;

3.7 Energy rich bond with reference to ATP; 3.8 Electromotive force, half-reaction and conjugate redox pair; 3.9 Standard reduction potential ($\Delta E'^0$)

4. Enzymology: - 4.1 Definition, mechanism of action (lock and key, and induced fit hypothesis) and classification (only major groups - according to IUBMB); 4.2 Basics - Co-factor, coenzyme, prosthetic group, apoenzyme, holoenzyme, active site, activation energy, rate equation, rate constant and first order reaction; 4.3 Allosteric regulation with example; 4.4 Enzyme kinetics - steady state, velocity, and equilibrium, Michaelis-Menten equation and Lineweaver-Burk plot, and enzyme inhibition.

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Anatomy

1. Esau, K.Plant Anatomy [Wiley Eastern]
2. Fahn, A.Plant Anatomy [Pergamon press]
3. Mauseth, J.D.Plant Anatomy [Benjamin Cummings Publications]
4. Foster, A.S.Practical Plant Anatomy [D. Van Nestnand Co.]
5. Ganguly, H.C. & Kar, A.K.College Botany Vol. I [New Central Book Agency]

Embryology

1. Maheswari, P.An Introduction to the Embryology of Angiosperms [Tata McGraw Hill]
2. Bhojwani, S.S. & Bhatnagar, S.D.The Embryology of Angiosperms [Vikas Publishing House]

Biochemistry

1. Voet, D. & Voet, J.G.Biochemistry [John Wiley]
 2. Conn, E.E., Stumpf, P.K., Bruening, G. & Doi, R.H.Outlines of Biochemistry [John Wiley & Sons]
 3. Lehninger, A.L., Nelson, D.L. & Cox, M.M.Principles of Biochemistry [CBS]
 4. Elliot, W.H. & Elliot, D.C.Biochemistry and Molecular Biology [Oxford University Press]
 5. Goodwin, T.W. & Mercer, E.I.Introduction to Plant Biochemistry [Oxford: Pergamon]
 6. Lea, P.J. & Leegwood, R.C.Plant Biochemistry and Molecular Biology [John Wiley]
 7. Berg, J.M., Tymoczko, J.L. & Stryer, L.Biochemistry [Freeman Publ.]
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Paper - VI Practical 50 Marks [External/ 5 hr.]
(Code - 121106)

<u>Topics</u>	<u>Marks</u>
1. Angiosperms (work out)	10
2. Anatomy (work out- double staining).....	10
3. Plant recognition (Angiosperm) [genus 1+species 1+family 1].....	3
4. Identification..... [4 specimens x 3 marks each].....	12
[From Bryophyta/ Pteridophyta/ Gymnosperms/ Palaeobotany/ Anatomy: - Not more than two from any group]	
5. Laboratory Note Books & Slides.....	4
6. Field records.....	4
7. Herbarium.....	3
8. Viva Voce..... [4 Qs. x 1 mark each].....	4
{2 Local Excursions, a visit to the BSI/CAL and One Excursion to a Different Phyto-Geographical Region - are all compulsory}	
[Field records, Laboratory Note Book of each section, Herbarium sheets [<u>only angiospermic weeds- at least 20 sheets</u>], signed by the respective teachers with date, and Slides, must be submitted at the time of examination]	

Angiosperms

1. [Work out] Identification of the Genus, with drawings, description, floral diagram, floral formula and identifying characters, of the wild plant specimens from the following families - **Malvaceae, Fabaceae (Papilionaceae), Solanaceae, Verbenaceae, Scrophulariaceae, Acanthaceae, Lamiaceae and Rubiaceae.**
2. **Plant recognition** - Names & Families of the specimens from the angiospermic families included in the theoretical syllabus.

Anatomy

1. [Work out] Microscopic studies on - Types of Stomata, Sclereids, Raphides, Cystolith, Aleurone grains, Laticiferous ducts and oil glands.
2. [Work out] Staining, Preparation of permanent slides and study of Anomalous secondary structures - in the stems of **Bignonia, Boerhaavia & Dracaena**, and in the root of **Tinospora**.

Bryophytes

1. External Morphology (macroscopic - from preserved specimens) of the gametophyte plant body and Internal Morphological (microscopic - from permanent slides) study of the features given in parentheses, in the genera as - **Riccia** (V.T.S. of Thallus showing Antheridia/ Archegonia/ Sporophyte), **Marchantia** (L.S. of gemma cup/ Antheridiophore/ Archegoniophore), **Anthoceros** (L.S. of sporophyte) and **Funaria** (L.S. of capsule)

Pteridophytes

1. External Morphology (macroscopic - from preserved specimens) of the sporophyte plant body and Internal Morphological (microscopic - from permanent slides) study of the features found in the conditions / preparations given in parentheses, in the genera as - *Psilotum* (L.S. of synangium), *Lycopodium* (L.S. of strobilus), *Selaginella* (L.S. of strobilus), *Equisetum* (L.S. / T.S. of strobilus), *Ophioglossum* (L.S. of spike), *Dryopteris* (V.T.S. of fertile pinnule through sori) and *Marsilea* (H.L.S. / V.L.S. of sporocarp).

Gymnosperms

1. Morphological and Anatomical study (from preserved specimens and permanent slides) of different parts of certain genera as stated in the following - *Cycas* (Megasporophyll, Microsporophyll & L.S. of Ovule), *Pinus* (Male Cone, Female Cone and their L.S. views) and *Gnetum* (Male and Female Cones, and L.S. of male cone and Ovule).

Palaeobotany

1. Morphological study of *Ptilophyllum* and *Glossopteris* leaf fossils.
2. Study from slides - T.S. views of the stems of *Rhynia*, *Lepidodendron*, *Calamites*, *Lyginopteris* and *Cordaites*.

PART - III : 400 Marks

Paper - VII Theoretical 100 Marks (Code - 121107)

1. Plant Physiology60 Marks [50 Periods]
2. Pharmacognosy.....20 Marks [15 Periods]
3. Plant Biotechnology.....20 Marks [15 Periods]

Plant physiology

1. Plant water relations: - 1.1 Water transport - short distance transport by diffusion (Fick's law) & long distance transport by mass flow; 1.2 Components of water potential - osmotic potential (Van't Hoff equation), pressure potential, relation between cell water potential with its components and relative cell volume (Hoffler diagram), cell water potential and its components; 1.3 Absorption by roots - apoplastic, symplastic & transmembrane pathways; 1.4 Ascent of sap - tensile strength of water & cohesion - tension theory, role of air-water interface in the development of transpiration pull, Cavitation.
2. Transpiration: - 2.1 Stomata - micellation of guard cell; 2.2 Role of CO₂, K⁺ - ion, sucrose, blue light & abscisic acid in stomatal movement; 2.3 Antitranspirant.
3. Membrane Transport: - 3.1 Transport proteins - channels and carriers; 3.2 Primary active transport (electrogenic pump) and secondary active transport (symport & antiport).
4. Phloem Transport: - 4.1 Source & Sink; 4.2 Phloem loading & unloading, and composition of phloem sap; 4.3 Mass flow hypothesis.
5. Photosynthesis: - 5.1 Pigments - Structure of chlorophyll a & b, importance of carotenoids, and nature of phycobilins and anthocyanins; 5.2 Photobiology - Absorption and Action spectra, Red drop & Emerson effect, Photosystems & Photochemical reaction centers, Water splitting, and Cyclic and non-cyclic Photophosphorylation; 5.3 Calvin cycle and Photorespiration (mechanism & significance); 5.4 C₄ cycle (an out line), and efficiency of C₃ & C₄ plants; 5.5 CAM and its ecological significance.
6. Respiration: - 6.1 Glycolysis & its significance, and synthesis of acetyl Co-A; 6.2 Krebs cycle and its significance; 6.3 Oxidative pentose phosphate pathway and its significance; 6.4 Electron Transport System and Mechanism of Oxidative Phosphorylation; 6.5 P/e ratio; 6.6 Stoichiometry of glucose oxidation.
7. Nitrogen metabolism: - 7.1 Nitrogen fixing organisms and process of nodule formation; 7.2 Biochemistry of N₂ - fixation; 7.3 Amino acid biosynthesis (by GS-GOGAT, Transamination and direct amination); 7.4 Nitrification, nitrate assimilation and denitrification; 7.5 A general idea about *nif* and *nod* genes.

8. Growth regulators: - 8.1 Source, chemical nature, structure and role of - auxins, gibberellins, cytokinins, ethylene and abscisic acid; 8.2 Biosynthesis of IAA; 8.3 Signal Transduction pathway; 8.4 G-proteins, Ca^{2+} -ion & Calmodulin; 8.5 Mode of action of GA_3 .

9. Photomorphogenesis: - 9.1 Definition with example; 9.2 Photoreceptors, chemical composition of phytochrome, photostationary state and active form of phytochrome and photoreversibility.

10. Photoperiodism: - 10.1 Classification of plants, on the basis of 'Critical day length', with examples; 10.2 Importance of dark period in flowering and phytochrome control of flowering; 10.3 Photoperiodic stimulus and translocation of floral hormone; 10.4 Florigen concept; 10.5 Vernalization.

11. Dormancy: - 11.1 Concept of bud & seed dormancy; 11.2 Factors causing seed dormancy and method of breaking seed dormancy.

Pharmacognosy

1. General account: 1.1 Pharmacognosy and its importance in modern medicine; 1.2 Crude drugs; 1.3 Pharmacological and chemical classification of drugs; 1.4 Drug evaluations - (Definitions with examples of the following) - organoleptic, microscopic, chemical & physical; 1.5 Bioassay of drug - Definition and examples.

2. Secondary metabolites of plants: - 2.1 Definitions of, and difference in between, Primary and Secondary Metabolites; 2.2 Secondary metabolites and plant protection; 2.3 Utilization of major types of metabolites as drug - phenolics & quinones, terpenoids, flavonoids and alkaloids.

3. Active constituents: - Source plants, parts used, chemical nature & uses of the following - 3.1 Glycosidic anthraquinone (Barbaloin); 3.2 Tannic acid derivative (Catechin); 3.3 Resins (Gingerol, Curcuminoids); 3.4 Steroids (Diosgenin, Digitoxin); 3.5 Alkaloids (Emetine, Caffeine, Quinine, Strychnine, Reserpine, Vinblastine).

Plant Biotechnology

1. Plant Tissue Culture: - 1.1 Cellular Totipotency; 1.2 Tissue culture media; 1.3 Methods of sterilization; 1.4 Methods and applications of Callus and Cell Suspension culture; 1.5 A brief idea about Organogenesis and Somatic Embryogenesis; 1.6 Factors affecting organ induction; 1.7 Artificial seeds.

2. Other Culture Techniques: - 2.1 Methods and applications of Embryo culture; 2.2 Techniques of Pollen and Haploid culture and their applications; 2.3 Protoplast isolation and culture; 2.4 Protoplast fusion (somatic hybridization) and its importance.

3. Micropropagation: - 3.1 Definition and applications.

4. Recombinant DNA Technology:- 4.1 Restriction Endonucleases (Definition and examples), 4.2 Cloning Vector (pBR322), 4.3 Genomic and cDNA library.

5. Genetic Engineering: - 5.1 Brief idea about gene transfer methods with special reference to Ti Plasmid; 5.2 Transgenic plants and their importance.

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Plant Physiology

1. Taiz, L & Zeiger, E.Plant Physiology [Sinauser Associates Inc. Publishers]
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2. Evans, W.C..... (G.E. Trease & W.C. Evans') Pharmacognosy [Saunders]
3. Melentyeva, G. & Antonova, L.Pharmaceutical Chemistry [MIR Publishers]
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 4. Dubey, R.C.Biotechnology [S. Chand & Co.]
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 6. ChannarayappaMolecular Biotechnology: Principles and Practices [Universities Press]
 7. Gamborg, O.L. & Philips, G.C.Plant Cell, Tissue and Organ Culture - Fundamental Method [Narosa Publications]
-

Paper - VII

(Co.)

1. Cell Biologyof the Gene [Benjamin/Cummings] 100s]
2. Genetics & Molecular Biology Principles of Gen 145 Periods]
3. Plant Breeding & Biometry20 Marks [15 Periods]

Cell Biology

1. Microscopy: - 1.1 Brief knowledge about microscopy (light, Phase contrast, TEM, SEM, Immunofluorescence and confocal) 1.2 Resolving power.
2. Origin and Evolution of cells: - 2.1 Ribozyme and RNA world; 2.2 The first cell; 2.3 Origin of Eukaryotic cell; 2.4 Organellar DNA (cp- & mt- DNA).
3. Cell Membrane: - 3.1 Ultrastructure and function; 3.2 Endomembrane system and Cytoskeleton; 3.3 Cellular Organelles - Mitochondria, Plastid and Golgi apparatus.
4. Nucleus and Chromosome: - 4.1 Ultrastructure of Nuclear pore complex; 4.2 Nucleolus ultrastructure and ribosome biogenesis; 4.3 Eukaryotic chromosome - chromatin organization and DNA packaging, euchromatin and heterochromatin; 4.4 Karyotype concept and its parameters; 4.5 Brief knowledge of chromosome banding (C, G, & Q) and its application.
5. Cell Cycle & its Regulation: - 5.1 Meiotic cell division and its significance; 5.2 structure & Functions of Centromere, Kinetochores & Spindle apparatus; 5.3 Structural organization & function of Telomere; 5.4 Dynamics of chromosome movement in anaphase; 5.5 Mechanism of cell cycle control in yeast (role of MPF); 5.6 Apoptosis (Preliminary idea).

Genetics & Molecular Biology

1. Inheritance: - 1.1 Mendelian basis of inheritance and Gene Interaction; 1.2 Epistasis; 1.3 Cytoplasmic inheritance; 1.4 Sex determination; 1.5 Sex linked inheritance.
2. Linkage, Crossing over and Gene mapping: - 2.1 Complete and incomplete linkage & linkage group; 2.2 Molecular mechanism of crossing over (Holliday Model) and Detection of crossing over (McClintock's experiment); 2.3 Gene mapping (Three point test cross); 2.4 Molecular mapping- FISH and GISH (brief idea),
3. Ploidy: - 3.1 concept and examples; 3.2 Aneuploidy and Polyploidy - types, examples, meiotic behavior and importance.
4. Chromosomal aberration: - 4.1 Definition and Factors responsible; 4.2 Types, meiotic behavior and significance of Deletion, Duplication, Translocation and Inversion.

Paper - IX Practical 100 Marks [6 hr.]
(Code - 121109)

1. Plant Physiology (Major & Minor)	30 Marks
2. Biochemistry (Qualitative & Quantitative).....	35 Marks
3. Pharmacognosy (Two Experiments)	15 Marks
4. Laboratory Note Books	10 Marks
5. Viva Voce	10 Marks

[Laboratory Note Book of each section, signed by the respective Teachers with date, must be submitted at the time of examination]

Plant Physiology

Major [20 marks]

1. Determination of stomatal frequency and rate of transpiration per stomata per hour.
2. Rate of photosynthesis under varying HCO_3^- concentration (using bicarbonate) in an aquatic plant to find out the optimum and toxic concentration.
3. Measurement of oxygen uptake by respiring tissue (per gram / hr.)- By germinating seeds.
4. Determination of R.Q. of germinating seeds.
5. Measurement of osmotic pressure of storage tissue by weighing method.
6. Measurement of osmotic pressure in the leaf cells of *Rhoeo discolor* by plasmolytic method.

Minor [10 Marks]

1. Determination of stomatal frequency.
2. Relationship between evaporation and transpiration.
3. Extraction and detection of anthocyanins pigments from plants.
4. Separation of plastidial pigments by usual solvent system method.
5. Comparison of imbibitions of water by starchy, proteinaceous and fatty seeds.

Plant biochemistry

A. Qualitative [15 Marks]

1. Detection of organic acids - citric, oxalic, malic & tartaric from laboratory samples.
2. Detection of protein from plant samples.
3. Detection of nature of carbohydrate- glucose, fructose and starch from laboratory samples.
4. Detection of Ca, Mg, Fe and S from plant ash samples.

B. Quantitative [20 Marks]

1. Estimation of amino-nitrogen in an amino acid by formol titration method.
2. Estimation of glucose by Benedict's quantitative reagent.
3. Estimation of titrable acidity from lemon.
4. Estimation of catalase activity in plant samples.
5. Estimation of urease activity in plant samples.
6. Colorimetric estimation of protein using Folin-Ciocalteu phenol reagent.

Pharmacognosy
Major [10 marks]

1. Chemical tests for - (a) Tannin (from *Camellia sinensis* & *Terminalia chibula* - any two confirmatory tests), and (b) Alkaloids (Caffeine and Quinine from any drug - single test - by I_2 Soln. in KI added to the sample in acidic medium).

Minor [5 Marks]

1. Microscopic study of powder (of parts used in drug) - *Zingiber officinale* and *Holarrhena antidysenterica*.

2. Histo-chemical tests of - (a) Curcumin (*Curcuma longa*), (b) Starch in non-lignified vessel (*Zingiber officinale*) and Alkaloids (in the stem of *Catharanthus roseus* and bark of *Holarrhena antidysenterica*)

Paper - X Practical 100 Marks [6 hr.]
(Code - 121110)

1. Study of Mitotic Chromosomes	25 Marks
2. Study of Meiotic Chromosomes	15 Marks
3. Study of Mitotic Index	10 Marks
4. Biometry	15 Marks
5. Identification.....[5 specimens x 3 marks each].....	15 Marks
(Specimens / Slides: - as prescribed in the syllabus)	
6. Laboratory Note Books & Slides	10 Marks
7. Viva Voce	10 Marks

[Laboratory Note Book of each section, signed by the respective Teachers with date, and Slides, must be submitted at the time of examination]

Study of Chromosomes & Mitotic Index

1. Chromosome Preparation: - 1.1 Pretreatment, Fixation, Staining, Squash and Smear preparation; 1.2 Preparation of permanent slides.
2. Study of Mitotic Index: - 2.1 Determination of index and frequency of different mitotic stages (to be calculated from dividing cells) in normal pre-fixed growing root tips of *Allium cepa*.
3. Study of Mitotic Chromosomes: - 3.1 Metaphase chromosome preparation, free hand drawing and drawing under drawing prism (under oil-immersion lens); 3.2 Determination of 2n number and comment on chromosome morphology of *Allium cepa*, *Nigella sativa*, and *Lens culinaris*.
4. Study of Meiotic Chromosomes: - 4.1 Smear preparation of meiotic plates, identification and free hand drawing of different meiotic stages of *Allium cepa* flower bud.
5. Identification from permanent slides: - 5.1 Meiotic cells - normal stages, abnormal stages - laggards, anaphase bridge and ring chromosome (*Rhoeo discolor*); 5.2 Mitotic cells - Abnormal stages: early separation, late separation, multipolarity, sticky bridge, fragmentation and pollen mitosis.
6. Isolation of plant genomic DNA (from Rice or Mustard seedling).

BIOMETRY

1. Determination of goodness of fit in normal and modified mono and dihybrid ratios (3:1, 9:7, 13:3, 1:1:1:1, 15:1, 9:3:3:1) by Chi-square analysis and comment on the nature of inheritance.
2. Univariate analysis of statistical data: Statistical tables, mean mode, median, standard deviation, and standard error (using seedling population/leaflet size).

West Bengal State University

Barasat

Syllabi for 3 year - B. Sc. Degree Course
[3 years 1+1+1 Examination System]

BOTANY

(GENERAL)

[WBSU Code - 1212]

2009

[Syllabus to be effective from 2010 – 2011 Session]

[Mode of internal assessment is to be made as per the directive given in the respective pages vide page No. 34 & 37]

Distribution of Marks

Total Allotment – 400 Marks				
Terminal Examinations	Theoretical Assessment	Practical Assessment		Total Marks
		Internal	External	
Part - I (Paper I) First Year	Paper I [100] 121201	Shall start and continue till the 2 nd Yr. Part II examination *	Nil	100
Part – II (Paper II & III) Second Year	Paper II [100] 121202	Paper III Practical** 121203		200
		80	20	
Part – III (Paper IV & V) Third Year	Paper IV [70] 121204	Paper V Practical 121205		100
		20	10	
Total Marks →	270	100	30	400

*/** It is very important to note that the Practical Classes for the topics included in the Paper III (Scheduled for Part II Exam / 2nd year Terminal Exam), should be started from First Year so as to complete the curriculum in time (see detailed syllabus).

BOTG

PART - I [First Year Terminal] : 100 Marks

Paper - I Theoretical 100 Marks [3hr.] (Code - 121201)

- Group A: - Algae, Fungi & Lichen, Plant Pathology & Microbiology.....40 Marks
Group B: - Bryophyta, Pteridophyta, Gymnosperms & Palaeobotany.....30 Marks
Group C: - Morphology & Taxonomy of Angiosperms, and Palynology.....30 Marks

Group A: - [40 Marks / 25 Periods]

Algae - [10 Marks / 6 Periods] General account.// Morphology, Reproduction & Examples of Cyanophyceae, Chlorophyceae, Bacillariophyceae, Phaeophyceae & Rhodophyceae.// Alternation of Generations in Chlorophyceae and Phaeophyceae.// Sources and uses of edible algae, agar, algin & diatomite.

Fungi & Lichen - [10 Marks / 6 Periods] General characters & types of spores.// Primary features and examples of Oomycota, Chytridiomycota, Zygomycota, Ascomycota and Basidiomycota.// Concept of Anamorph & Teleomorph.// Fungal symbiosis - Mycorrhiza, Lichens and their importance.// Sources and uses of ethanol, alpha amylase, penicillin & Griseofulvin.

Plant Pathology - [10 Marks / 6 Periods] Terms & Definitions - Pathogen, Propagule, Vector, Inoculum, Infection, Symptoms (necrosis, wilt, spot, blight, hypoplastic & hyperplastic).// Disease & Disease Cycle, Disease Triangle, Disease Management // Koch's postulates // Phytoalexins.// Symptoms, Causal organisms, Disease cycle & Control measures of - (a) Tungro virus disease of rice & (b) Late blight of potato.

Microbiology - [10 Marks / 7 Periods] Three Domains of Life.// Prokaryote & Eukaryote.// Binary fission & Exponential Growth.// Bacterial Cell Wall.// Salient features of Plant Virus & Phage.// Lytic (by T₄ phage) cycle & Lysogeny (with λ Phage).// Horizontal gene transfer and gene recombination through - Transformation, conjugation & Transduction.// Sources & Uses of Amylase & Streptomycin.

Group B: - [30 Marks / 15 Periods]

Bryophyta - [8 Marks / 4 Periods] General character (the amphibian nature).// Characters and examples of Hepaticopsida, Anthocerotopsida & Bryopsida.// Reproductive Structures and Sporophytes of *Riccia*, *Anthoceros* and *Funaria*.

Pteridophyta - [8 Marks / 4 Periods] Characters and examples of Psilophyta, Lycophyta, Sphenophyta & Filicophyta.// Structure of reproductive organs in the Sporophytes of *Lycopodium*, *Selaginella* and *Dryopteris*.

Gymnosperms - [8 Marks / 4 Periods] Concept of Progymnosperms // Characters and examples of Cycadophyta, Coniferophyta & Gnecophyta // Structures of Microsporangia and Ovules of *Cycas*, *Pinus* & *Gnetum*.

Palaeobotany - [6 Marks / 3 Periods] Importance of fossil study // Definitions and Examples of Impression, Cast and Amber // Organization of Reconstructed *Williamsonia Sewardiana*.

Group C: - [30 Marks / 15 Periods]

Morphology - [5 Marks / 3 Periods] Types of Inflorescences and Flowers with Examples // Aestivation // Cohesion and Adhesion of floral parts.

Palynology - [5 Marks / 2 Periods] Definition // Pollen Types // Various Branches & Applications.

Taxonomy - [20 Marks / 10 Periods] Objectives & Functions // Alpha & Omega taxonomy, Phylogenetic Classification & Data source // ICBN - Principles, Binomial, Authors' citations, Suffixes for major taxa & sub-groups // Definitions of Artificial, Natural and Phylogenetic systems of classification // Classification of Dicotyledonous angiosperms, following Bentham & Hooker, upto series with characters // Diagnostic features of the following families - Malvaceae, Leguminosae (Fabaceae), Solanaceae, Lamiaceae, Cucurbitaceae, Asteraceae, Poaceae & Orchidaceae.

PART - II [Second Year Terminal] : 100 Marks

Paper - II Theoretical 100 Marks [3 hr.] (Code - 121202)

Group A: - Anatomy, Embryology, Economic Botany & Ecology.....40 Marks

Group B: - Cell Biology and Genetics30 Marks

Group C: - Biochemistry and Plant Physiology.....30 Marks

Group A: - [40 Marks / 25 Periods]

Anatomy - [10 Marks / 8 Periods] Cell wall - chemistry, ultrastructure & function // Stomatal types // Evolution of stelar types // Shoot apex (Tunica-Corpus) and root apex (Körper-Kappe) // Secondary growth in the stem of *Tecoma*.

Embryology - [10 Marks / 6 Periods] Sporogenesis and Gametogenesis // Embryo development in *Capsella bursa-pastoris* // Endosperm development.

Economic Botany - [10 Marks / 5 Periods] Study of the following economically important plants [only binomials, families, parts used and uses] - rice & wheat // sugarcane // mung & gram // ginger & cumin // onion & garlic // tea & coffee // cinchona, neem, ipecac & vasak // mustard, ground nut & coconut // potato, pumpkin & carrot // cotton & jute // sal & teak // mango, litchi & jack fruit.

Ecology - [10 Marks / 6 Periods] Ecotype and microclimate // Plant community // Plant succession - Hydrosere & Xerosere // Adaptive features of Hydrophytes, Halophytes & Xerophytes // Biodiversity - definition & levels of biodiversity (genetic, species & ecosystem) // Methods of *in situ* & *ex situ* conservation.

Group B: - [30 Marks / 25 Periods]

Cell Biology - [10 marks / 8 Periods] Endomembrane system & Cytoskeleton // Ultrastructure of nuclear membrane & nucleolus // Nucleosome, euchromatin & heterochromatin // cell cycle, interphase & cell division with reference to meiosis // Chromosomal aberration - deletions, duplications, inversion and translocation // Aneuploidy and polyploidy - types, importance, and role in evolution.

Genetics - [20 Marks / 17 Periods] Central dogma // DNA replication - Meselson and Stahl's experiment & mechanism of replication // Transcription and translation (Protein synthesis) // Genetic code - Properties // Mendelian basis of inheritance, predicting Mendelian ratios, sex determination, sex linked inheritance, gene concept, gene interactions (allele interactions) & epistasis // Linkage group and genetic map (three point test cross) // Test cross and back cross // Mutation, point mutation (tautomerization, transition, transversion and frame shift) // Mutagen - examples of physical & chemical mutagens // Brief concept of split gene, transposons & repetitive DNA.

Group C: - [30 Marks / 25 Periods]

Biochemistry - [10 marks / 8 Periods] Carbohydrates - chemistry and importance of ribose, glucose, fructose, sucrose, maltose, starch, cellulose & dextran // Protein - primary, secondary, tertiary & quaternary structures // Enzyme- Definition, Types and examples, co-factors, co-enzymes.

Plant Physiology - [20 Marks / 17 Periods] Transpiration - transpiration stream and pathway of water movement // Role sugar and K^+ ion in stomatal movement // Xylem cavitation & embolism // Source-sink relation in phloem transport // Photosynthesis - Absorption and action spectra, enhancement effect, PS-I & PS-II, Z-scheme and photo-phosphorylation // Calvin cycle & RUBISCO // Significance of photorespiration, C4 cycle & CAM // Respiration - Glycolysis, Role of ATP, Krebs cycle, ETS & oxidative phosphorylation // N_2 fixation and amino acid synthesis (GS - GOGAT system) // Specific role of auxine, gibberellins, cytokinin, ethylene and abscisic acid in the biological cycle of a plant // Photomorphogenesis - physiology of flowering, phytochrome, cryptochrome & Florigen concept.

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Paper - III Practical 100 Marks

(Code - 121203)

[Internal - 80 Marks] & [External - 20 Marks]
Regular & Daily Internal Assessment [60 Marks]

Topics	Marks [Completion & Performance]
1. Cryptogams - Algae/Fungi.....	8
2. Angiosperms.....	10
3. Anatomy.....	8
4. Plant Physiology.....	10
5. Study of Mitotic Chromosome.....	8
6. Field Work.....	6
7. Attendance.....	10

Field record - stating date, types of vegetation & predominant plant species present in the area visited [Two local excursions (3 x 2 = 6 Marks) are to be attended by the students]

Centralized Internal Assessment [20 Marks]

8. Identification..... [10 specimens x 2 marks each].....20

Centralized External Assessment [20 Marks]

To be scheduled by the W. B. State University

9. Laboratory note books, Slides, Field records, Herbarium sheets..... [5+3+3+3].....14

10. *Viva Voce*.....6

Laboratory note books [must regularly be checked and signed with date]; Slides [permanent slides prepared in the class]; Herbarium [at least 10 (ten) herbarium specimens (sheets) of common angiospermic weeds are to be prepared by the students, stating details of the specimens].

[The materials included under Topic No. 9 are to be submitted, as and when required, at the time of external centralized examination]-----

Internal Assessment System

Pro-forma of Log Book cum Attendance Register for continuous Internal Assessment of Paper III: Effective & Valid from 2008 -09 Session

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West Bengal State University

Barasat

Syllabi for 3 year - B. Sc. Degree Course
[3 years 1+1+1 Examination System]

BOTANY

(GENERAL)

[WBSU Code - 1212]

2009

[Syllabus to be effective from 2010 – 2011 Session]

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		80	20	
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BOTG

PART - I [First Year Terminal] : 100 Marks

Paper - I Theoretical 100 Marks [3hr.]
(Code - 121201)

Group A: - Algae, Fungi & Lichen, Plant Pathology & Microbiology.....40 Marks
Group B: - Bryophyta, Pteridophyta, Gymnosperms & Palaeobotany.....30 Marks
Group C: - Morphology & Taxonomy of Angiosperms, and Palynology.....30 Marks

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Group C: - [30 Marks / 15 Periods]

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PART - II [Second Year Terminal] : 100 Marks

Paper - II Theoretical 100 Marks [3 hr.]

(Code - 121202)

Group A: - Anatomy, Embryology, Economic Botany & Ecology.....40 Marks

Group B: - Cell Biology and Genetics30 Marks

Group C: - Biochemistry and Plant Physiology.....30 Marks

Group A: - [40 Marks / 25 Periods]

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Group B: - [30 Marks / 25 Periods]

Cell Biology - [10 marks / 8 Periods] Endomembrane system & Cytoskeleton. // Ultrastructure of nuclear membrane & nucleolus. // Nucleosome, euchromatin & heterochromatin. // cell cycle, interphase & cell division with reference to meiosis. // Chromosomal aberration - deletions, duplications, inversion and translocation. // Aneuploidy and polyploidy - types, importance, and role in evolution.

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Group C: - [30 Marks / 25 Periods]

Biochemistry - [10 marks / 8 Periods] Carbohydrates - chemistry and importance of ribose, glucose, fructose, sucrose, maltose, starch, cellulose & dextran. // Protein - primary, secondary, tertiary & quaternary structures. // Enzyme- Definition, Types and examples, co-factors, co-enzymes.

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Paper - III Practical 100 Marks

(Code - 121203)

[Internal - 80 Marks] & [External - 20 Marks]

Regular & Daily Internal Assessment [60 Marks]

Topics	Marks [Completion & Performance]
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Field record - stating date, types of vegetation & predominant plant species present in the area visited [Two local excursions (3 x 2 = 6 Marks) are to be attended by the students]

Centralized Internal Assessment [20 Marks]

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Chemistry Honours : Scheme of the Syllabus

Course names and Marks distribution :

CEMAT denotes **Chemistry Hons Theory**

CEMAP denotes **Chemistry Hons Practical**

Code : First digit refers to year, second to paper, third letter to subject, fourth to part.

PART – I (1st Year), Total marks = 200 (Theory = 150, Practical = 50)

Paper I

CEMAT [11-IA+11-IB], each course 25 marks, Total marks = 50 (Inorganic)

CEMAT [11-0A+11-0B], each course 25 marks, Total marks = 50 (Organic)

Paper II

CEMAT [12-PA+12-PB], each course 25 marks, Total marks = 50 (Physical)

CEMAP [12 -PrA+12 PrB], each course 25 marks, Total marks = 50
(course 12-PrA – Organic, 12-PrB – Inorganic{Analytical})

Courses 11-IA, 11-IB, 11-OA, 11-OB, 12-PA, 12-PB each contains two units.
Unit 1 : 12 marks, Unit 2 : 13 marks

PART – II (2nd Year), Total marks = 200 (Theory = 150, Practical = 50)

Paper III

CEMAT [23 -IA+23-IB], each course 25 marks, Total marks = 50 (Inorganic)

CEMAT [23 -0A+23-0B], each course 25 marks, Total marks = 50 (Organic)

Paper IV

CEMAT [24-PA+24-PB], each course 25 marks, Total marks = 50 (Physical)

CEMAP [24-PrA+24-PrB], each course 25 marks, Total marks = 50
(course 24-PrA – Physical, 24-PrB – Inorganic{Qualitative})

Courses 23-IA, 23-IB, 23-0A, 23-0B, 24-PA and 24-PB each contain two units.
Unit 1 : 12 marks, Unit 2 : 13 marks

PART – III (3rd Year), Total marks = 400 (Theory = 200, Practical = 200)

Paper V

CEMAT [35-IA+35-IB], each course 25 marks, Total marks = 50 (Inorganic)

CEMAT [35-AA+35-AB], each course 25 marks, Total marks = 50 (Advanced Chemistry)
{Course 35-AA – Bioinorganic + Material Chemistry
Course 35-AB – Bioorganic + Biophysical}

Paper VI

CEMAT [36-OA+36-OB], each course 25 marks, Total marks = 50 (Organic)

CEMAT [36-PA+36-PB], each course 25 marks, Total marks = 50 (Physical)

Courses 35-IA, 35-IB, 35-AA, 35-AB, 36-OA, 36-OB, 36-PA and 36-PB each contain two units. {Unit 1 : 12 marks, Unit 2 : 13 marks}

Paper VII

CEMAP [37] Total marks = 100

Course 37-Pr

Physical (50 marks) + Organic TLC etc (25 marks) + LNB-viva (25 marks)

Paper VIII

CEMAP [38] Total marks = 100

Course 38-Pr

Inorganic (50 marks) + Organic Preparation (25 marks) + LNB-viva (25 marks)

Notes:

1. Each Theory module of 25 marks contains units I (marks = 13) and II (marks = 12).
2. Number of class hours = 30-35 for a 25-mark Theory module, 70-80 for a 25-mark Practical module

Effective from academic session 2011-2012

B.Sc Part-I (1st Year) Chemistry (Honours)

Total Marks 200 (Theory = 150, Practical = 50)

Paper I

Courses : CEMAT 11-IA, 11-IB, 11-OA, 11-OB

(Each 25 marks : Total 100 marks)

CEMAT 11-IA

Unit-I. Radioactivity and Atomic Structure

13 marks

Nuclear stability and nuclear binding energy. Nuclear forces: meson exchange theory. Nuclear models (elementary idea): Concept of nuclear quantum number, magic numbers. Nuclear Reactions: Artificial radioactivity, transmutation of elements, fission, fusion and spallation. Nuclear energy and power generation. Separation and uses of isotopes in tracer techniques. Radio chemical methods: principles of determination of age of rocks and minerals, age of earth, radio carbon dating, hazards of radiation and safety measures.

Bohr's theory to hydrogen-like atoms and ions; spectrum of hydrogen atom. Sommerfeld's theory (no derivation). Quantum numbers. Introduction to the concept of atomic orbitals; shapes, radial and angular probability diagrams of s, p and d orbitals (qualitative idea). Many electron atoms and ions: Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitation. Electronic energy level diagram and electronic configurations of hydrogen-like and polyelectronic atoms and ions. Term symbols of atoms and ions for atomic numbers < 30.

Unit-II. Chemical periodicity I

12 marks

Periodic table, group trends and periodic trends in physical properties. Classification of elements on the basis of electronic configuration. Modern IUPAC Periodic table. General characteristic of s, p, d and f block elements. Position of hydrogen and noble gases in the periodic table.

Effective nuclear charges, screening effects, Slater's rules, atomic radii, ionic radii (Pauling's univalent), covalent radii. Ionization potential, electron affinity and electronegativity (Pauling's and Allred-Rochow's scales) and factors influencing these properties. Inert pair effect. Group trends and periodic trends in these properties in respect of s-, p- and d-block elements. Catenation property and its controlling factors.

CEMAT 11-IB

Unit-I. Chemical Bonding and structure

13 marks

Ionic bonding: Size effects, radius ratio rules and their limitations. Packing of ions in crystals, lattice energy, Born-lande equation, Born-Mayer equation, Kapustinskii equation (no derivation) and applications, Born-Haber cycle and its applications. Solvation energy, polarizing power and polarizability, ionic potential, Fajan's rules. Defects in solids (elementary idea).

Covalent bonding: Lewis structures, formal charge. Valence Bond Theory, directional character of covalent bonds, hybridizations, equivalent and non-equivalent hybrid orbitals, Bent's rule, VSEPR theory, Failure of VSEPR theory-to explain [e.g., TeCl_6^{2-} , TeBr_6^{2-} and SbBr_6^{3-} in $(\text{NH}_4)_4(\text{SbBr}_6)_2$] shapes of molecules and ions containing lone pairs and bond pairs (examples from main groups chemistry), importance of π -bonding particularly in the '2p' sublevel- and its effect on – structure (dimerization, polymerization etc.), bonding and reactivity e.g. acid base and redox properties (application to different groups.). Partial ionic Character of covalent bonds, bond moment, dipole moment and electronegativity differences. Concept of resonance, resonance energy, resonance structures. Effect of $3d^{10}$ configuration on the chemistry of non metals e.g. As, Se, and Br particularly on the acidic and redox properties of compounds.

Unit-II. Acid-Base reactions

12 marks

Acid-Base concept: Arrhenius concept, theory of solvent system (in H_2O , NH_3 , SO_2 and HF), Bronsted-Lowry's concept, relative strength of acids, Pauling rules. Amphoterism. Lux-Flood concept, Lewis concept. Superacids, HSAB principle. Acid-base equilibria in aqueous solution and pH. Acid-base neutralisation curves; indicator, choice of indicators. Buffer solution, composition, buffer capacity.

CEMAT 11-OA

Unit I

13 marks

Nomenclature (trivial and IUPAC), DBE, hybridization(sp^n , $n = 1,2,3$) of C, N, O, halogens, bond distance, bond angles, VSEPR, shapes of molecules, inductive and field effects, bond energy, bond polarity and polarisability, dipole moment, resonance, resonance energy, steric inhibition of resonance, hyperconjugation, π M.O diagrams of ethylene, butadiene, 1,3,5-hexatriene, allyl cation, allyl anion, allyl radical, HOMO and LUMO in ground and excited states, orbital pictures of allene, carbene(singlet and triplet), vinyl cyanide, Huckel's rule for aromaticity and antiaromaticity (neutral systems 4,6,8,10 annulene, charged systems 3,4,5,7 rings, homoaromaticity, Frost-diagram, melting point, boiling point, heat of hydrogenation, heat of combustion, hydrogen bonding (intra- and inter-molecular), crown-ether, concepts of acidity, basicity and nucleophilicity.

Unit II

12 marks

Stereochemistry of acyclic compounds: representation of molecules in Fischer, flying-wedge, Sawhorse and Newman formula and their translations, chirality, elements of symmetry, simple axis (C_n), plane of symmetry (σ), centre of symmetry (i), alternating axis of symmetry (S_n), asymmetry and dissymmetry, optical activity, specific rotation, molar rotation, specific rotation of mixture, Biot's law.

Stereoisomerism: enantiomerism, diastereoisomerism, stereogenic centre, systems with chiral centres, stereogenic centres involving $C=C$, $C=N$, D/L, R/S, E/Z, syn/anti, cis/trans, meso/dl, threo/erythro nomenclature.

Conformation: conformational nomenclature; eclipsed, staggered, gauche and anti, dihedral angle, torsional angle, Klyne-Prelog terminology, energy barrier of rotation, relative stability of conformers on the basis of steric effect, dipole-dipole interaction, hydrogen bonding, conformational analysis of ethane, propane, n-butane, 1,2-dihaloethane, 2-methylbutane, 1,2-glycols, invertomerism of trialkyl amines.

Stereochemistry of carbocation, carbanion, radical, thermodynamic requirements of reaction, ΔH , ΔG , ΔS , dependence of ΔH on bond energy, equilibrium controlled changes, relative ease of intermolecular versus intramolecular reactions.

Reaction kinetic; rate equations, transition-state theory and ΔG^\ddagger , free energy profile for one step and two steps reactions, Hammond postulate, kinetically and thermodynamically controlled reactions, kinetic studies, studies of intermediates, cross-over experiments, stereochemical proof, isotope labeling (kinetic and non-kinetic), primary kinetic isotope effect (K_H/K_D only),

CEMAT 11-OB

Unit I

13 marks

Addition to $C=C$ and $C\equiv C$ bonds, halogenation, oxidation, epoxidation, hydroxylation, ozonolysis, carbene addition, oxymercuration-demercuration, peroxide effect, conjugated dienes, 1,2- vs 1,4- addition, Birch reduction of alkadienes and alkynes, regio and stereo selectivity.

Nucleophilic substitution and elimination reactions: SN_1 , SN_2 , SN_i , NGP, E_1 , E_2 , E_1CB mechanism, elimination vs substitution, Saytzeff and Hoffman rules, 1,1-elimination.

Alcohol and ethers: synthesis and reactivity including pinacol-pinacolone rearrangement.

Unit II

12 marks

Aromatic electrophilic substitution: π -complex, σ -complex, ipso-substitution, activating and deactivating groups, orienting influence of groups, activated aromatic nucleophilic substitution, cine- substitution.

Alkanes: synthesis and reactivity, reactivity of radicals, carbene, nitrene: generation and stability, definition and examples of ylide and zwitterions.

Paper II

**Courses : CEMAT 12-PA, 12-PB, CEMAP 12-PrA, 12-PrB
(Each 25 marks : Total 100 marks)**

CEMAT 12-PA

Unit -I : Kinetic Theory of Gas

13 marks

Concept of pressure and temperature. Nature of the distribution of velocities in one dimension (with derivation), extension to two and three dimensions (without derivation, expression by induction). Maxwell's distribution of speeds. Kinetic energy distribution in one, two and three dimensions, calculations of average, root mean square and most probable values in each case ; calculation of the number of molecules having energy $\geq \epsilon$. Principle of the equipartition of energy and its application to calculate the classical limit of molar heat capacity of gases.

Collision of gas molecules; collision diameter; collision number and mean free path; frequency of binary collisions (similar and different molecules); wall collision and rate of effusion. Viscosity of gases from kinetic theory of gas.

Unit-II : Real gas and Liquid State

12 marks

Deviation of gases from ideal behaviour; Compressibility factor; Andrew's and Amagot's plots; van der Waals equation and its characteristic features. Existence of critical state. Critical constants in terms of van der Waals constants. Law of corresponding state and significance of second virial coefficient. Boyle temperature. Intermolecular forces; Lennard-Jones potential.

Nature of the liquid state (short range order and long range disorder). Vapor pressure. Surface tension, surface energy, excess pressure, capillary rise and measurement of surface tension (relative and absolute methods). Work of cohesion and adhesion, spreading of a liquid over other surface. Vapour pressure over curved surface. Temperature dependence of surface tension.

General features of fluid flow (streamline flow and turbulent flow). Reynold number, nature of viscous drag for streamline motion, Newton' equation, viscosity coefficient. Poiseuille's equation (with derivation), temperature dependence of viscosity of liquid and its difference from gas, principle of determination of viscosity coefficient of liquids by the falling sphere method.

CEMAT 12-PB

Unit-I : Thermodynamics-I

13 marks

Definition of thermodynamic terms : intensive and extensive variables, isolated, open and closed systems, concept of heat and work, thermodynamic processes : cyclic, reversible, irreversible, isothermal, adiabatic processes, thermodynamic functions and their differentials, zeroth law of thermodynamics; first law of thermodynamics, internal energy (U), Joule's experiment and its consequences, Joule-Thomson experiment and its consequences, enthalpy (H), relation between C_p and C_v , calculation of work (w), quantity of heat (q), ΔU and ΔH for expansion of ideal and van der Waals gases, gas under isothermal and adiabatic conditions for reversible and irreversible processes including free expansion. Heat changes during various physico-chemical processes at constant pressure / constant volume, Hess's law, Kirchoff's relation, concept of standard state, bond dissociation energy, Born-Haber cycle for calculation of lattice energy.

Spontaneous process, heat engine, Carnot cycle and its efficiency, statements of second law, refrigeration cycle, thermodynamic scale of temperature, entropy as a state function, Clausius inequality, calculation of entropy changes in different processes, molecular interpretation of entropy. Maxwell relations.

Unit-II : Chemical Kinetics

12 marks

Introduction of reaction rate in terms of extent of reaction (degree of advancement); rate constants, order and molecularity of reactions. Reactions of zero order, first order, second order and fractional order. Pseudo first order reactions (example using acid catalyzed hydrolysis of methyl acetate). Determination of the order of a reaction by half-life and differential method, integrated rate equation and isolation method. Rate-determining and steady-state approximation – explanation with suitable examples.

Opposing reactions, consecutive reactions and parallel reactions (with explanation of kinetic and thermodynamic control of products; all steps first order).

Temperature dependence of rate constant: Arrhenius equation, energy of activation. Collision theory (detailed treatment); outline of Transition State theory. Primary kinetic salt effect. Lindemann theory of unimolecular reaction. Homogeneous catalysis with reference to acid-base catalysis.

CEMAP 12-PrA**25 marks**Practical Organic
Experiment

20M

1. Melting point determination 1M
2. Detection of special elements (N, Cl, Br, I, S) by Lassigne's test 3M
3. Solubility and classification. 2+1 = 3M
(Solvents: water, 5% HCl, 5% NaHCO₃, 5% NaOH)
4. Detection of the following functional groups by systematic chemical analysis:
9x1=9M

Aromatic amino(NH₂), anilido, amido, aromatic nitro, C=C, phenolic OH, ester, carboxylic acid, carbonyl(aldehyde and ketone distinction), only one test for each functional group is to be reported.

- 5a. Preparation of suitable derivative 3M
- b. M.P. of derivative 1M

NOTE: Each student during laboratory session is required to carry out qualitative chemical test for all special elements and functional groups in known and unknown (at least six) organic compounds. In practical examination, one unknown solid organic compound containing not more than two of the above functional groups (5) shall be assigned to a candidate through a single draw lottery

- b) Laboratory records & viva: 2.5x2=5M

CEMAP 12-PrB**25 marks**

Practical Inorganic

- 1) Determination of hardness of water (by EDTA).
- 2) Estimation of vitamin-C (Iodometry).
- 3) Determination of strength of H₂O₂ (Permanganometry).
- 4) Estimation of i) NH₄⁺ ii) H₃BO₃ (any one).
- 5) Estimation of available oxygen in pyrolusite.
- 6) Estimation of Cu(II) – iodometric.
- 7) Estimation of Fe(III) – after reduction (Dichromatometry).

** If NH₄HF₂ is used in place of H₃PO₄ titration should be carried out in 100 ml. 2(N) H₂SO₄ solution for better result.

B.Sc Part-II (2nd Year) Chemistry (Honours)

Total Marks 200 (Theory = 150, Practical = 50)

Paper III

Courses : CEMAT 23-IA, 23-IB, 23-OA, 23-OB

(Each 25 marks : Total 100 marks)

CEMAT 23-IA

Unit I. Chemical Periodicity II

13 marks

General trends of variation of electronic configuration, elemental forms, metallic nature, magnetic properties (if any), catenation and catalytic properties (if any), oxidation states, inert pair effect (if any), aqueous and redox chemistry in common oxidation states, properties and reactions of important compounds such hydrides, halides, oxides, oxy-acids (if any), complex chemistry (if any) in respect of the following elements:

(i) s-block elements: Li-Na-K, Be-Mg-Ca-Sr-Ba.

(ii) p-block elements: B-Al-Ga-In-Tl, C-Si-Ge-Sn-Pb, N-P-As-Sb-Bi, O-S-Se-Te, F-Cl-Br-I, He-Ne-Ar-Kr-Xe

Unit II. Other Types of Bonding

12 marks

Molecular orbital concept of bonding (elementary pictorial approach) :sigma and pi-bonds, multiple bonding, MO diagrams of H₂, F₂, O₂, C₂, B₂, CO, NO, CN⁻, HF, and HF₂⁻ ion, BeH₂, CO₂, magnetic properties, bond orders, bond lengths. Coordinate bonding: Lewis acid-base adducts (examples), double salts and complex salts, Werner theory of coordination compounds. Ambidentate and polydentate ligands, chelate complexes, intermetallic complexes (formation as a function of pH and effect of entropy and ring size). IUPAC nomenclature of coordination compounds (up to two metal centers). Coordination numbers, constitutional isomerism. Stereoisomerism in square planar and octahedral complexes.

Hydrogen bonding and its effects on the physical properties and chemical properties of compounds of the main group elements.

Metallic bonding: qualitative idea of band theory, conducting, semi conducting and insulating properties with examples from main group elements.

CEMAT 23-IB

Unit I. Chemistry of s- and p-block Elements

13 marks

(i) Structure, bonding and reactivity of B_2H_6 ; $(SN)_x$ with $x = 2, 4$; phosphazines; interhalogens; XeF_6 . (ii) Structure of borates, polyphosphates, borazole, boron nitride, silicones, thionic acids (iii) Reactivity of polyhalides, pseudo halides, fluorocarbons, freons and NO_x with environmental effects, (iv) Chemistry of hydrazine, hydroxylamine, N_3^- , thio- and per-sulphates.

Noble gases: oxides, fluorides and oxofluorides of xenon; chemical and photochemical reactions of ozone.

Unit II. Precipitation and Redox Reactions

12 marks

Solubility product principle, common ion effect and their applications to the precipitation and separation of common metallic ions as hydroxides, sulfides, phosphates, carbonates, sulfates and halides. Ion-electron method of balancing equation of redox reaction. Elementary idea on standard redox potentials with sign conventions, Nernst equation. Influence of complex formation, precipitation and change of pH and ionic strength on redox potentials; formal potential. Feasibility of a redox titration, redox potential at the equivalence point, redox indicators. Redox potential diagram (Latimer, Frost, Ellingham diagrams) of common elements and their applications. Disproportionation and comproportionation reactions (typical examples), Choice of redox indicators.

CEMAT 23-OA

Unit-I

13 marks

UV: Electronic transitions ($\sigma \rightarrow \sigma^*$, $n \rightarrow \sigma^*$, $\pi \rightarrow \pi^*$, $n \rightarrow \pi^*$),

Factor influencing the relative position of λ_{max} (conjugative effect, steric effect, solvent effect, conformational effect, effect of pH), relative intensity of absorption of allowed transition, transition moment, effective chromophore concentration, red shift (bathochromic shift), blue shift (hypsochromic shift), hyperchromic shift, hypochromic shift (typical examples).

IR: Modes of molecular vibration, application of Hook's law, force constant, factor influencing stretching frequency (H-bonding, mass, electronic factors, bond multiplicity, ring size, solvent effect, bond coupling), Fermi resonance, characteristic and diagnostic stretching frequencies of O-H, N-H, C-H, C-D, C=C, C=N, C=O, C≡C, C≡N functions.

1H -NMR: Nuclear spin, NMR active nuclei, principle of proton magnetic resonance, equivalent and non-equivalent protons, chemical shift(δ), shielding and deshielding of protons, upfield and downfield shift, NMR peak area, spin-spin coupling (simple type), 1H -NMR spectra of toluene, nitrobenzene, benzaldehyde, o-,m-,p-dichlorobenzene,

dinitrobenzene, $\text{CH}_3\text{CH}_2\text{Br}$, CH_3CHBr_2 , $\text{CH}_2\text{BrCH}_2\text{Br}$, $\text{CHBr}_2\text{CH}_2\text{Br}$, $\text{CH}_3\text{CH}_2\text{OH}$ (ordinary and pure), *E*- and *Z*- 2-butene, ethylene and acetylene, *E*- and *Z*- 1-Bromo-2-chloroethene.
Mass: Basic principle of mass spectroscopy

Unit II

12 marks

Phenol, ambident nucleophile: C- substitution versus O-substitution, reaction of phenols: Reimer-Tiemann reaction, Kolbe's reaction, Manasse reaction, alkylation, acetylation, Fries rearrangement, Claisen rearrangement, nitration, sulphonation, halogenation, oxidation (aerial), oxidative coupling by Fe^{3+} , Dakin reaction, Cumene-phenol rearrangement.
Organometallic compounds: Preparation and synthetic applications of organomagnesium, organolithium, organozinc, organocopper, use of TMSCl , TMSI , TMSCN .
Stereochemistry: cumulene with odd and even number of $\text{C}=\text{C}$, axial chirality (allene, spiro compound, alkylidene cycloalkanes, biphenyls (atropisomerism)), and R/S nomenclature, resolution of racemic acids, bases, and alcohols, optical purity/enantiomeric excess, topicity (topic attribute-chirotopic, achirotopic,; topic relationship-homotopic, enantitopic, diastereotopic), prochirality, Pro-r, Pro-s and re/si descriptor.

CEMAT 23-OB

Unit I

13 marks

Chemistry of carbonyl compounds: Nucleophilic addition to $\text{C}=\text{O}$, reactivity of carbonyl compounds, relative stability of acetal, ketal, thioacetal, thioketal and cyanohydrin, reductions (using LiAlH_4 , NaBH_4 , electrolytic reduction, reductive coupling, MPV reduction), Cannizzaro reaction, benzil-benzilic acid rearrangement, Tischenko reaction, nucleophilic addition to α,β -unsaturated carbonyl compounds, reaction of benzoquinone, Wolf-Kishner reduction, aldol condensation, Claisen-Schmidt reaction, Wittig reaction, enamine reaction, Eschweiler-Clarke methylation, Darzen's reaction, Perkin reaction, benzoin condensation, electrophilic substitution at α position of carbonyl compounds (D-exchange, nitrosation, halogenation, haloform reaction, SeO_2 oxidation), Baeyer-Villiger oxidation, concept of umpulung.

Carboxylic acids and their derivatives: Nucleophilic substitution at the acyl carbon of acyl halide, anhydride, ester, carboxylic acid, amide, esterification of carboxylic acids and hydrolysis of ester- AAc^2 , AAc^1 , AAI^1 , BAc^2 , BAc^1 , BAI^1 mechanisms, HVZ reaction, Claisen ester condensation, Bouveault Blanc reduction, decarboxylation reaction, Hunsdiecker reaction, action of heat on hydroxy acid.

Unit II**12 marks**

Organonitrogen compounds: synthesis and reactions of nitroalkanes, alkylnitrites, alkyl cyanides and isocyanides, aliphatic amines, aromatic nitro, amines and diazo compounds, distinction and separation of 1^o, 2^o, 3^o amines, diazomethane, diazoacetic ester-preparation and synthetic applications.

Paper IV

Courses : CEMAT 24-PA, 24-PB, CEMAP 24-PrA, 24-PrB

(Each 25 marks : Total 100 marks)

CEMAT 24-PA

Unit-I : Quantum Chemistry I

13 marks

Black body radiation: Rayleigh-Jeans and Planck's energy distribution law, Planck's theory, Wave-particle duality, light as particles: photoelectric and Compton effects; electrons as waves (electron diffraction experiment) and the de Broglie hypothesis.

Elementary concepts of operators, eigenfunctions and eigenvalues. Linear operators. Commutation of operators, fundamental commutator and uncertainty relation (without proof). Expectation value. Hermitian operator. Schrödinger time-dependent and time-independent equation: nature of the equation, acceptability conditions imposed on the wave functions and probability interpretations of wave function, postulates of quantum mechanics.

Particle in a box: setting up of Schrodinger equation for one-dimensional box and its solution. Comparison with free particle eigenfunctions and eigenvalues. Properties of PB wave functions (normalisation, orthogonality, probability distribution). Expectation values of x , x^2 , p_x and p_x^2 and their significance in relation to the uncertainty principle. Extension of the particle in a one-dimensional problem to two and three dimensions and the concept of degenerate energy levels.

Simple Harmonic Oscillator: setting up of the Schrodinger equation, energy expression (without derivation), expression of wave function for $n = 0$ and $n = 1$ (without derivation) and their characteristic features.

Unit-II : Quantum Chemistry II and Photochemistry

12 marks

Stationary Schrodinger equation for the H-atom in polar coordinates, separation of radial and angular (θ , ϕ) parts. Solution of ϕ -part and emergence of quantum number 'm'; energy expression (without derivation), degeneracy. Hydrogenic wave functions up to $n = 2$ (expression only); real wave function. Concept of orbitals and shapes of s and p orbitals.

Potential energy curves (diatomic molecules), Qualitative idea of Born Oppenheimer approximation and Franck-Condon principle, vibrational structure of electronic spectra. Bond dissociation and principle of determination of dissociation energy (ground state). Decay of excited states by radiative and non-radiative processes. Fluorescence and phosphorescence, Jablonsky diagram.

Laws of photochemistry: Grotthus-Draper law, Stark-Einstein law of photochemical equivalence and Lambert-Beer's law; quantum yield and its measurement for a

photochemical process, actinometry. Photostationary state. Photosensitized reactions. Kinetics of HI decomposition, $\text{H}_2\text{-Br}_2$ reaction, dimerisation of anthracene.

CEMAT 24-PB

Unit-I : Thermodynamics(II) and Chemical Equilibrium

13 marks

Gibbs function (G) and Helmholtz function (A), criteria of thermodynamic equilibria and spontaneity, Maxwell's relations, variation of G and A with P, V and T, Thermodynamic equation of state, Clausius-Clapeyron equation, equilibrium between different phases, system of variable composition, partial molar quantities, chemical potential of a component in an ideal mixture, thermodynamic functions of mixing of ideal gases, Gibbs-Duhem equation, variation of chemical potential with T, P and mole fraction, thermodynamics of real gases – fugacity and activity determination.

Equilibrium constant and standard Gibbs free energy change. Definitions of K_P , K_C and K_x ; van't Hoff's reaction isotherm, isobar and isochore from different standard states. Shifting of equilibrium due to change in external parameters e.g. temperature and pressure. Le Chatelier's principle and degree of advancement.

Unit -II : Electrochemistry(Conductance, EMF and Ionic Equilibrium)

12 marks

Conductance and measurement of conductance, cell constant, specific conductance and molar conductance. Variation of specific and equivalent conductance with dilution for strong and weak electrolytes. Kohlrausch's law of independent migration of ions, ion conductance and ionic mobility. Equivalent and molar conductance at infinite dilution and their determination for strong and weak electrolytes. Ostwald's dilution law. Debye-Huckel model (physical idea only). Application of conductance measurement (determination of solubility product and ionic product of water). Conductometric titrations. Determination of transport number by moving boundary method.

Types of electrochemical cells and examples, cell reactions, emf and change in free energy, ΔH and ΔS of cell reactions from emf measurements. Thermodynamic derivation of Nernst equation. Standard cells. Half-cells/electrodes, different types of electrodes (with examples). Standard electrode potential (IUPAC convention) and principles of its determination. Types of concentration cells. Liquid junction potential and its minimization. Glass electrode and determination of pH of a solution. Potentiometric titrations: acid-base and redox.

Activity and activity coefficients of electrolyte/ion in solution. Debye-Huckel limiting law (statement and applications only). Solubility equilibrium and influence of common ions and indifferent ions thereon. pH, buffer solution, buffer capacity, salt hydrolysis (detailed treatment).

CEMAP 24-PrA**25 marks****Experiments:**

1. Determination of surface tension of a given solution by the drop weight method using a stalagmometer, considering aqueous solutions of NaCl, acetic acid, ethanol etc, as systems.
2. Determination of viscosity coefficient of a given solution with Ostwald's viscometer considering aqueous solutions of cane-sugar, glycerol, ethanol, etc.
3. Determination of solubility of sparingly soluble salts in water and various Electrolyte medium by titrimetric method. KHTa as sparingly soluble salt in water, KCl, NaNO₃ may be used.
4. Determination of partition coefficient of Iodine or Acetic acid in water and an immiscible organic solvent.
5. Determination of the rate constant for the first order acid catalyzed hydrolysis of an ester (V_0 and V_∞ to be supplied)
6. Determination of rate constant of decomposition of H₂O₂ by acidified KI solution using clock reactions.
7. Determination of the equilibrium constant of the reaction $KI + I_2 = KI_3$ by partition method (partition coefficient to be supplied).
8. Determination of pH of an unknown buffer solution by colour matching.

A separate laboratory workbook should be maintained for these experiments.

CEMAP 24-PrB**25 marks****Qualitative inorganic analysis of mixtures containing not more than 4 radicals from the following:**

Cation Radicals: Na⁺, K⁺, NH₄⁺, Ca²⁺, Sr²⁺, Ba²⁺, Al³⁺, Mg²⁺, Cr³⁺, Mn²⁺, Fe²⁺, Fe³⁺, Sn²⁺, Co²⁺, Ni²⁺, Cu²⁺, Zn²⁺, Sb³⁺.

Anion Radicals: F⁻, Cl⁻, Br⁻, BrO₃⁻, I⁻, SCN⁻, S²⁻, SO₃²⁻, SO₄²⁻, S₂O₃²⁻, NO₃⁻, NO₂⁻, PO₄³⁻, BO₃³⁻, CrO₄²⁻/Cr₂O₇²⁻, Fe(CN)₆⁴⁻, Fe(CN)₆³⁻, IO₃⁻

Insoluble Materials: Al₂O₃, Fe₂O₃, Cr₂O₃, SnO₂, SrSO₄, BaSO₄, CaF₂.

Detection of toxic metal ions and radicals (under special supervision): As³⁺, AsO₄³⁻, Bi³⁺, Pb²⁺, Hg₂²⁺, Hg²⁺, Cd²⁺.

Analysis of the sample with confirmation avoiding interference including special tests (dry/wet) taking different extracts [e.g. (i) aqueous; (ii) HCl extract; (iii) HNO₃ extract; (iv) NaOH extract (after fusion) or from the residue left after Na₂CO₃ extract for basic radicals] or by the usual procedure as follows:

1.	Reporting of radicals including charges	4 x 0.5 = 2
2.	Dry tests for radicals	4 x 1 = 4
3.	Wet tests for radicals	4 x 1 = 4
4.	Confirmation of radicals	4 x 1.5 = 6
5.	Probable composition with appropriate logic	4
6.	Laboratory note book	3
7.	Viva voce	2

Note: Students will be allowed to sit for practical examination provided they submit the Laboratory Note book containing at least six unknown sample analysis, duly signed by the concerned teacher.

Oxide, hydroxide, carbonate and bicarbonate should not be reported as radicals.

B.Sc Part-III (3rd Year) Chemistry (Honours)

Total Marks 400 (Theory = 200, Practical = 200)

Paper V

Courses : CEMAT 35-IA, 35-IB, 35-AA, 35-AB

(Each 25 marks : Total 100 marks)

CEMAT 35-IA

Unit I. Chemistry of coordination compounds

13 marks

Isomerism, reactivity and stability: Determination of configuration of cis- and trans- isomers by chemical methods. Labile and inert complexes (application of CFAE), substitution reaction on square planer complexes, trans effect (example and applications). Stability constants of coordination compounds and their importance in inorganic analysis.

Structure and bonding: EAN rule, VB description and its limitations. Elementary Crystal Field Theory: splitting of d^n configurations in octahedral, square planar and tetrahedral fields, crystal field stabilization energy in weak and strong fields; pairing energy, evidence and application of crystal field (lattice energy, ionic radius, hydration energy, redox pot, spinel), Jahn-Teller distortion (static and dynamic), evidence from stability constant and vis-spectra. Metal-ligand bonding (MO concept, elementary idea), sigma- and pi-bonding in octahedral complexes (qualitative pictorial approach) and their effects on the oxidation states of transitional metals (examples).

Magnetism and Colour: Orbital and spin magnetic moments, spin only moments of d^n ions and their correlation with effective magnetic moments, including orbital contribution; quenching of magnetic moment: super exchange and antiferromagnetic interactions (elementary idea with examples only); d-d transitions; L-S coupling, Hole formalism principle; qualitative Orgel diagrams for $3d^1$ - $3d^9$ ions and their spectroscopic ground states; selection rules for electronic spectral transitions; spectrochemical series of ligands; Nephelauxetic parameter charge transfer spectra, different types (elementary idea with examples).

Unit II. Chemistry of d- and f- block elements

12 marks

General comparison of 3d, 4d and 5d elements in term of electronic configuration, elemental forms, metallic nature, atomization energy, oxidation states, redox properties, coordination chemistry, spectral and magnetic properties.

f-block elements: electronic configuration, ionization energies, oxidation states, variation in atomic and ionic (3+) radii, magnetic and spectral properties of lanthanides, comparison between lanthanide and actinides, separation of lanthanides (by ion-exchange method).

Chemistry of some representative compounds: $K_2Cr_2O_7$, $KMnO_4$, $K_4[Fe(CN)_6]$, $K_2[Ni(CN)_4]$, H_2PtCl_6 , $Na_2[Fe(CN)_5NO]$.

CEMAT 35-IB

Unit I. Organometallic Compounds

13 marks

18-electron rule and its applications to carbonyls (including carbonyl hydrides and carbonylates), nitrosyls, cyanides, and nature of bonding involved therein. Simple examples of metal-metal bonded compounds and metal clusters. Metal-olefin complexes: zeise's salt (preparation, structure and bonding), Ferrocene (preparation, structure and reactions). Hapticity(n) of organometallic ligands, examples of mono tri and penta-hapto cyclopentadienyl complexes. Simple examples of fluxional molecules. Coordinative unsaturation: oxidative addition and insertion reactions. Homogeneous catalysis by organometallic compounds: hydrogenation, hydroformylation and polymerization of alkenes (Ziegler-Natta catalysis).

Unit II: Gravimetric and titrimetric methods of analysis

12 marks

Requirements of gravimetry: properties of precipitates and precipitating reagents, particle size and filterability of precipitates, colloidal and crystalline precipitates coprecipitation and post-precipitation drying and ignition of precipitates, principles of gravimetric estimation of chloride, phosphate, zinc, iron, aluminum and magnesium singly.

Primary and secondary standard substances in acid-base, redox, complexometric (EDTA) and argentometric titrations. Principle and application of redox titrimetric estimation based on the use of the following reagents: $KMnO_4$, $K_2Cr_2O_7$, I_2 , $Na_2S_2O_3 \cdot 5H_2O$, $KH(IO_3)_2$ and $KBrO_3$. Principle of argentometric estimation of chloride using adsorption indicators.

Principle of complexometric EDTA titration, metal ion indicators (examples), masking and demasking reactions, estimation of Cu-Zn, Fe-Al and Ca-Mg mixture by EDTA titration methods.

Dissolution, scheme of analysis and principles of estimation of the constituents of the following materials: dolomite, pyrolusite, chalcopyrites, Portland cement, basic slag, brass, steel and type metal.

CEMAT 35-AA

Unit I. Bioinorganic Chemistry

13 marks

Elements of life: essential major, trace and ultratrace elements. Basic chemical reactions in the biological systems and the role of metal ions (specially Na^+ , K^+ , Mg^{2+} , Ca^{2+} , $\text{Fe}^{3+/2+}$, $\text{Cu}^{2+/+}$, and Zn^{2+}). Metal ion transport across biological membrane Na^+ -ion pump, ionophores. Biological functions of hemoglobin and myoglobin, cytochromes and ferredoxins, carbonate bicarbonate buffering system and carbonic anhydrase. Biological nitrogen fixation, Photosynthesis: Photosystem-I and Photosystem-II. Toxic metal ions and their effects, chelation therapy (examples only), Pt and Au complexes as drugs (examples only), metal dependent diseases.

Unit II. Material Chemistry

12 marks

Silicate minerals (Quartz) Zeolite: structure, accommodation of 'guest ions'.
Nanomaterials: (Definition and properties). Carbon nano particles (Buckminster Fullerene C_{60}), Gold nano particles
Metal cluster structure i) carbonyl ii) oxide, Metal surface catalysis (NH_3 products, Haber process).
Polymer: definition, classification, different types of molecular weight and their determination (viscosity average and weight average method).

CEMAT 35-AB

Unit I : Bioorganic Chemistry

13 marks

Secondary, tertiary and quaternary structure of proteins, classification of enzymes and co-enzymes (simple examples), nucleic acids: structure of nucleosides and nucleotides, DNA, RNA, complementary base pairings, elementary idea of double helical structure of DNA [Watson-Crick model, Houg-Stein model (for adenine only)], naturation and denaturation of protein.

Unit-II : Biophysical Chemistry

12 marks

Colloids and their stability, elementary idea of electrical double layer and its protective role in the stability of colloids, isoelectric point, Autocatalysis, Enzyme catalysis, Michaelis-Menten equation, Lineweaver-Burk plot, turnover number and catalytic efficiency of enzymes, Mechanisms of enzyme inhibition, pH-dependence of enzyme activity, Electrophoresis, elementary idea of gel electrophoresis, polyacrylamide gel electrophoresis (PAGE) and SDS-PAGE, Isoelectric focusing.

Paper VI

Courses : CEMAT 36-OA, 36-OB, 36-PA, 36-PB

(Each 25 marks : Total 100 marks)

CEMAT 36-OA

UNIT I

13 marks

Organic synthesis : Disconnection approach towards synthesis of bifunctional molecules (both cyclic and acyclic) : Concept of synthons, synthetic equivalents (ethyl acetoacetate, ethyl cyanoacetate and diethyl malonate as examples), functional group interconversion (FGI), protection and deprotection of common functional groups (-OH, -carbonyl, -NH₂, -COOH) in synthetic route, activation of synthetic equivalents, umpulung, illogical electrophiles and nucleophiles, disconnection and synthesis of 1,3-, 1,4, 1,5 and 1,6-dioxygenated compounds, Robinson ring annulation, Favorskii rearrangement, large ring compound synthesis (High dilution principle), stereoselective synthesis (Cram's rule, Prelog's rule).

Pericyclic reactions : Definition and classification, Electrocyclic reactions : FMO approach, examples of electrocyclic reactions (thermal and photochemical) involving 4- and 6 π -electrons and corresponding cycloreversion reactions, Cycloaddition reactions : FMO approach, Diels-Alder Reaction, photochemical [2+2] reactions, Sigmatropic shifts and their order, [1,3] and [1,5] H shifts, [3,3] shifts with references to Claisen and Cope rearrangements, ene reaction (simple treatment)

Polynuclear hydrocarbons: Nomenclature, synthesis and important reactions of naphthalene, anthracene and phenanthrene.

UNIT II

12 marks

Heterocyclic compounds : Synthesis (including retrosynthetic approach), reactivity, orientation and important reactions of furan, pyrrole, thiophene, pyridine, indole, quinoline and isoquinoline, Knorr pyrrole synthesis, Hantzsch pyridine synthesis, Fischer indole synthesis and Bischler-Napieralsky synthesis.

Pharmaceuticals : Preparation and uses of sulphadiazine, chloroquine, metronidazole, chlorpromazine, indomethacin, ranitidine.

CEMAT 36-OB

UNIT I

13 marks

Stereochemistry of cyclohexanes, mono- and disubstituted, Baeyer strain theory, Concept of I-strain, conformational analysis of cyclohexanes, energy profile of ring inversion of cyclohexane, symmetry properties of chair, boat and skew boat conformations, conformational analysis of mono and di-substituted cyclohexanes, Dynamic stereochemistry: E₂, SN₂ and NGP, lactonisation reactions of cyclohexane systems, oxidation of cyclohexanols with chromic acid, pinacol-pinacolone rearrangements, esterification, saponification of ester, steric assistance and steric hindrance there in, cyclohexene and cyclohexanone: stereochemistry, bromine addition and epoxydation of cyclohexene, nucleophilic addition to cyclohexanone.

Carbohydrates: monosaccharides: classification of monosaccharides, osazone formation, stepping up and stepping down of aldoses, interconversion of aldose and ketose, epimerization, constitution and configuration of D- glucose and D- fructose, ring structure and conformational aspects of D- glucose and its derivatives, anomeric effect, mutarotation of D- glucose, Disaccharides : Structure of sucrose only.

UNIT II

12 marks

Amino acids, peptides and proteins: synthesis of α - amino acids [Gabriel, Strecker, azlactone, hydantoin, acetamidomalonic ester methodologies], isoelectric point, ninhydrin reaction,, peptides: geometry of peptide linkage, peptide synthesis including Merrifield protocol, C - terminal and N- terminal determination, determination of amino acid sequence, proteins: classification , structure (primary only).

Natural products: Terpenoids : Classification, isoprene rule, structure and synthesis of citral, geraniol and nerol.

Alkaloids: Structure and synthesis of ephedrine and nicotine.

CEMAT 36-PA

Unit-I: Statistical Thermodynamics and Third Law

13 marks

Macrostates and microstates, thermodynamic probability, entropy and probability, Boltzmann distribution formula (with derivation). Applications to barometric distribution. Partition function. Derivation of expression of thermodynamic functions using partition function.

Dulong-Petit's law and Einstein's theory of heat capacity of solids. Limitation of Einstein's theory and Debye's modification (qualitative). Nernst heat theorem. Approach towards zero kelvin, adiabatic demagnetisation. Planck's formulation of third law and absolute entropies.

Unit-II : Molecular Spectroscopy

12 marks

Rotational spectroscopy of diatomic molecules: rigid rotor model, selection rules, spectrum, characteristic features of spectral lines (spacing and intensity). Determination of bond length, effect of isotopic substitution.

Vibrational spectroscopy of diatomic molecules: SHO model, selection rules, spectra; anharmonicity and its consequences on energy levels, overtones, hot bands. Raman Effect. Characteristic features and conditions of Raman activity with suitable illustrations. Rotational and vibrational Raman spectra. Rule of mutual exclusion with examples.

CEMAT 36PB

Unit-I : Properties of Solid, interface and dielectrics

13 marks

Crystal, crystal planes, law of rational indices, Calculation of fraction occupied for simple cubic, bcc, and fcc. Miller indices. Bragg's law and its applications for the determination of crystal structure for cubic system single crystal. Crystal structures of NaCl and KCl. Brief idea about liquid crystals.

Special features of interfaces compared to bulk. Surface dynamics: Physical and chemical adsorption. Freundlich and Langmuir adsorption isotherms; multilayer adsorption and BET isotherm (no derivation required). Gibbs adsorption isotherm and surface excess. Heterogeneous catalysis (single reactant).

Electrical properties of molecules: Polarizability of atoms and molecules, dielectric constant and polarisation, molar polarisation for polar and non-polar molecules. Clausius-Mosotti equation and Debye equation (both without derivation) and their application. Determination of dipole moments.

Unit-II : Phase equilibria and colligative properties

12 marks

Phase equilibrium and colligative properties. Definitions of phase, component and degrees of freedom. Phase rule and its derivations. Definition of phase diagram. Phase equilibria for one component system – water, CO₂. First order phase transition and Clapeyron equation; Use of Clausius-Clapeyron equation.

Liquid vapour equilibrium for two component systems. Ideal solution at fixed temperature and pressure. Principle of fractional distillation. Duhem-Margules equation. Henry's law. Konowaloff's rule. Positive and negative deviations from ideal behaviour. Azeotropic

solution. Liquid-liquid phase diagram using phenol-water system. Solid- liquid phase diagram. Eutectic mixture. Nernst distribution law. Solvent extraction.

ΔG , ΔS , ΔH and ΔV of mixing for binary solutions. Vapour pressure of solution. Ideal solutions, ideally diluted solutions and colligative properties. Raoult's law. Thermodynamic derivation of colligative properties of solution (using chemical potential) and their inter-relationships. Abnormal colligative properties.

Paper VII

Course : CEMAP 37-Pr (Total 100 marks)

Physical Chemistry

50 marks

Experiments:

1. To study the kinetics of inversion of sucrose using polarimeter.
2. To study the phase diagram of a binary system (Phenol + water) and the effect of impurities (e.g. NaCl).
3. Determination of ionization constant of a weak acid by conductometric method.
4. To study the kinetics of saponification of ester by conductometric method.
5. Conductometric titration of HCl vs NaOH, AcOH vs NaOH.
6. Determination of formal potential of $\text{Fe}^{+3}/\text{Fe}^{+2}$ couple in the hydrogen scale by potentiometric titration of ferrous ammonium sulfate solution using KMnO_4 , or, $\text{K}_2\text{Cr}_2\text{O}_7$ as standard.
7. Determination of concentration of (i) AgNO_3 solution and (ii) solubility product of AgCl by potentiometric titration of standard KCl solution against AgNO_3 solution.
8. Determination of pK values of weak monobasic, dibasic and polybasic acid by pH-metric method (e.g. using, acetic acid, succinic acid, oxalic acid, phosphoric acid, etc.).
9. Study of the kinetics of the reaction $\text{I}^- + \text{S}_2\text{O}_8^{2-}$ by colorimetric method.
10. Determination of Λ° of a strong electrolyte (KCl) conductometrically.
11. Determination of specific rotation of an optically active substance.
12. Determination of indicator constant by colourimetric method.
13. Verification of Lambert Beer's Law.
14. Conductometric titration of mixed acid.

Organic

25 marks

1. Identification of amino acids by TLC/paper.
2. Binary mixture separation (neutral + acid or base) and identification by TLC/Paper.

Laboratory Note Book & Viva

25 marks

Paper VIII

Course : CEMAP 38-Pr (Total 100 marks)

Inorganic Chemistry

50 marks

- 1) Complexometric estimation:
 - i) $(\text{Ca}^{2+} + \text{Mg}^{2+})$ in solution.
 - ii) $(\text{Fe}^{3+} + \text{Al}^{3+})$ in solution.
- 2) Dichromatometry and iodometry:
 - i) $\text{Fe}^{3+} + \text{Cr}_2\text{O}_7^{2-}$
 - ii) $\text{Fe}^{3+} + \text{Cu}^{2+}$
 - iii) $\text{Fe}^{3+} + \text{Mn}^{2+}$.
- 3) Permanganometry: $\text{Fe}^{3+} + \text{Ca}^{2+}$.
- 4) Analysis of Fe^{3+} in cement.
- 5) Gravimetry:
 - i) Ni^{2+} as glyoximato complex.
 - ii) Cu^{2+} as CuSCN .
- 6) Determination of temporary and permanent hardness in supplied water.

Organic Preparation

25 marks

Preparation of an organic compound, purification and determination of its M.P., Nitration (cold, hot), Condensation, Hydrolysis, Oxidation, Halogenation (Green method), acetylation.

Laboratory Note Book & Viva

25 marks



Chemistry General : Scheme of the Syllabus

Effective from academic session 2011-2012

B.Sc Part-I (1st Year) Chemistry (General)

Total Marks 100 (Theory = 100)

Paper I

Courses : CEMGT 11A, 11B, 11C, 11D

(Each 25 marks : Total 100 marks)

CEMGT 11A

Unit I. Basic physical chemistry I

(12 Marks)

Physical states of matter

(a) Gaseous state:

Kinetic theory of gas, collision and gas pressure, average kinetic energy of translation, Boltzmann constant

Maxwell's distribution law of molecular speeds (without derivation), most probable, average and root mean square speed of gas molecules, concept of degrees of freedom and principle of equipartition of energy (without derivation). Mean free path and collision frequencies. Heat capacity of gases (molecular basis); viscosity of gases.

Real gases, compressibility factor, deviation from ideality, van der Waals equation of state, critical phenomena, (principle of continuity of states), critical constants.

(b) Liquid state:

Physical properties of liquids and their measurements: surface tension and viscosity.

(c) Crystalline state:

Types of bonding in solids, law of constancy of angles, concept and types of unit cell (viz. simple cubic, bcc, fcc) coordination number, law of rational indices, Miller indices.

Unit II. Basic physical chemistry II

(13 Marks)

Thermodynamics I:

(a) Definition of thermodynamic terms: Intensive and extensive variables, isolated, closed and open systems. Cyclic, reversible and irreversible processes. Thermodynamic functions and their differentials. Zeroth law of thermodynamics, concept of heat (q) and work (w); IUPAC nomenclature of work and heat.

(b) First law of thermodynamics, internal energy (U) and enthalpy (H); relation between C_p and C_v , calculation of w , q , ΔU and ΔH for expansion of ideal gas under isothermal and adiabatic conditions for reversible and irreversible processes including free expansion, P , V , T relationship for adiabatic reversible process, Joule's Law Joule-Thomson Coefficient and inversion temperature.

(c) Application of First law of thermodynamics: standard state, standard enthalpy changes of physical and chemical transformations: fusion, sublimation, vaporization, solution, dilution, neutralization, ionization. Hess's law of constant heat summation. Bond-dissociation energy, Kirchhoff's equation, relation between ΔH and ΔU of a reaction.

CEMGT 11B**Unit I. General Chemistry**

(12 Marks)

Extra-nuclear Structure of atoms: Bohr's theory for hydrogen atom (simple mathematical treatment), atomic spectra of hydrogen and Bohr's model, Sommerfeld's model, quantum numbers and their significance, Pauli's exclusion principle, Hund's rule, electronic configuration of many-electron atoms, *Aufbau* principle and its limitations.

Radioactivity and Nuclear Structure of Atoms: Natural radioactivity; radioactive disintegration series, group displacement law, law of radioactive decay, half-life of radio elements. Atomic Nucleus: Stability of atomic nucleus, n/p ratio, nuclear binding energy, mass defect. Nuclear reactions: fission, fusion, transmutation of elements.

Unit II: Principles of organic and Inorganic qualitative analysis:

(13 Marks)

Reactions involving the detection of special elements N, S and Cl in an organic compound (only Lassaigne's test).

Reactions involving the detection of the following functional groups:

Aromatic primary amino group (Diazo-coupling reaction); Nitro group (Mulliken Barker's test); Carboxylic acid group (reaction with NaHCO_3); Phenolic OH (FeCl_3 test); Carbonyl (aldehyde and ketone) group (DNP Test, etc.).

Formation of sublimes; principle of flame test, borax-bead test, cobalt nitrate test, fusion test, chromyl chloride test, analytical reactions for the detection of nitrate, nitrite, halides, phosphate, sulphide, sulphate, borate, boric acid. Analytical reactions for the detection of Cr^{3+} , Fe^{3+} , Ni^{2+} , Cu^{2+} , Mn^{2+} , Importance of common-ion effect in the separation of Group II cations and Group III cations.

CEMGT 11C

Unit I. Basic organic chemistry I

(12 Marks)

- a) Inductive effect, resonance and resonance energy. Homolytic and heterolytic bond breaking, electrophiles and nucleophiles; carbocations, carbanions and radicals (stability and reactivity)
- b) Alkanes, alkenes and alkynes: Synthesis and chemical reactivity of alkanes, mechanism of free-radical halogenation of alkanes, general methods of synthesis of alkenes, electrophilic addition reaction, mechanism of bromination and hydrohalogenation, Markownikoff's addition, peroxide effect, hydroboration, ozonide formation, polymerization reaction of alkenes (definition and examples only), general methods of synthesis, acidity, hydration and substitution reactions of alkynes.
- c) Aromatic Hydrocarbons: Structure of benzene, general mechanism of electrophilic substitution, reactions of benzene, synthesis of aromatic compounds using nitration, halogenation, Friedel-Craft's reactions.

Unit II. Basic organic chemistry II

(13 Marks)

- a) Stereochemistry of carbon compounds: Different types of isomerism, geometrical and optical isomerism, optical activity, asymmetric carbon atom, elements of symmetry (plane and centre), chirality, enantiomers and diastereomers, R and S nomenclature, E and Z nomenclature, D and L nomenclature, Fischer projection formula of simple molecules containing one and two asymmetric carbon atoms.
- b) Alkyl and Aryl halides: SN1, SN2, E1 and E2 reactions (elementary mechanistic aspects), Saytzeff and Hoffmann elimination reactions. Nucleophilic aromatic substitution.
- c) Alcohol and Ether : Method of synthesis , physical properties , distinction of primary, secondary and tertiary alcohol and their chemical reactions and uses of ethers .
- d) Organometallic compounds: Grignard reagents – preparations and reactions, application of Grignard reagents in organic synthesis. [1^o, 2^o and 3^o alcohols, aldehydes, ketones and carboxylic acids.]

CEMGT 11D

Unit I. Basic inorganic chemistry I

(12 Marks)

Ionic bonding: General characteristics of ionic compounds, sizes of ions, radius ratio rule and its limitation. Lattice energy, Born Haber cycle.

Covalent bonding: General characteristics of covalent compounds, valence-bond approach, directional character of covalent bond, hybridization involving s-, p-, d orbitals, multiple bonding, Valence Shell Electron Pair Repulsion (VSEPR) concept,

shapes of simple molecules and ions (examples from main group chemistry). Bond moment and dipole moment, partial ionic character of covalent bonds, Fajan's rules. Hydrogen bonding and its effect on physical and chemical properties.

Unit II. Basic inorganic chemistry II

(13 Marks)

Chemical Periodicity: classification of elements on the basis of electronic configuration: general characteristics of s-, p-, d- and f-block elements. Positions of hydrogen and noble gases. Atomic and ionic radii, ionization potential, electron affinity, and electronegativity; periodic and group-wise variation of above properties in respect of s- and p- block elements.

Comparative study of p-block elements: Group trends in electronic configuration, modification of pure elements, common oxidation states, inert pair effect, and their important compounds in respect of the following groups of elements:

- i) B-Al-Ga-In-Tl
- ii) C-Si-Ge-Sn-Pb
- iii) N-P-As-Sb-Bi
- iv) O-S-Se-Te
- v) F-Cl-Br-I

B.Sc Part-II (2nd Year) Chemistry (General)

Total Marks 200 (Theory = 100, Practical = 100)

Paper II

Courses : CEMGT 22A, 22B, 22C, 22D

(Each 25 marks : Total 100 marks)

CEMGT 22A

Unit I. Basic physical chemistry III

(12 Marks)

Thermodynamics II:

(a) Spontaneous processes, heat engine, Carnot cycle and its efficiency, Second law of thermodynamics, Entropy (S) as a state function, molecular interpretation of entropy, entropy changes in simple transformations; including entropy change of ideal gas during expansion. Free energy: Gibbs function (G) and Helmholtz function (A), Gibbs-Helmholtz equation, criteria for thermodynamic equilibrium and spontaneity of a process.

(b) Chemical equilibrium: chemical equilibria of homogeneous and heterogeneous systems, derivation of expression of equilibrium constants; temperature, pressure and concentration dependence of equilibrium constants (K_p , K_c , K_x); Le Chatelier's Principle of dynamic equilibrium.

Definitions of phase, component and degrees of freedom. Phase rule. Definition of phase diagram. Phase equilibria for one component system – water, CO₂.
Heterogeneous systems : Nernst Distribution Law, miscibility and distillation of binary liquid mixtures, azeotropic mixture, Critical Solution temperature, steam distillation.

Unit II. Basic physical chemistry IV

(13 Marks)

(a) Chemical kinetics and catalysis:

Order and molecularity of reactions, rate laws and rate equations for first order and second order reactions (differential and integrated forms); zero order reactions. Determination of order of reactions. Temperature dependence of reaction rate, the Arrhenius equation; special emphasis on temperature coefficient, energy of activation.

Catalytic reactions: homogeneous and heterogeneous catalytic reactions, autocatalytic reactions, catalyst poisons, catalyst promoters (typical examples).

(b) Photochemistry

Grothus-Draper Law , Lambert-Beer's Law, molar extinction coefficient, Stark- Einstein Law of photochemical equivalence and quantum yield, examples of low and high quantum yields, Luminiscence: Fluorescence and phosphorescence.

CEMGT 22B

Unit I. Basic physical chemistry V

(12 Marks)

(a) Acids-bases and solvents:

Modern aspects of acids and bases: Arrhenius theory , theory of solvent system, Bronsted and Lowry's concept, Lewis concept with typical examples, applications and limitations. Strengths of acids and bases (elementary idea).

Ionization of weak acids and bases in aqueous solutions, application of Ostwald's dilution law, ionization constants, ionic product of water, pH-scale, buffer solutions and calculation of pH values, buffer actions; hydrolysis of salts.

(b) Solutions of electrolytes:

Electrolytic conductance, specific conductance, equivalent conductance and molar conductance of electrolytic solutions. Influence of temperature and dilution on conductivity of strong and weak electrolytes, conductometric titration – acid-base, precipitation.

Electrode potential:

Electrode potentials, Nernst Equation, Reference electrodes, Normal Hydrogen Electrode and calomel electrodes, Emf of electrochemical cells and its measurement, electrode potential series and its applications, measurement of pH using glass calomel electrode.

(a) Solutions of non-electrolytes:

Colligative properties of solution, Henry's Law, Raoult's Law, relative lowering of vapor pressure, osmosis and osmotic pressure; Elevation of boiling point and Depression of freezing point of solvents – (without deduction), calculation of molecular weight of solute from measurement of colligative properties of solutions.

(b) Colloids:

Colloids and crystalloids, classification of colloids, preparation and purification of colloids: ferric hydroxide sol and gold sol. Properties of colloids: Brownian motion, peptization, dialysis, Tyndal effect and its applications. Protecting colloids, gold number, isoelectric points, coagulation of colloids by electrolytes, Schulze-Hardy rule.

CEMGT 22C**Unit I. Basic organic chemistry III**

(12 Marks)

a) Aldehydes and ketones: the nature of carbonyl group, methods of synthesis, physical properties, Cannizzaro reaction, relative reactivities and distinction of aldehydes and ketones, Aldol condensation (with mechanism), Perkin reaction, Benzoin condensation, Claisen condensation, Oxidation and reduction reactions.

b) Carboxylic acids and their derivatives: acidity of carboxylic acids and effects of substituents on acidity, chemical reactivity, mechanism of esterification of carboxylic acids and hydrolysis of esters (BAC2 and AAC2 only)

c) Carbohydrates: Introduction, occurrence and classification of carbohydrates, constitution of glucose, osazone formation, reactions of glucose and fructose, mutarotation, cyclic structures – pyranose and furanose forms (determination of ring-size excluded), epimerization, chain-lengthening (Kiliani –Fischer method) and chainshortening (Ruff's method) in aldoses.

Unit II. Basic organic chemistry IV

(13 Marks)

a) Phenols: synthesis, acidic character and chemical reactions of phenols, Kolbe reactions, Reimer-Tiemann reaction, Fries rearrangement, Claisen rearrangement.

b) Organic compounds containing nitrogen: aromatic nitro compounds – reduction under different conditions. [acidic, neutral and alkaline]. Methods of synthesis of aliphatic amines, Heinsberg's method of amine separation, Hofmann degradation, Gabriel's phthalimide synthesis, distinction of primary, secondary and tertiary amines; methods of synthesis of aromatic amines, basicity of aliphatic and aromatic amines. Diazotization and coupling reactions and their mechanisms; synthetic applications of benzene diazonium salts. [Sandmeyer's reaction, preparation of nitro compounds, phenols, carboxylic acids and hydrocarbons thereby].

c) Amino acids, Proteins: methods of synthesis of α -amino acids (glycine and alanine using Gabriel's phthalimide synthesis and Strecker synthesis). Physical properties. Zwitterion structures, isoelectric point.

Unit I. Basic inorganic chemistry III

(12 Marks)

Coordinate bonds and Coordination compounds: complex salts and double salts, Werner's theory of coordination, chelate complexes, stereochemistry of coordination numbers 4 and 6. IUPAC nomenclature of coordination complexes (mononuclear complexes only).

Preparation and uses of the following compounds:

Sodium borohydride, lithium aluminium hydride, calcium carbide, hydrazine, hydroxylamine, sodium bismuthate, sodium thiosulphate, potassium peroxydisulphate, Perchloric acid, potassium bromate, potassium ferrocyanide, Mohr's salt, potassium chromate, potassium dichromate and potassium permanganate.

Unit II: Basic inorganic chemistry IV

(13 Marks)

Comparative study of s-block elements: Group trends, electronic configuration, isolation of pure elements, common oxidation states, inert pair effect, chemical properties and reactions in respect of the following group elements:

i) Li-Na-K

ii) Be-Mg-Ca-Sr-Ba

Extraction and purification of elements from natural sources: Li, Cr, Ni, Ag, Au.

Electroplating, galvanizing and anodizing.

Paper III (Practical)

Courses : CEMGP 23A, 23B

Course CEMGP 23A (50 marks)

UNIT 1 : Qualitative Analysis of Single Organic Compound (Solid)

UNIT-2 : Qualitative Analysis of Inorganic Mixture

UNIT-3 : VIVA- VOCE

UNIT-4 : Laboratory Records

Details of Practical Courses

UNIT 1 : Qualitative Analysis of Single Organic Compound (Solid)

The solid sample should be pure compound containing not more than two types of functional groups.

Experiment A: Test for special element (N, S, Cl, Br and I)

Experiment B: Solubility tests and solubility classification.

Experiment C: Test for the following functional groups.

Aromatic $-\text{NO}_2$, Aromatic $-\text{NH}_2$, $-\text{OH}$ (phenolic), Carbonyl (aldehyde and ketone), $-\text{COOH}$ and olefinic unsaturation.

Experiment D: Determination of the melting point of the compound.

Note : At least 6(six) unknown organic samples are to be analyzed by each student during Laboratory Session.

CEMGP 23B (50Marks)

Qualitative Analysis of Inorganic Mixtures

Experiments A: Preliminary Tests for Acid and Basic radicals in given samples.

Experiments B: Wet tests for Acid and Basic radicals in given samples.

Experiments C: Confirmatory tests.

Acid Radicals: Cl⁻, Br⁻, I⁻, NO₃⁻, S²⁻, SO₄²⁻, S₂O₃²⁻, PO₄³⁻, BO₃³⁻, H₃BO₃.

Basic Radicals: Cu²⁺, Cr³⁺, Fe³⁺, Ni²⁺, Mn²⁺, Co²⁺, Ca²⁺, Sr²⁺, Ba²⁺, Na⁺, K⁺, NH₄⁺

Insoluble: BaSO₄, SrSO₄, Cr₂O₃.

Note: At least 6 unknown samples are to be analyzed by each student during the Laboratory session.

B.Sc Part-III (3rd Year) Chemistry (General)

Total Marks 100 (Theory = 75, Practical = 25)

Paper IV

Courses : CEMGT 34A, 34B, 34C, CEMGP 34D

(Each 25 marks : Total 100 marks)

CEMGT 34A

Unit I. Chemical analysis

(12 Marks)

Gravimetric Analysis: Solubility product and common ion effect. Requirements of gravimetry. Gravimetric estimation of chloride, sulphate, lead, barium and nickel.

Error analysis and computer applications

Accuracy and precision of quantitative analysis, determinate-, indeterminate-, systematic- and random-errors. Methods of least squares and standard deviations.

General introduction to computers, different components of a computer, hardware and software, input and output devices, binary numbers and arithmetic. Introduction to computer languages, programming and operating systems.

Unit II: Volumetric Analysis

(13 Marks)

Primary and secondary standard substances, principles of acid-base, oxidation-reduction, and complexometric titrations; acid-base, redox and metal-ion indicators. Principles of estimation of mixtures of NaHCO_3 and Na_2CO_3 (by acidimetry); iron, copper, manganese, chromium (by redox titration); zinc, calcium, magnesium (by complexometric EDTA titration). Chromatographic methods of analysis: column chromatography and thin layer chromatography.

CEMGT 34B

Unit I. Industrial chemistry I

(12 Marks)

a) Fuels: Classification of fuel, heating values. Origin of coal, carbonization of coal, coal gas, producer gas, water gas, coal based chemicals. Origin and composition of petroleum, petroleum refining, cracking, knocking, octane number, anti-knock compounds, Kerosene, liquefied petroleum gas (LPG), liquefied natural gas (LNG), petrochemicals (C1 to C3 compounds and their uses).

b) Fertilizers: Manufacture of ammonia and ammonium salts, urea, superphosphate, biofertilizers.

c) Glass and Ceramics: Definition and manufacture of glasses, optical glass and coloured glass. Clay and feldspar, glazing and vitrification, glazed porcelain, enamel. Portland cement: composition and setting of cement, white cement.

Unit II. Industrial chemistry II

(13 Marks)

a) Polymers: Basic concept, structure and types of plastics, polythene, polystyrene, phenol-formaldehydes, PVC; manufacture, physical properties and uses of natural rubber, Synthetic rubber, silicone rubber; synthetic fibres: Nylon-66, polyester, terylene, rayon; Foaming agents, plasticizers and stabilizers.

b) Paints, Varnishes and Synthetic Dyes: Primary constituents of a paint, binders and Solvents for paints. Oil based paints, latex paints, baked-on paints (alkyd resins). Constituents of varnishes. Formulation of paints and varnishes. Synthesis of Methyl orange, Congo red, Malachite green, Crystal violet.

c) Drugs and pharmaceuticals: Concept and necessity of drugs, pharmaceuticals and Vitamins.

Preparation and uses of Aspirin, Paracetamol, Sulphadiazine, Quinine (Structure and Use), Chloroquine (Structure and Use), Phenobarbital, Metronidazole.

Fermentation Chemicals: Production, and purification of ethyl alcohol, citric acid, lactic acid.

CEMGT 34C

Unit I. Environmental chemistry

(12 Marks)

The Atmosphere:

Composition and structure of the atmosphere: troposphere, stratosphere, mesosphere and thermosphere. Ozone layer and its role. Major air pollutants : CO, SO₂, NO and particulate matters –their origins and harmful effects, problems of ozone layer depletion, green house effect, acid rain and photochemical smog. Air pollution episodes. Air quality standard. Air pollution control measures: cyclone collector, electrostatic precipitator, catalytic converter.

The Hydrosphere :

Environmental role of water, natural water sources, water treatment for industrial, domestic and laboratory uses. Water pollutants: action of soaps and detergents, phosphates, industrial effluents, agricultural run off, domestic wastes; thermal pollution radioactive pollution and their effects on animal and plant life, water pollution episodes. Water pollution control measures: waste water treatment: chemical treatment and microbial treatment; water quality standards: DO, BOD, COD, TDS and hardness parameters. Desalination of sea water: reverse osmosis, electro dialysis.

The Lithosphere:

Fats-Oils-Detergents : Fats and oils, natural fat, edible and inedible oil of vegetable origin. Common fatty acids, glycerides. Hydrogenation of unsaturated oil, production of vanaspati and margarine. Production of toilet and washing soaps, Enzyme based detergents, detergent powder, liquid soaps.

Pesticides: Common pesticides : Production, applications and residual toxicity of gammaxane, aldrin, parathion, malathion, DDT, paraquat, decamethrin.

Food Additives: Food flavour, food colour, food preservatives, artificial sweeteners, acidulants, alkalies, edible emulsifiers and edible foaming agents, sequesterants – uses and abuses of these substances in food beverages.

CEMGP 34D**Quantitative Chemical Analysis****(25 Marks)**

Experiment –I. Preparation of standard (N/20) solution of oxalic acid and standardization of (a) NaOH solution (b) KMnO_4 solution (c) Mohr's salt solution (against KMnO_4).

Experiment –II. Preparation of standard (N/20) $\text{K}_2\text{Cr}_2\text{O}_7$ solution of oxalic acid and standardization of (a) Mohr's salt solution (b) KMnO_4 solution (c) sodium thiosulphate solution.

Experiment –III. Preparation of standard (M/50) Zinc acetate solution and (a) standardization of Na_2EDTA solution and (b) Estimation of unknown solution of single metal ion ($\text{Zn}^{2+}/\text{Ca}^{2+}/\text{Mg}^{2+}$).

Experiment –IV. Acidimetric estimation of NaHCO_3 , Na_2CO_3 mixture using phenolphthalein and methyl orange.

Experiment –V. Alkalimetric estimation of HCl , CH_3COOH mixture

Experiment –VI. Estimation of Fe (II) + Fe (III) mixture using standard (N/20) solution of (a) $\text{K}_2\text{Cr}_2\text{O}_7$ (b) KMnO_4 as titrants.

Experiment –VII. Estimation of total hardness of water (EDTA method).

Experiment –VIII. Estimation of Vitamin C by iodometric method.

Experiment –IX. Estimation of available oxygen in pyrolusite.



Chemistry General : Scheme of the Syllabus

Effective from academic session 2011-2012

B.Sc Part-I (1st Year) Chemistry (General)

Total Marks 100 (Theory = 100)

Paper I

Courses : CEMGT 11A, 11B, 11C, 11D

(Each 25 marks : Total 100 marks)

CEMGT 11A

Unit I. Basic physical chemistry I

(12 Marks)

Physical states of matter:

(a) Gaseous state:

Kinetic theory of gas, collision and gas pressure, average kinetic energy of translation, Boltzmann constant.

Maxwell's distribution law of molecular speeds (without derivation), most probable, average and root mean square speed of gas molecules; concept of degrees of freedom and principle of equipartition of energy (without derivation). Mean free path and collision frequencies; Heat capacity of gases (molecular basis); viscosity of gases.

Real gases, compressibility factor, deviation from ideality, van der Waals equation of state, critical phenomena, (principle of continuity of states), critical constants.

(b) Liquid state:

Physical properties of liquids and their measurements: surface tension and viscosity.

(c) Crystalline state:

Types of bonding in solids, law of constancy of angles, concept and types of unit cell (viz. simple cubic, bcc, fcc) coordination number, law of rational indices, Miller indices.

Computer Science Honours Course

Course Structure

Paper	Type/Marks	Group	Title	Periods
Part-I				
I	Theoretical 100	A	Computer Fundamentals	35
		B	Introduction to Basic Electronics	35
		C	Digital System Design	35
		D	Computer Organization-I	45
II	Theoretical 50	A	Section-I : System Software-I Data Structure-I	10 25
	Practical 50	B	Section-II : Programming through C Language Hardware	40
Part-II				
III	Theoretical 100	A	Graph Theory	30
		B	Discrete Mathematical Structures	45
		C	Numerical and Optimization Techniques	45
		D	Formal Languages and Automata Theory	30
IV	Theoretical 50	A	Section-I : Data Structure-II Section-II : System Software-II	30 45
	Practical 50	B	Software : Operating System, PC Software, C Language	
Part-III				
V	Theoretical 100	A	Microprocessor	45
		B	Computer Organization-II	45
		C	Data Communication & Computer Network Internet Technology	40 20
VI	Theoretical 100	A	Object-Oriented Programming	30
		B	Software Engineering	30
		C	Computer Graphics	30
		D	Database Management System	60
VII	Practical 100	A	Hardware : Microprocessor Programming & I/O Interfacing	
		B	Project	
VIII	Practical 100	A	Object-Oriented Programming	
		B	RDBMS	
		C	Shell Programming	



PART – I PAPER – I (THEORETICAL) : 100 Marks

Group A: Computer Fundamentals

(35 Periods)

Introduction to Computer and Problem Solving: Information and Data.

Hardware: CPU, Primary and Secondary storage, I/O devices, Bus structure

Software: Systems and Application.

Generation of Computers: Super, Mainframe, Mini and Personal Computer.

Introduction to Programming Languages: Machine Language, Assembly Language, High Level Language.

Problem Solving: Flow Charts, Decision Tables and Pseudocodes. (8)

Number Systems and Codes:

Number representation: Weighted Codes, Non-weighted codes, Positional, Binary, Octal, Hexadecimal, Binary Coded Decimal(BCD), Conversion of bases. Complement notions. Binary Arithmetic, Binary Codes: Gray, Alphanumeric, ASCII, EBCDIC; Single Error-Detecting and Correcting Codes, Hamming Codes. (15)

Boolean Algebra:

Fundamentals of Boolean Algebra, Switches and Inverters, Functionally Complete Gates (AND, OR, NOT), NAND, NOR, Switching function and Boolean Function. De Morgan's Theorem, Minterm, Truthtable and minimization of switching function upto four variables, Algebraic and K-map method of Logic circuit synthesis: Two level and Multi level. (12)

Group B: Introduction to Basic Electronics

(35 Periods)

Elementary circuit theory: Kirchoff's Laws with simple applications, Statement and illustration of Thevenin's & Norton's theorems(without proof) in resistive network only& its simple applicatons.

Elementary Physics of semi-conductors: Intrinsic and Extrinsic semiconductors, P & N type, Diode & its applications: P-N Junction diodes, Biasing of a junction diode, Depletion region & its effect, Zener diodes & its applications, Diode as a rectifier, Types of diodes, LED, LCD. Principle of junction transistor, Current components of transistor, Modes of a transistor (CB, CE and CC) and their properties, I/O characteristics of a transistor in CE mode. Relation between β & α -parameters of Transistor, Biasing of a transistor : Q point, load line, Self-bias, fixed bias & collector to base bias.

Amplifiers: Concepts, Class A & B.

Inverters using Transistors–transfer characteristics and threshold voltages. Switching characteristics of diodes and transistors-SCR & UJT.

Principle of FET and MOSFET, Depletion and Enhanced modes of operations, Characteristics and definition of different parameters, Symbols and Application for switching functions. Concept of NMOS, PMOS and CMOS switch.

Principle of Multivibrators, Applications of Multi-vibrators – Monostable and Astable Multivibrators

Principle of differential amplifiers, CMRR of differential amplifiers, Properties of Ideal OP-AMP, Concept of virtual ground, Offset parameters and its uses as an inverting, non-inverting amplifiers, adder/subtractor/multiplier/divider, differentiator, integrator and scale changer, Schmitt trigger.

Group C : Digital System Design

(35 Periods)

Combinational Circuits: Realization of AND and OR Gates using diodes and NOT Gate using transistors, Standard Gate Assemblies, IC chips packaging nomenclature, Half and Full Adder(3 & bit), Multi-bit adders – Ripple carry and Carry Look Ahead Adder, Adder/subtractor, BCD-Adder, Data selectors/multiplexers – expansions, reductions, function realization, universal function realization, multi-function realization, Decoders: function realization, De-multiplexer and function realization, Encoder, Priority Encoder, Parity bit Generator/checker, Gray Code Generator, Code Converters, Keyboard encoder, Seven segment display unit, Comparators.

Sequential Circuits: Model of Sequential computing, Difference between Combinational and Sequential circuit, RS-Latch: using NAND and NOR Gates, RS Latch as a Static RAM Cell, Problems of Basic Latch circuits, Digital Clock – Duty Cycle, Rising time, Falling time, Clocked Flip Flops - SR, JK, D, T, Level Trigger and Edge Trigger, Excitation Functions of each flip-flops, Flip-flops with Preset and Clear, Application of Flip-flops: Asynchronous Counter(UP/DOWN) upto 4 bit counter, Decade Counter, Mod – n Counter, Finite State machine Model – State Transition Diagram and Table, Synchronous Counters – different mod counters, Ring counter, Johnson's Counter, Registers, Registers with parallel load, Shift Registers.



Data Converter: D/A Conversion principle using basic circuit, R-2R Ladder circuit, Counter based A/D converter, Successive approximation method for A/D conversion.
DTL and TTL NAND gate circuits and its operations, Fan in & Fan out. SSI, MSI, LSI, and VLSI classifications.

Group – D : Computer Organization – I

(45 Periods)

Basic Computer Organization – IAS Computer, Von Neumann Computer, System Bus. Instruction Cycle, Data Representation, Machine instruction and Assembly Language, CPU Organization, Arithmetic and Logic Unit, Control Unit, CPU Registers, Instruction Registers, Program Counter, Stack Pointer. CISC & RISC processors.

Instruction: Operation Code and Operand. Zero, One, Two and Three address instruction. Instruction types. Addressing modes. Stack organization.

Memory: Types of Memory, RAM, ROM, EPROM, DRAM, SRAM, SAM, PLA, Associative memory. Different storage technology. I/O system organization and interfacing, Bus: SCSI, PCI, USB; Tri State Devices, Bus Arbitration.

Distribution of questions/Marks:

Q1. (Compulsory short questions – 20 marks). Five questions to be answered from the rest which consists of at least 8 questions. (All questions are of 16 marks: questions may have subdivisions. At least one question to be answered from each group).

Text Books :

1. Introduction to Computer Science, by P.K.Sinha (PHI)
2. Electronics Fundamentals and Applications by D.Chattopadhyay and P.C.Rakshit, 6th Edition, New Age International (P)
3. Digital Logic and Computer Design by M.Morris Mano, PHI
4. Digital Principle and Applications by Malvino & Leach, TMH
5. Digital Systems Principles and Applications by Ronal J. Tocci and Neal S. Widmer, 8th Edition, PHI
6. Digital Fundamentals by Floyd, Pearson Education
7. Computer Architecture and Organizations 2nd Edition, J. P. Hayes, TMH
8. Computer System Architecture by M. Morris Mano
9. Computer Organization and Architecture by William Stallings, Pearson Education
10. Electronics Devices and Circuit Theory by Boylestad, Nashelsky, PHI

PAPER – II : 100 MARKS

Group – A(THEORETICAL) : 50 Marks

Section – I : System Software-I

(10 periods)

Introduction: Different System Softwares : A brief of Operating Systems, Assemblers, Loaders, Linkers, Interpreters, Compilers, various phases of compilation.

Data Structure-I

(25 Periods)

Definition: Concepts of Data Types, Elementary structures, Data types and their interpretation

Arrays: Types, Memory Representation, Address Translation, Functions of single and multi-dimensional arrays with examples.

Linked Structures: Singly and doubly linked list(non-circular and circular), List manipulation with pointers: Searching, Insertion and deletion of elements.

Stacks and Queues : Definition. Representation. Uses and Applications, Infix, Prefix &Postfix notations, Infix to postfix : conversion and evaluation. Application of queues.

Recursion: Divide and Conquer, Elimination of Recursion.

Section-II: Programming through ‘C’ Language

(40 periods)

Introduction: Basic Structure, Character sets, Keywords, Identifiers, Constants, Variables, Data Types, Program Structure.



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Operators: Arithmetic, Relational, Logical and Assignment; Increment, Decrement and Conditional, Operator Precedence and Associations; Expressions. Expression evaluation and type conversion. Formatted input and output.

Statements: Assignment, Initialization, String handling with arrays, String handling functions, Functions – Arguments passing, Return values and their types, recursion. Enumerated data types. Structures. Arrays of structures. Arrays within structures.

Pointers: Declaration and initialization, Accessing variables through pointer arithmetic, Pointers and arrays, String, Pointer to Functions and Structures.

File Access: Opening, Closing, I/O operations.

Linked List : Concepts, Simple implementation, Dynamic Storage Allocation.

Low-Level Programming.

Distribution of Questions/Marks :

Q1. (Compulsory Short questions – 8 marks). Three questions to be answered from the rest which consists of at least 5 questions (All questions are of 14 marks: questions may have subdivisions. At least one question to be answered from each section).

Text Books :

1. System Programming by John J. Donovan, TMH
2. Compilers Principles, Techniques and Tools, by Alfred V. Aho, Ravi Sethi and Jeffrey D. Ullman, Pearson Education
3. System Software – An Introduction to System Programming by Leland L. Beck, Pearson Education, 3rd Edition
4. Data Structure by Liptsuitz, S. Outline Series
5. Data Structure by Ellis Horowitz, Sartaz Sahani, Galgotia
6. Data Structure Using C by S. K. Bandyopadhyay and K. N. Dey, Pearson Education
7. Data Structures and Algorithm Analysis in C by Mark Allen Weiss, 2nd Edition, Pearson Education
8. C Programming by Karnighan,&Ritchie, PHI
9. Programming through C by Richard Johnsonbaugh and Martin Kalin, Pearson Education
10. A Book on C by Kelley and Pohl, Pearson Education

Group-B(Practical) Hardware Laboratory : 50 Marks

<i>Marks Allotment:</i>	Sessional	-	05 marks
	Experiment	-	35 marks
	Viva-voce	-	10 marks

Pre-requisites:

Study of IC Data Books – Linear and Digital. Familiarity with breadboard, LED, 7 segment display etc. Observe the output waveform of a function generator in a CRO. Mean Time Period , Peak Voltage, Frequency and comparison with function generator readings, Study of basic logic functions like AND, OR, NOT, NAND etc. Ideas of fan in, fan out, Noise Margin, Threshold Voltage, Transfer Characteristics, Design of a NOT Gate(inverter) using transistors. Design of a debouncing switch. Logic probe, Clock (crystal timer). Verification of NAND and NOR gates as universal gates, De Morgan's Theorem.

Analog Circuits

- 1) Use Diodes to implement bridge rectifier. Observe the waveform on CRO. Measure peak values. Use three terminal regulator (IC 78XX) for voltage regulation. Drawing of load regulation characteristics.
- 2) Using Transistor construct NOT or Invert Operation and draw the transfer characteristics and measure the threshold voltage.
- 3) OP-AMP : Close loop gains inverting and non-inverting OP-AMP. Use of OP-AMP as adder, subtractor, differentiator, integrator. For each case offset null arrangement has to be done.

Digital Circuits:

Combinational Circuits:

- 1) Implement Half Adder/Half Subtractor/Full Adder/Full Subtractor using Logic Gates. Realize a logic function using basic/universal gates in SOP and POS form. Study the functionalities of 7483 and design a BCD adder using 7483 or equivalent.
- 2) Design of two level AND – OR, NAND –NAND, NOR-NOR circuits to realize any truth table. Realize XOR in two level and multilevel.



- 3) Design a 4 bit 2's complement adder – subtractor unit using 7483 or equivalent and XOR gates.
- 4) Design a circuit to convert BCD numbers to corresponding gray codes.
- 5) Design a 4:1 MUX using NAND gates. Study of 74153 and 74151. Design Full Adder/Subtractor using MUX.
- 6) Design a 2:4 decoder using NAND gates. Study of 74155 and 74138. Design Full Adder/Subtractor using decoders.
- 7) Design a parity generator/checker using basic gates.
- 8) Design magnitude comparator using basic/universal gates. Study of 7485.
- 9) Design a seven segment display unit.

Sequential Circuits:

- 1) Realize S-R, D, J-K and T flip-flop using basic gates. (Study the undefined state in S-R flip-flop).
- 2) Design a shift register (shift left and shift right) using flip-flops. (Study the functional characteristic of IC 74194 with emphasis on timing diagram).
- 3) Design Asynchronous and Synchronous counters. Study of IC 74193.
- 4) Study the functional characteristics of RAM IC chip. Study of open collector and tri-state output. Horizontal and vertical expansion of RAM chips by cascading. Use 74189, 7489, 2114 or any available chip.

Part-II Paper – III (Theoretical) : 100 MARKS

Group – A : Graph Theory

(30 Periods)

Graphs : Definition, Finite and Infinite Graphs, Directed and Undirected Graphs, Degree, Isolated vertex, Pendant vertex, Null graphs.

Walks : Paths and Circuits, Connected and Disconnected graphs, Euler's graphs, Hamiltonian paths and circuits, Trees, Definition and basic properties, Distance and contents, Matrix representation of graphs, Incidence, Adjacency and Circuit matrices, Graph Search – BFS, DFS, Spanning Trees, Shortest Path Problems.

Group – B : Discrete Mathematical Structures

(45 Periods)

Logic : Proposition, Predicates and Quantifiers. Sets, Functions, Growth of Functions, Relation, Equivalence Relation : Big O Notation, Big Omega and Big-Theta Notations.

Algorithms : Complexity of Algorithms, Space and Time, Polynomial and Exponential Algorithms.

Counting theory: Counting, Pigeon Hole Principle, Inclusion and Exclusion Principle, Permutations and Combinations, Recurrence relation, Definition and use.

Introduction to Probability: Definition of sample space, events, probability, simple problems, Conditional Probability, Probability distribution – Binomial Distribution (significance only), Random variable, expected value, Standard Deviations and Variance;

Group – C : Numerical and Optimization Techniques

(45 Periods)

Errors : Concepts, types of errors

System of Linear Equations: Properties of Set of Linear Equations – linearly dependent and independent, Rank, Singularity of Coefficient matrix, Ill-condition matrix, Gaussian Elimination, Gauss– Jordan Elimination, Iteration method & its convergence condition and testing, Gauss Iteration and Gauss-Seidel Iteration Algorithm and its applications.

Nonlinear Equation: Iterative Methods and different types convergence, divergences and its test conditions, Bisection algorithm, Regular-falsi method, Secant and Newton-Raphson method, Problems and its graphical significances.

Solution of Differential Equation: Euler Method, Taylor Method, Runge-Kutta second and fourth order method for solving differential equations.

Interpolation : Newton Forward and Backward interpolation, Lagrange interpolation

Curve Fitting: Linear, Quadratic, fittings.

Integration: Mathematical Foundation for Trapezoidal and Simpson's 1/3rd Rules and its Composite forms.

Linear Programming: Linear Programming, Simplex Method, Duality, Transportation, Assignment problems.

Group – D : Formal Languages and Automata Theory

(30 Periods)



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Introduction to Formal Languages and Grammar, Finite Automata, Regular Expressions, Deterministic and Non-Deterministic finite automata and their equivalence. State minimization, Chomsky Classification of Grammars, Concepts of Turing Machines and Universal Turing Machines.

Distribution of Questions/marks:

Q1. (Compulsory Short questions – 20 marks). Five questions to be answered from the remaining which consists of at least 8 questions. (All questions are of 16 marks: questions may have subdivisions. At least one question to be answered from each group).

Text Books :

1. Graph Theory by Narsingh Deo, PHI
2. Introduction to Graph Theory by D B West, 2nd edition, Pearson Education
3. Discrete Mathematics and its applications by Rosen, 5th Edition, TMH
4. Discrete Mathematics by C.L.Liu, TMH
5. Numerical Methods for Scientific and Engineering Computation by M.K.Jain, S.R.K.Iyengar, R.K.Jain, 4th Edition, New Age International Publishers
6. Computer Oriented Numerical Methods, 3rd Edition, V Rajaraman, PHI
7. Operations Research by Kanti Swarup, P.K. Gupta, Sultan Chand & Sons
8. Operations Research Techniques for Management by V.K.Kapoor, 7th Edition, Sultan Chand & Sons
9. Switching and Finite Automata Theory by Kohavi, TMH
10. Theory of Computer Science(Automata, Languages & Computation) by K L P Misra & N Chandrasekharan, PHI

Paper-IV : 100 Marks

Group-A(Theoretical) : 50 Marks

Section – I :Data Structures-II

(30 Periods)

Trees : Definition, Quantitative Properties, Binary Tree, Tree traversals, Internal and external path lengths: Properties, Minimum and maximum path length of a binary tree, Importance.

Binary Search Trees : Definition, Searching, Insertion, Deletion.

Searching: Linear and binary search, Performance and complexity.

Hashing : Concepts, Advantages and Disadvantages, Different types of hash functions, Collision and Collision Resolution Techniques – Open Addressing with probing, Linear Chaining, Coalesced Chaining, Application.

Sorting : Terminology, Performance Evaluation, Different Sorting Techniques (Bubble, Insertion, Selection, Quick sort, Merge Sort, Heap, Partition Exchange, Radix with iterative and recursive description). Complexity, Advantages and Disadvantages.

Section-II: Systems Software –II

(45 Periods)

Operating Systems : What is OS? Multiprogramming, Multitasking OS, Concepts of processes, Files, Shell, System Calls; Structures : Monolithic, Layered, Virtual, Client Server and Distributed Model.

Concepts of Synchronization : Semaphores, Critical Regions, Monitor Inter Process Communication Mechanism.

Processor Management : Scheduling and its types, Priority Queue.

I/O Management : Device and Device Controllers, Interrupt Handlers and Device drivers.

Memory Management : Real & Virtual memory ,Swapping , Paging, Segmentation , Page Replacement Techniques.

File Systems : Files and Directories, File Servers, Security and Protection.

Dead Lock : Definition, Prevention, Avoidance, Detection, Recovery.

Case Study : Standard OS.

Distribution of Questions/Marks:

Q1. (Compulsory Short questions – 8 marks). Three questions to be answered from the rest which consists of at least 5 questions (All questions are of 14 marks: questions may have subdivisions. At least one question to be answered from each section).

Text Books :

1. Operating Systems by H.M.Deitel, 2nd Edition, Pearson Education



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2. Operating System Concepts, A.Silberschatz, Peter B. Galvin, G. Gagne, 6th Edition, John Wiley & Sons, Inc.
3. References of Data Structure is given previously

Group – B(Practical) Software Laboratory : 50 marks

Section – I

(Lab Periods – 5)

Familiarity with single user and multi user operating systems.

Internal and External Commands. File name and extension, Batch File creation, Command Line Arguments, System Configuration.

Menus, Folders, Program Manager, File Creation, View and sort files, Document Preparation and Presentation.

Files and Directories, Copy, Delete, Rename Directory, Creation, Navigation, Editor, Pipes and Filters, Pattern searching.

Section-II

Programming through ‘C’ Language

(Lab Periods – 35)

Problems should cover basic features of the Language; Applications including numerical problems, Data Structure, Graph representation and manipulation.

Distribution of Marks:

Section I	-	one question to be answered	
Section II	-	-do-	
Marks Allotment :	Section I	-	5 marks
	Section II	-	30 marks
Sessional	-	05 marks	
Viva-voce	-	10 marks	

Part – III -Paper – V (Theoretical) : 100 Marks

Group – A : Microprocessor and Computer Organization – II

Microprocessor:

(45 Periods)

Evolution of Microprocessor: Architecture of 8 bit and 16 bit microprocessor Machine Language Instructions, Addressing Modes, Instruction Formats, Instruction Sets, Instruction Cycle, Clock Cycles, Timing Diagrams, Interrupts, DMA, Bus Standards and types, Interfacing concepts- Memory Interfacing, I/O Interfacing and Ports – Keyboard Interfacing, Display Interfacing, Storage Device Interfacing, Programming a Microprocessor, Interrupt Handling, Methods of Interrupts, Priority and Management Case Studies : 8085 and 8086 microprocessor.

Computer Organization – II:

(45 Periods)

Fixed and Floating Point Arithmetic : Addition, Subtraction, Multiplication and Division.

ALU – Combinational ALU, 2’s Complement Addition, Subtraction Unit

Memory Hierarchy: CPU Register, Cache Memory, Primary Memory, Secondary Memory and Virtual Memory.

Control Unit : Control Structure and Behaviour, Hardwired Control and Micro programmed Control : Basic Concept, Parallelism in Microinstruction.

I/O : Polling, Interrupts, DMA, I/O Bus and Protocol.

Computer Peripherals – VDU, Keyboard, Mouse, Printer, Scanner etc.

Group B : Data Communication and Computer Network

(40 Periods)

Data Communications; Transmission Media; Network : Protocol and standards; Analog & Digital Signals, Periodic & Non-periodic signals, Time and Frequency Domain; Multiplexing : FDM, TDM and Application, Encoding D/A and A/D Encoding; Error : Different types of Errors and their detection, Concepts of Centralized and Distributed Computing; Advantages of Networking; Layered Architecture : OSI Architecture, Basic Features, LAN, MAN and WAN; Simple PC based Network : Example, Block Diagram, Mode of Operation and Characteristic Features.

Group – C : Internet Technologies

(20 Periods)



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Intranet and Internet; Servers and Clients; Ports; Domain Name Server (DNS); Accounts, Internet Service Providers; Connections : Dial Up, ISDN, ADSL; Cable, Modem; E-Mail: Account, Sending, Receiving, Mailing List, IRC, Voice and Video Conferencing, WWW, Browsers.

Distribution of Questions/marks:

Q1. (Compulsory Short questions – 20 marks). Five questions to be answered from the remaining which consists of at least 8 questions. (All questions are of 16 marks: questions may have subdivisions. At least one question to be answered from each group).

Text Books :

1. Computer Architecture and Organizations 2nd Edition, J. P. Hayes, TMH
2. Computer System Architecture by M. Morris Mano
3. Computer Organization and Architecture by William Stallings, Pearson Education
4. Introduction to Microprocessor by Gonakar, PHI
5. Introduction to Microprocessor by Ajit Pal, PHI
6. Data Communications and Networking by Behrouz A. Forouzan, 4th Edition, TMH
7. Data and Computer communication by William Stallings, 6th Edition, Pearson Education
8. Computer Networks by Tanenbaum, Pearson Education

Paper – VI (Theoretical) : 100 Marks

Group – A : Object Oriented Programming (30 Periods)

Concepts: Difference with procedure oriented programming, Data Abstraction and Information Hiding : Objects, Classes and Methods, Encapsulation, Inheritance, Polymorphism, Object Oriented Programming through C++: Input/Output, Function and Operator Overloading, Constructors and Destructors, Copy Constructors and Assignment Operator, Overloading, Single and Multiple Inheritance, Polymorphism and Virtual Functions, Namespace, Exception Handling, Templates.

Group – B : Software Engineering (30 Periods)

Software Life Cycle, Different Models : Waterfall, Spiral; Software Requirement Analysis & Specification, Structured Analysis, DFD, Data Dictionary, Structured Design, Structure Charts, Software Testing : White Box and Black Box Testing, Software Quality Assurance.

Group – C : Computer Graphics (30 Periods)

Introduction : Co-ordinate System, Information Handling Software, Graphics Software, Area of Application, Translation, Rotation, Scaling, Matrix Representation, Homogeneous Co-ordinate System, Composite Transformation, Inverse Transformation, Computer Art, Animation, Morphing, Projection & Clipping, 2D & 3D Transformations, Lines, Curves and their presentations.

Group – D : Data Base Management System (60 Periods)

Basic Concept, File Management Systems, Advantages of DBMS, ANSI/SPARC Architecture, Physical, Conceptual and External Models, ER Diagram, Data Models : Relational, Hierarchical, Network; File Organization : Sequential, Indexed Sequential, Random, Inverted; Query Languages, Relational Algebra, Relational Calculus, Functional Dependencies, Normal Forms : 1NF, 2NF, 3NF and BCNF; Structured Query Languages (SQL), Elementary Concepts of Security, Integrity.

Case Studies : Any Commercial RDBMS Package.

Distribution of Questions/marks:

Q1. (Compulsory Short questions – 20 marks). Five questions to be answered from the remaining which consists of at least 8 questions. (All questions are of 16 marks: questions may have subdivisions. At least one question to be answered from each group).

Text Books :

1. Object Oriented Programming with C++ by Balagurusamy, TMH
2. Object Oriented Programming with C++ by Robert Lafore, PHI



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3. An Integrated Approach to Software Engineering by Pankaj Jalote, Narosa Publishing House
4. Introduction to System Analysis and Design by Igor Hawryszkiewicz, PHI
5. Fundamental of Computer Graphics and Multimedia by D. P. Mukherjee, PHI
6. Computer Graphics by Hearn and Baker, PHI
7. Database System Design by Elmasri, Navathe, Somayajulu, Gupta, Pearson Education
8. Database Systems: Concept, Design and Application by S. K. Singh, Pearson Education, 1st Edition
9. An Introduction to Database Systems by C.J. Date, A.Kannan, S.Swamynathan, Pearson Education
10. Relational Database Design by Jan L. Harrington, an imprint of Elsevier

Paper – VII (Practical) : 100 MARKS

Group – A (Hardware) : Microprocessor Programming & I/O Interfacing

Experiment with 8085A based micro computing kits (50 Marks)

- 1) Data movement between register – register, register-memory, memory-memory.
- 2) Arithmetic operations on single byte, word and multi-byte integer, signed and hexadecimal operands.
- 3) Ordered arrangement of a set of operands.
- 4) Bubble Sorting , Sequential and Binary Search.
- 5) Block Replacement and transfer.
- 6) Parity Generator.
- 7) Delay Routines.

Interfacing :

- 1) Display of Alphanumeric Characters on 7 segment displays.
- 2) Matrix Keyboard Interfacing and Identification of the keys.

Group – B : Project Work

(50 Marks)

Marks Allotment :	Project Report	-	08 marks
	Presentation	-	07 marks
	Project Work	-	25 marks
	Viva-voce	-	10 marks

Guidelines : Each student of B.Sc Part II (Computer Science Honours) will carry out one project work under the supervision of a faculty member of the college. The project will be assigned at the beginning of Part II academic session. The student will submit a project report representing the actual work in a suitable format. The student should defend the project before the examiners. The project work will be evaluated on the basis of presentation and viva-voce examination.. The examination will be as per University guidelines.

Project Report should contain the following:

- 1) Title of the Project
- 2) Objectives of the Project
- 3) Analysis Report in a suitable format
- 4) Detailed Design steps
- 5) Circuit Layout/Program Listing
- 6) Testing and Analysis
- 7) Conclusion and future scope for development
- 8) Bibliography

Broad areas:

Computer Networking, Network Protocol, Application DBMS, Multimedia, Graphics, Internet based application, Software Engineering Tool Development, Simulation, any other related topics, I/O Controller, I/O interfaces, Microprocessor based system.

Project Evaluation:



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Projects(Paper-VII, Group-B, Full Marks-50) for B.Sc(Hons) Part-II Examination are to be evaluated internally by the college itself in the presence of the project guide.

Paper – VIII (Practical) : 100 Marks

<i>Marks Allotment :</i>	Sessional	-	10 marks
	Viva-voce	-	20marks
	Experiment	-	70 marks

Group-A : Object Oriented Programming

Language : C++,

Problems : Problem set should cover the basic features of the language and implementation of different algorithms covered in theoretical papers.

Group-B : RDBMS

RDBMS :standard database

Front Ends : standard font end.

Problems : Application Database with GUI.

Group C : Shell Programming

Platform : UNIX/LINUX

Problems : Problem set should cover the basic features of shell programming.



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Computer Science General

SUMMARY OF PERIOD DISTRIBUTION : Total Marks : 400

Paper (F.M)	Group (F.M)	Type	Minimum Number of Periods	
			Theoretical(T)	Practical(P)
*COURSE WORK FOR PART-I EXAMINATION				
I(100)	*	T	120	
*COURSE WORK FOR PART-II EXAMINATION				
II(100)	*	P	35	120
III(100)	A(50)	T	60	
	B(50)	P	10	110
*COURSE WORK FOR PART-III EXAMINATION				
IV(100)	A(50)	T	60	
	B(50)	P	10	40

* Shown within the syllabus; T-Theoretical, P-Practical F.M-Full Marks

Note: Figures within() below indicate number of periods allotted for that topic.

Part – I Paper I (Theoretical) : 100 Marks

Distribution of Questions : Q1. (Compulsory – 20 marks, any ten questions to be answered out of fifteen, each carrying 02 marks). No. of questions (Group) : 02(A), 05(B), 06(C), 02(D) Q2 to Q9. Five questions to be answered out of eight as given below : Group A & B combined : any two – from three questions of 16 marks each with emphasis on Gr. B Group C : Any two – from three questions of 16 marks each. Group D : Any one – from two questions of 16 marks each All questions may have smaller subdivisions.

Group A : General Concepts

(15 Periods)

Information : Definition, Categories, Data : Storage, Retrieval and Processing.

Computer : Hardware – CPU, Primary & Secondary Storage, I/O Devices.

Software: Classification System and application; Stored Program Concept and Von-Neumann Architecture;

Evolution: types – supercomputers, mainframes, minis and workstations, PC's, Parallel Machines.

Computer Languages : Types – low level, Assembly, High Level

Application Software : User specific application development; standard packages.

System Software : Classifications – Operating Systems(OS); Translators – Compilers and Interpreters, Preprocessors, Assemblers, Macro Assemblers, Loaders, Linkers, Line and Screen Editors, other utilities.

Virus : Concept, detection and protection.

Multimedia : Basic concept, associated hardware and software.

Object Oriented Languages : Basic characteristics, brief comparison with other types of languages.

Group B : Algorithms & Data Structure : Brief Introduction

(35 Periods)

Algorithms and Problem Solving : Flowchart; algorithm definition and characteristics; structured form sequence; selection and iteration; recursive and non-recursive algorithms. Writing algorithms – use of pseudo language, structured constructs, indentation and comments. Efficiency – O notation (definition, basic properties and use)

Data Structures : Data types and structures – definition. Concept of sequential and linked allocation. Simple Structures (concept and implementation) : Array, Stack, Queue, Binary Tree.

Brief Study on Algorithms; linear search, binary search, bubble sort, quick sort, merge sort, heap sort.

Group C : Computer Architecture and Organization

(50 Periods)

*Basic Building Blocks*** : Combinational Logic – Boolean Algebra; AND, OR, NAND, NOR, XOR gates; adder, multiplexer, demultiplexer/decoder, encoder-sequential logic; flip-flops, registers, counters (synchronous & asynchronous) (**only conceptual study with block diagram and truth/state table)



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Computer Arithmetic and ALU : Positional number system and conversion – base 2, 8, 10, 16 Bits and Bytes : use in arithmetic, storage capacity, data transmission, alphanumeric codes (ASCII, EBCDIC).

Integer Representation: Unsigned, signed magnitude, 1's complement, 2's complement, biased, floating point representation – single and double precision IEEE format. Algorithms for integer and floating point addition, multiplication/division; range, precision and accuracy. Basic structure of an ALU.

CPU : Addressing modes, instruction formats. Handling of interrupts and subroutines, Instruction pipe lining, CISC and RISC processor.

Control Unit : Instruction and Execution Cycle; Control of sequence, jump and branch instruction; shift instruction.

*I/O ** : Controller, interrupt, DMA, Memory mapped I/O. Standard buses. Concept of interfacing. Devices; VDU, mouse, keyboard, joystick, scanner printers-DMP, LASER, ink jet, line/matrix.

Memory : Memory devices *– static and dynamic RAM, ROM, cache; secondary memory (floppy disc, hard disc, tape, CD ROM, DVD); large memory using chips.

(*brief description of basic characteristics, principle of operation related parameters, nomenclature and comparative study where applicable)

Elements of Computer Networks : Centralized and Distributed Processing LAN and WAN. Media Telephone lines, co-axial cables, optical fiber, satellite; VSAT; Basic components – LAN card, Modem; TCP/IP protocol. Concept of E-mail and Internet.

Group D : Brief Studies on OS

(20 Periods)

OS types (single user, multi user, multitasking) : Brief idea on resource management concepts.

GUI and Window : Basic idea. Case Study (latest version of OS). (## : characteristics, advantages and limitations, shell, memory management, file and directory system (I/O).)

Text Books :

1. Introduction to Computer Science by P.K.Sinha
2. Computer Architecture and Organizations 2nd Edition, J. P. Hayes, TMH
3. Computer System Architecture by M. Morris Mano
4. Data Structure by Liptsuitz, S. Outline Series
5. Data Structure by Ellis Horowitz, Sartaz Sahani, Galgotia
6. Data Structure Using C by S. K. Bandyopadhyay and K. N. Dey, Pearson Education

Part - II Paper II (Practical) : 100 Marks

Distribution of questions: Group A : One question to be answered 10 marks. Group B : One question to be answered 10 marks. Group C : One question to be answered 40 marks. Sessional Work – 20 marks; Viva-voce – 20 marks

Duration of Examination – 6 hours.

Note: Problems to be assigned to a student by drawing lots in a manner similar to that followed in other practical examinations. The sessional work must be submitted in a word processed version with computer printout of problems, algorithms, listings, output, discussions, graphs, charts, figures, handwritten output will not be accepted under any circumstances. Questions will not be package/product specific.

Group A : Operating System

(Theoretical – 8 periods. Minimum Laboratory work – 20 periods in total)

Booting, warm and cold reboot, internal and external commands; file name and extensions; wild card notation. Commands; directory, file management, disc management, general. Disc Organization : sectors, boot records, partitioning, FAT. Redirection, pipes. EDIT; Copy Con-batch file creation commands, command line arguments, loop structures, nested, config.sys, utilities.

Starting menus, simultaneous use, reduction/enlargement, folders, starting an application, running one or more application, help, exit.

Program manager: Move, Copy, Delete items/folders, changing attributes.

File Manager: Expansion of compressed files, management of multiple folders, creation/renaming; view and sort files, browse, identify and save settings, disc operations.



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Files and Directories, Copy, Delete, Rename Directory, Creation, Navigation, Editor, Pipes and Filters, Pattern searching.

Group B : Wordprocessing , Document Preparation & Presentation and Spreadsheet

(Theoretical – 02 periods, Minimum Laboratory Work – 20 periods)

WORDPROCESSING: Opening, creating, saving, quitting documents. Using menus and toolbars.

Text : Copy, delete, move, spell check; Character & page formatting; size, font, header, footer, bordering, coloring, margins and justification, graph, text

Picture: Creation, Editing and import, Printing. Use of other available features.

DOCUMENT PREPARATION & PRESENTATION: Slide Preparation, Adding Special Effects, Adding Picture, Animation, Time Control, Slide Show.

SPREADSHEET: Data Entry, Moving data, range selection, use of toolbars and menus : editing; calculation and use of formula, display, print. Graphs and Charts : formatting facilities for presentation (e.g. changing fonts, colours, sizes, adding titles, legends, gridlines).

Macros : Creation, running shortcut.

Group C : Programming in C (Theoretical 25 periods, Minimum Laboratory work – 80 periods)

Basic Structure : Character set, keywords, identifiers, constants, variables and type declaration. Sample programs, preprocessor.

Operators : Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, comma; operator precedence and associativity; arithmetic expression-evaluation and type conversion. Character I/O, Escape sequence and formatted I/O.

Branching and Looping: if, if-else, while, do-while, for.

Arrays : One-dimensional and 2-dimensional. Different types of uses. String handling with arrays – read and write, concatenation, comparison, string functions.

User defined functions : Need; Call by Reference and Call by value; return values and types; nesting of functions; recursion.

Structures : Initialization; arrays of a structure, arrays within structures, structure within structure, size of structures, Dynamic Storage Allocation.

Pointers : Declaration and initialization; operators; pointer arithmetics; accessing variables, pointer & arrays, strings, functions, Linked lists, concepts and use in C with different examples.

File handling : Opening & Closing, I/O.

Other Features – bit level operations, macro definitions, union, command line arguments.

Paper III : Full Marks – 100 (Theoretical-50, Practical-50)

Group A (Theoretical) Full Marks : 50

Groups A1 & A2 together constitute Group A

Distribution of questions :

Q1. (Compulsory – 10 marks, any five questions to be answered out of eight, each carrying 02 marks)

No. of questions (Group) : 02(A1), 06(A2)

Q2 to Q9. Five questions to be answered out of eight as given below :

Group A1 (any one – from two questions of 08 marks each)

Group A2 (any four – from six questions of 08 marks each)

Questions may have smaller subdivisions.

Group A1 : System Analysis and Design

(20 Periods)

Introduction : System definition, characteristics; real-time and distributed systems.

System Life Cycle : Waterfall model, description of different phases.

Planning : Data gathering techniques; feasibility study. Cost-benefit analysis



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Design and Modelling : Logical and physical design; flowcharts and structured charts; DFD and ERD. Form design, User interface design

Modularity : Module specification concepts; coupling and cohesion

Maintenance : Evaluation, testing and validation. Maintenance issues

Case Study : Accounting and Finance System, Personnel system

Group A2 : Database Management

(40 Periods)

Overview : Files and database. Data independence. 3-level DBMS architecture, Data Dictionary, Database Languages

Traditional Models : Network, Hierarchical and Relational. Comparison

Relational Model : Definition and properties, Keys of different types

Relational Algebra : Operations – select, project, cross product, join, set.

Relational Calculus : Concept of tuple and Domain Calculus.

Query Language : SQL – basic concepts, Transaction Processing

Design : ER diagram to relational scheme; Normalization (upto 3NF)

File Organizations : Hashed, Sequential, heap, indexed sequential B-Tree.

Related topics : Concurrency and recovery; security and integrity.

Current trends in databases : Distributed, Client-Server, Object oriented

Text Books :

1. An Integrated Approach to Software Engineering by Pankaj Jalote, Narosa Publishing House
2. Introduction to System Analysis and Design by Igor Hawryszkiewicz, PHI
3. Database System Design y Elmasri, Navathe, Somayajulu, Gupta, Pearson Education
4. Database Systems: Concept, Design and Application by S. K. Singh, Pearson Education, 1st Edition
5. An Introduction to Database Systems by C.J. Date, A.Kannan, S.Swamynathan, Pearson Education

Group B (Practical) : Full Marks 50 Groups B1 & B2 together constitute Group B

Distribution of questions :

Group B1 : One question to be answered out of four

20 marks

Group B2 : One question to be answered out of four

10 marks

Sessional Work – 10 marks; Viva-voce – 10 marks

Duration of Examination - 6 hours

Note : Problems to be assigned to a student by drawing lots in a manner similar to that followed in other practical examinations. The sessional work must be submitted in a word processed version with computer printout of problems, algorithms, listings, output, discussions, graphs, charts, figures, Handwritten output will not be accepted under any circumstances. Question will not be package/product specific.

Group B1 : Database Design and Applications (Minimum Laboratory Periods – 70)

The student should be familiar with at least one standard commercial RDBMS software under desktop or multiuser environment. A small project is recommended. Topic of works should include :

Database Design : Data types, creating databases, adding records, edit, browse, delete, save.

Application Design : Menu and screen design; data validation; report design and generation; use of GUI facilities.

SQL : Constructs; insert, delete, update, view, temporary tables; nested queries, API types of call, native API, ODBC.

Trouble shooting : Validation , correctness, integrity, Performance tuning and documentation.

Group B2 : Assembly and Troubleshooting of PCs (Theoretical 10 periods, Minimum Laboratory Work – 40 periods)



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Theoretical:

PC Organization

Overview of Intel 16-bit, 32-bit/latest processor

(Block Diagram, bus width, clock speed, real and virtual memory, performance parameters)

Laboratory Work:

Students should get appropriate ideas reg the following : assembling a PC, upgradation of a PC, installation of different softwares, running diagnostic software for performance tuning and related topics.

Experiments (the following topics should at least be covered) :

1. Assemble a PC with a given configuration
2. Upgrade processor, RAM, SMPS, Operating System
3. Install mouse, keyboard, printer
4. Servicing problems : HDD – not booting from it, formatting, partitioning, virus removal, changing
5. FDD : Head alignment, seek error, sector not found
6. Power Supply problem
7. VDU problems
8. Networking problems including installation of LAN card
9. Install TV; tuner card, MPEG card, multimedia components
10. ROM location error
11. RAM : general protection error.

Part – III Paper IV Full Marks: 100(Theoretical 50, Practical 50)

Group A (Theoretical) Full Marks : 50

Distribution of questions : Q1. (Compulsory – 10 marks, any five questions to be answered out of eight, each carrying 02 marks) Q2 to Q9. Any five questions to be answered out of eight, each carrying 08 marks. Questions may have smaller subdivisions.

Group A : Communication and Computer Networks

(60 Periods)

Communication Concepts : Analog and Digital communication – basic concept and comparison. Signal types frequency spectrum, strength, bandwidth, data rate, channel capacity. S/N ratio, modulation and demodulation FSK, ASK.

Transmission media (brief idea, characteristics, comparison) : Guided (twisted pair, co-axial, optical fiber) and unguided (microwave, satellite-geo synchronous and low-orbit, VSAT).

Audio and Video communication systems : Analog and digital telephone, AM & FM radio, cable TV network, ISDN, paging, cordless and cellular phones, ATM.

Computer Networks : Distributed processing and resource sharing concepts. Classes – LAN, MAN, WAN

Architecture – OSI , TCP/IP and http protocol – brief study. Basic idea of protocols, routing, congestion control.

LAN : Ethernet and Token Ring topology (principle of operation, characteristics, comparison). High speed LANs Internetworking Modems, bridges and routers, connectivity concepts. Network security.

The Internet : basic idea, DNS and URL, IP address, browsers

E-mail : Architecture and services

Text Books :

1. Data Communications and Networking by Behrouz A. Forouzan, 4th Edition, TMH
2. Data and Computer communication by William Stallings, 6th Edition, Pearson Education
3. Computer Networks by Tanenbaum, Pearson Education

Group B (Practical) Full Marks – 50

Group B1 & B2 together constitute Group B.



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Distribution of questions : Group B1 : One question to be answered out of four 20 marks. Group B2 : One question to be answered out of four 10 marks. Sessional Work – 10 marks, Viva-voce – 10 marks
Duration of Examination – 6 hours

Note : Problems to be assigned to a student by drawing lots in a manner similar to that followed in other practical examinations. The sessional work must be submitted in a word processed version with computer printout of problems, algorithms, listings, output, discussions, graphs, charts, figures, Handwritten output will not be accepted under any circumstances.

Question will not be package/product specific.

Group B1 : Shell Programming (Minimum Laboratory Work 50 periods)

Files & Directories : Copy, delete, rename, compare files, create, navigate, remove directories, access vi editor, status of users, background jobs; Pipes & filters; cutting, pastings and sorting of files, pattern searching in a string.

Shell Programming : Concept and simple programming problems. Unix/Linux system administration-creation and maintenance of accounts, super user, disk management, backups, X-windows.

Group B2 : Programming in GUI environment (Theoretical – 10 periods, minimum Lab. Work – 40 periods)

Students should learn about programming on the following topics using one of the two languages, primarily through practical sessions, along with theoretical classes in between.

Basic Features; building objects with classes, operations with objects, class libraries. Multitasking and multithreading applications; software design involving forms, objects, events, functions, procedure and methods (32 bit programming). ODBC driver; Front and development for database. Multimedia applications.



ADDITIONAL INFORMATION

EQUIPMENT, COMPONENT & SOFTWARE

i. Computing System (minimum configuration)

PC with Pentium MMX colour monitor, keyboard, mouse, multimedia cards, speaker; Peripheral : at least DMP.
Add-ons (expected) : LAN facility, with proper OS.

Minimum number of units : 1 per batch of 2 students.

: As any particular package has not been specified in the syllabus, any other standard package may be used. At any point of time the latest version available is recommended.

ii. Other equipment and components

1. (a) Logic probes, Digital or Analog multimeter, soldering iron, Desoldering pump, wire cutter, screw driver set. (b) CRO (20 MHz or higher) storage type recommended.
2. Motherboard and CPU with manuals – current standard recommended I/O IDE card (if not inbuilt in motherboard). Cable set – IDE data cable, FDC, COM1 and COM2, LPT1 etc. Colour Monitor. Power Supply – SMPS (not less than 20C W).
3. Keyboard, floppy disk drive, HDD, CDROM drive, mouse, LAN card, MODEM. Speaker, microphone, headphone,.
4. System management and device installation software: Disk manager, installation CDROM, diagnostics – PC tools etc.



WEST BENGAL STATE UNIVERSITY

**SYLLABUS
FOR THREE YEAR B. Sc. DEGREE COURSE**

**(HONOURS)
IN
ECONOMICS**

**According to the New Examination Pattern
Part – I, Part- II & Part- III**

**WITH EFFECT FROM THE SESSION
2010 – 2011**

PART-I

PAPER 1: ECONOMIC THEORY-1

GROUP A -MICROECONOMICS I

Full Marks- 50

Minimum Number of Lectures 70

1. INTRODUCTION: Nature and scope, Scarcity and choice, Concepts of demand and supply-Demand function, Supply function, Market equilibrium, Impact of changes in demand and supply, Price system as an economic mechanism.

TEXT: Maddala & Miller – Microeconomics

Chapter -1 Section – 1.1 & 1.2

Chapter -2 Section – 2.2 & 2.3

2. CONSUMER BEHAVIOUR: Assumptions on preference ordering, Indifference curve, Budget constraint and Consumer's equilibrium, Substitution effect (Hicks & Slutsky) and Income effect, Ordinary and Compensated demand curves, Inferior goods and Giffen goods, Price consumption and income consumption curves, Derivation of labour supply and intertemporal choice, Saving and borrowing, Revealed Preference – the weak axiom and substitution effect.

TEXT: (i) Maddala & Miller

Chapter -4 Sections – 4.4, 4.5, 4.6

Chapter -5 Sections – 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8.1

REFERENCES: (i) Ryan & Pearce – Price Theory

Chapter -1 Section – 1.1, 1.2, 1.3

Chapter -2 Section – 2.0, 2.2, 2.6, 2.7, 2.10

(ii) Ferguson & Gould – Microeconomics Theory

Chapter 4, Section – 4.6, 4.7

Chapter 3

(iii) Varian – Intermediate Microeconomics (3rd edition)

Chapter -3 (page – 34, 35), 7 (page – 118-126)

(iv) Henderson & Quandt – Microeconomic Theory- A Mathematical Approach (3rd Edition) Chapters- 2, 6

3. DEMAND AND SUPPLY: Market equilibrium, Stability of equilibrium, Elasticities of demand and supply, Consumer's and producer's surplus, Burden of indirect taxes and subsidies, Price and quantity controls, Minimum wage, Import tariff and quota.

REFERENCES: (i) Maddala & Miller

Chapter -2 (Section 2.7.1), Chapter-3 (Section 9.9)

(ii) Pindyck & Rubinfeld – Microeconomics

Chapter -4 (Section 4.4, page 113-118), Chapter -9(Section 9.1, Page 277-278) Chapter -9(Section 9.4, 9.5, 9.6)

4. PRODUCTION AND COST: Production function, Total, Average and Marginal products, Isoquants and economic regions of production, Cost minimization and expansion path, Elasticity of substitution, Economies of scale, Cobb Douglas, Fixed coefficient and CES functions, Short run and long run costs, Derivation of the cost function from production function.

REFERENCES: (i) Ferguson & Gould

- Chapter -5, 6, 7 (pp: 183)
 - (ii) Maddala & Miller
 - Chapter -6 (Sections – 6.3, 6.5, 6.6, 6.7), 7 (Section – 7.7)
 - (iii) Chiang & Wainwright– Fundamental Methods of Mathematical Economics (4th Edition,)
 - Chapter – 12 pages: 386-388, 390-394, 396, 397-399
 - (iv) Salvatore – Microeconomics
 - Section – 7.4, 8.2, 8.3 (Appendix pp: 221-225)
5. PERFECT COMPETITION: Features, Short run and long run equilibrium of the firm, Short run supply function, Industry equilibrium, Long run industry supply with or without external economies or diseconomies.
- TEXT: Maddala & Miller, Chapter -10 (page 283-292)
- REFERENCES: (i) Ferguson & Gould - Chapter – 9 (page 253-266)
- (ii) Henderson & Quandt – Chapter - 6
 - (iii) Koutsoyiannis – Modern Microeconomics- Chapter–5 (Page 154-163)

GROUP B: MACROECONOMICS I

Full Marks- 50

Minimum Number of Lectures - 70

1. Macroeconomic Data: National Income accounting – GDP, GNP, NNP, NI, DPI, Different methods of Calculating NI; Measurement of cost of living – CPI, GDP Deflator; Measuring Joblessness – Unemployment rate, Unemployment and GDP – Okun’s Law
NI as a measure of economic welfare.
TEXT:- Mankiw - Macroeconomics (5th Edition); Chapter- 2
REFERENCES: Soumyen Sikdar - Principles of Macroeconomics (OUP); Chapter- 2
Abel & Bernanke - Macroeconomics (4th Edition); Chapter- 2
2. The Economy in the Long run: The classical Analysis of the real sector – Determination of employment, income and interest rate.
TEXT: Mankiw (5th Edition); Chapter – 3
3. (i) The economy in the Short run: Simple Keynesian analysis of aggregate demand with or without govt. sector, Multipliers; IS-LM analysis, Fiscal policy and Monetary policy; IS-LM analysis in the short run and long run.
TEXT: Mankiw (5th Edition); Chapters- 10, 11
References: Dornbusch, Fischer and Startz - Macroeconomics (8th Edition); Chapters- 9, 10, 11
Branson – Macroeconomics - Theory and Policy (2nd Edition)

(ii) Introduction to economic fluctuation: Impact of shift of aggregate demand curve both in the short run and in the long run.
TEXT: Mankiw (5th Edition); Chapter- 9
4. The complete Keynesian Model: A three sector model taking into consideration of product market, money market and labour market.
TEXT: Branson (2nd Edition); Chapter- 7
References: Archibold and Lipsey: A Mathematical Treatment of Economics; Chapter – 16

PAPER II: QUANTITATIVE TECHNIQUES FOR ECONOMICS -I

GROUP A: STATISTICS-I

Full Marks- 50

Minimum Number of Lectures 70

1. **DATA PRESENTATION:** Statistical data, Classification and presentation, Population and sample, Collection of data, Variable and attribute, Frequency distribution, Diagrammatic representation of frequency distribution, Ogive.
TEXT-Goon, Gupta & Dasgupta-Basic Statistics (1999)
Chapters- 2, 3
2. **DESCRIPTIVE STATISTICS:** (i) Measures of Central tendency: Arithmetic mean, Median and mode (for both grouped and ungrouped data) – Comparison of mean, median and mode, Geometric mean and harmonic mean, Composite mean.
TEXT- Goon, Gupta & Dasgupta – Chapter - 4

(ii) Index number: Fixed Base and Chain Base Index – Laspeyres, Paasche, Fisher and cost of living index number.
Goon, Gupta & Dasgupta, Chapter- 14.

(iii) Measures of Dispersion: Range, Mean deviation and standard deviation, Quartile deviation, Measures of relative dispersion, Curve of concentration
TEXT-- Goon, Gupta & Dasgupta, Chapter- 5

(iv) Measures of Skewness and Kurtosis
TEXT- Goon, Gupta & Dasgupta, Chapter- 6
3. **ANALYSIS OF BIVARIATE DATA:** Simple correlation and simple regression – Properties and methods of calculation
TEXT: (i) Goon, Gupta & Dasgupta – Basic Statistics, Chpater-9
4. **Time Series:** Trend, Polynomial trend & Logistic trend, Seasonal Variation, Methods Moving Average.

REFERENCES: Goon, Gupta & Dasgupta –Basic Statistics.

- (i) N.G. Das – Statistical Method [Vol. I], Chapters- 1, 2, 4, 5, 6, 7, 9
- (ii) N.G. Das – Statistical Method [Vol. II], Chapter- 17
- (iii) Nagar & Das – Basic Statistics [2nd Edition], Chapters- 3, 4, 5, 6, 7

GROUP B: MATHEMATICAL ECONOMICS I

Full Marks- 50

Minimum Number of Lectures -70

1. Sets: (i) Set Operations (ii) Finite and infinite sets (iii) Mapping of Set (iv) Ordered Sets (v) Linear point Sets.
TEXT: (i) Chiang & Wainwright – Fundamental Methods of Mathematical Economics (4th Edition)
Chapter – 2 [Section 2.3, 2.4]
REFERENCE: (i) Mukherji & Pandit – Mathematical Methods of Economic Analysis
Chapter – 1
(ii) Mehta & Madnani – Mathematics for Economists (2001) - Chapter-I
(iii) Archibald & Lipsey- A Mathematical Treatment of Economics
2. Elements of Calculus: Functions, Limits & Continuity, Total derivatives, Partial derivatives, Homogenous function, Euler’s theorem, Simple integration, Definite integrals.
TEXT: (i) Chiang & Wainwright –
Chapters – 7, 8 (Section 8.4), 12 (Section 12.6), 14 (section 14.3).
(ii) Silberberg – The Structure of Economics
Chapter – 3 (Section 3.2, 3.3, 3.4, 3.6, 3.7)
(iii) Mukherji & Pandit - Chapters – 5, 9.
(iv) Mehta & Madnani - Chapters- 8, 9, 10.
(v) Allen – Mathematical Analysis for Economists (1987) - Chapter – 4
3. Maxima & Minima of functions (constrained or unconstrained) – Economic Applications – Utility Functions, Revenue Function, Cost Function, Profit Function, Maximising Excise – Tax & Revenue.
TEXT: (i) Chiang & Wainwright –
Chapters– 7, [Section 7.2], 9 [Section 9.1 9.2, 9.3, 9.4], 12 [Section 12.5]
(ii) Silberberg, Chapters – 4 (Section 4.1, 4.2, 4.4), 6 (Section 6.3, 6.4, 6.5)
(iii) Mehta & Madnani, Chapters- 6, 7
(iv) Allen – Chapters – 5, 6
4. Linear Algebra: Determinants – Minors and cofactors, Properties of determinant, Jacobian theorem, Matrix
TEXT: Chiang & Wainwright, Chapter – 4 & 5
REFERENCE: Mehta & Madnani, Chapter-5
5. Some simple applications of mathematics on economic theory.
 - a. Domain & Range of the Cost function
 - b. Finding Marginal revenue (MR) function from Average revenue (AR) function
 - c. Application of Matrix and Determinant to market models, National Income Determination and IS –LM model.
 - d. Given the production function $Q=f(K, L)$, Write the set notation of an isoquant
 - e. Given the average revenue function justify whether AR & MR curves are continuous

PART- II
PAPER III: ECONOMIC THEORY-II
GROUP A: MICROECONOMICS-II

Full Marks- 50

Minimum Number of Lectures 70

1. Monopoly and Monopolistic Competition:
 - a) Monopoly: Sources of monopoly power, Index of monopoly power, Equilibrium with single plant, multiple plants, Price discrimination, Constrained revenue maximisation, Natural monopoly, Effects of different types of location, Dead-weight loss of monopoly.
TEXT: Pindyck & Rubinfeld: Chapter 10, 11
REFERENCES: i) Dominick Salvatore: Chapter 10
ii) Handerson & Quandt: Chapter 7 (sec. 7-1, 7-2 & 7-3)
iii) Maddala & Miller: Chapter 11, 12 (pg. 344-347, 352-362)
 - b) Monopolistic Competition: Features, Short-run & Long-run equilibrium, Excess Capacity.
TEXT: Ferguson & Gould & Lazear: Chapter 12
REFERENCES: Pindyck & Rubinfeld: Chapter 12 (sec. 12:1)
Maddala & Miller: Chapter 13 (pg. 374-381)
2. Oligopoly:

Conjectural Variation & Reaction functions, Analysis of Cournot & Stackelberg Collusive Oligopoly & Prisoners' dilemma in cartel stability, Nash equilibrium of game.

TEXT: i) Pindyck & Rubinfeld: Chapter 12, 13 (sec. 13:1-13:5)
ii) Salvatore: Chapter 11, 12
iii) Gravelle & Resse: (For Conjectural Variation & Reaction function)
3. Factor Pricing:

Derived demand for a single input & multiple input in competitive & imperfectly competitive markets, Firm demand & industry demand, Adding up problem, Collective bargaining & exploitation, Rent & Quasi-rent.

TEXT: Ferguson & Gould: Chapter 14, 15
Maddala & Miller: Chapter 15 (sec. 15.1-15.6, pg. 431-444)
Chapter 16 (sec. 16.1-16.6, pg. 462-474)

REFERENCES: i) Koutsoyanis (2nd ed.): Chapter 21
ii) Ryan & Pearce (For Economic Rent only, pg. 230-233)
4. Welfare Economics:

Conditions of Pareto optimality in pure exchange & in production, Optimality of perfect competition, Externalities & market failure.

Text: Ferguson & Gould: Chapter 17
Maddala & Miller: Chapter 19

REFERENCES: i) Koutsoyanis: Chapter 23 (pg. 526-538)
ii) Ryan & Pearce: (pg. 371-378)
5. Choice under Uncertainty: only basic concepts
Describing Risk, Preferences towards risk, Reducing risk, the demand for Risky assets-the trade-off between Risk & Return.
TEXT: Pindyck & Rubinfeld: Chapter 5

GROUP B: MACROECONOMICS - II

Full Marks: 50

Minimum No. of Lectures-70

1. Microfoundation of Macrobbehaviour:

(i) Consumption function: Keynes and the consumption function, Secular stagnation & the consumption puzzle, Inter-temporal choice, Permanent income hypothesis and life-cycle hypothesis.

Text: Mankiw: Macroeconomics (6th edition); Ch-16

Reference: W.H. Bon- Macroeconomic Theory & Polity (2nd edition); Ch-10

(ii) Investment function: Fixed investment; The neoclassical approach, Tobin's q, Residential investment, Accelerator model of investment.

Text: Mankiw (6th edition); Ch-17

Reference: Dornbusch, Fischer & Startz- Macroeconomics (9th edition); Ch-14

(iii) Demand for Money: Transaction demand for money, Precautionary demand for money, Speculative demand for money, The Regressive Expectations Model, The portfolio balance approach, The Baumol-Tobin models of Cash Management, Money as a consumer's and producer's good.

Text: i) W.H. Branson; Ch-12

References: ii) Mankiw; Ch-18

iii) Dornbusch, Fischer & Startz (9th edition); Ch-15

(iv) The supply of money: Definitions of Money supply (M_1 , M_2 , M_3 , M_4), Credit creation by commercial banks, Money multiplier, Instruments of monetary policy.

Text: i) Mankiw; Ch-18

References: ii) Dornbusch, Fischer & Startz (9th edition); Ch-16

iii) Soumyen Sikdar – Macroeconomics; Ch-6

2. Inflation:- Definition and functions of money, Quantity theory of money, Money, prices and inflation, Inflation and interest rates; The fisher effect, Future money and current prices, The social costs of inflation.

Text: Mankiw; Ch-4

3. Aggregate supply and Phillips curve; Inflation, unemployment and Phillips curve, Shift of Phillips curve, Causes of inflation, Disinflation and sacrifice ratio, Rational expectation and painless disinflation.

Text: i) Mankiw (2nd edition); Ch-13

References: ii) Abel & Bernanke (4th edition); PP – 441-445 (for shifting of Phillips curve)

iii) S. Sikdar (OUP); Ch-9; PP – 131-137

4. Recent Developments in Macroeconomics:

Rational expectations, Real business cycle, New Keynesian Economics:

Text: i) Mankiw; Ch-19

Reference: ii) Soumyen Sikdar; Ch-11 (Page 160-164)

PAPER IV: DEVELOPMENT ECONOMICS AND ISSUES ON ECONOMIC DEVELOPMENT

GROUP A: DEVELOPMENT ECONOMICS

Full Marks- 50

Minimum Number of Lectures - 70

1. **MEANING OF DEVELOPMENT:** Issues of Economic development – Traditional approach (Economic & non-economic – Per capita income, Physical quality life index, Basic needs approach, Sustenance, Self esteem, Freedom from servitude) - Capability approach – Human development index – Gender related development index.
TEXT- Thirlwall: Growth & Development (5th Edn), Chapter–1 (Pages 9, 22, 51, 52-54)
REFERENCES: (i) Meier: Leading Issues in Economic Development
Chapter – 1 (1.A, 1.B.1)
(ii) Todaro & Smith: Economic Development
Chapter 1 (pages 49-56), Chapter – 2 (pages 80-97)

2. **STAGES OF GROWTH:** Rostow and Marx in comparison with Rostow
TEXT- Thirlwall: Chapter 1 (page 61)

REFERENCES: (i) ROSTOW – The Stages of Economic Growth – A non-Communist Manifesto.
(ii) Meier: Chapter – IIA (page 69)

3. **SOURCES OF ECONOMIC GROWTH** (i) Labour: Demographic issues, Theory of demographic transition, Trap models and their criticism (Nelson’s and Leibenstein’s models may be discussed in brief.)

(ii) Capital: Capital accumulation, Capital-output ratio, Technological progress - Concepts of Hicks, Harrod, Solow, Neutral Technological progress (no graphical/Mathematical exposition is required)

REFERENCE: (i) Hayami- Development Economics [2001], Chpaters-3 (Section 3.1.1, 3.1.2, 3.3.3), 5 (Section 5.2.3)
(ii) Thirlwall: Chapter–4 (page 112, 114), Chapter – 6 (page 163, 164)

4. **PROBLEMS OF LABOUR SURPLUS ECONOMY:** Lewis model and its criticism, Nurkse’s idea of disguised saving potential, Concept of labour surplus (disguised unemployment), Sen’s Model Labour migration and Harris-Todaro model.
TEXT- Thirlwall, Chapter - 3 (page 96-100 & page 104-110)
REFERENCE:

- (i) Nurkse – The Problems of Capital formation in underdeveloped countries (selected portion)
 - (ii) Dewett & Wadhawan- Economics of Growth and Development [1977], Chapter- 32, Page- 429-430
 - (iii) Sen: ‘Peasants & Dualism with or without surplus labour’ in Journal of Political Economy (1966), Oct,
 - (iv) K. Basu–The Less Developed Economy (1984), Chapters: 5, 6
 - (v) K. Basu – Analytical Development Economics
Chapter – 7 (Section 7.2)
Chapter – 8 (Section 8.1, 8.2, 8.3)
 - (vi) Reprinted in Agarwala & Singh – The Economics of Under Development (1988) – “Economic Development with Unlimited Supplies of Labour” by W. A. Lewis (Page No. 400- 413), Published in - The Manchester School, May 1954
5. DEVELOPMENT STRATEGY: Balanced vs. unbalanced growth, Choice of technique in labour surplus economy.
TEXT- Thirlwall– Chapter - 7 (page 180-187)
 6. POVERTY INEQUALITY AND STANDARD OF LIVING: Measurement and issues, Lorenz curve, Gini Coefficient, Headcount index, Poverty gap, Inequality and development, Sen’s Index.
REFERENCE: Debraj Roy – Development Economics [1999],
Chapters – 6 (Sections - 6.2, 6.3), 8 (Sections - 8.2, 8.3)
 7. THE ENVIRONMENT AND DEVELOPMENT: Sustainable development, common property resources (tragedy of the commons), Kuznet’s curve.
REFERENCE: R.N. Bhattacharyya
Environment Economics (selected portion)

GROUP B: ISSUES ON ECONOMIC DEVELOPMENT

Full Marks: 50

Minimum No. of Lectures - 70

1. Trade and Development:-

- (a) Trade as an engine of growth – The historical perspective, Static and dynamic gains from trade, Trade as a rent for surplus, Some criticisms of Traditional Free Trade Theory in the context of the experience of developing nations

Text: Thirlwall; Growth and Development with special reference to Developing Economics (8th edition) Ch-16 (Pages: 514-515, 518-523, 542-544)

- (b) Arguments for protection – The Infant industry argument for tariff protection

Text: i) Salvatore: International Economics (3rd edition) Ch-9; (Pages: 258-260)

References: ii) Sodersten & Read; International Economics (3rd edition) Ch-9; (Pages: 256-261)

iii) Debraj Ray; Development Economics Ch-17 (Pages: 669-674)

- (c) Terms of Trade and Economics Development – various terms of trade (net barter and income terms of trade) – Prebisch-Singer thesis and terms of trade debate

Text: i) Thirlwall (8th edition); Ch-16, Pages: 548-552

Reference: ii) Salvatore (3rd edition); Ch-11; (Pages: 317-321)

- (d) Alternative Industrialisation Strategy for developing nations – Import Substitution and Export promotion

Text: i) Salvatore (3rd edition); Ch-11; (Pages: 326-329)

References: i) Thirlwall (8th edition); Ch-16, Pages: 547-548

ii) Todaro and Smith: Economic Development (8th edition); Ch-13 (Pages: 556-567)

- (e) Multinational Corporations and Foreign Direct Investment – FOI and FPI; Two main forms of FDI (Greenfield investment & merger or acquisition); MNCs – main features, implications for the host nations; Foreign aid (concept only)

Text: i) Salvatore; Ch-12; (Pages: 354-360)

References: ii) Todaro and Smith (8th edition); Ch-15

iii) S. Sikdar; Contemporary Issues in Globalisation (2nd edition); Ch-4
(Pages: 79-100) (OUP)

iv) B. Dasgupta Structural adjustment, Global trade and the new political
economy of development –(Pages: 195-203) (Vistaar Publications)

(2) Development and Underdevelopment as a historical process:-

(a) Dependency theory of Baran and Frank

(b) The concept of unequal exchange

Text: Debesh Bhattacharya; The Political Economy of Development (Pages: 135-143)

Reference: Thirlwall; Ch-7, Pages: 252-255

(3) Planning for Development:-

Rationale for planning, The instances of market failure and the role of state; Govt.
failure and Resurgent preference for markets over planning; Decentralisation (concept
only)

Text: i) Todaro and Smith (8th edition); Ch-16 (Pages: 680-684, 694-698, 700-702,
714-719)

References: i) Pindyck & Rubinfeld; Microeconomics (6th edition) Ch-16; (Pages:
607-609)

ii) Meier & Rauch; Leading Issues in Economic Development (7th edition) (Pages:
426-433)

(4) Evolution of the International Economy:-

The origin, objectives and functions of IMF and World Bank; The Third World Debt
crisis and the structural adjustment policies adopted by IMF; The new International
Economic Order

Text: i) Salvatore (3rd edition); Ch-11; (Pages: 331-337); Ch-20

Reference: ii) Sodersten and Read (3rd edition); Ch-31

iii) Todaro and Smith (8th edition); Ch-14

PART - III

PAPER – V: INTERNATIONAL ECONOMICS & PUBLIC FINANCE

Full Marks- 100

Minimum Number of Lectures 130

GROUP – A: INTERNATIONAL ECONOMICS

Full Marks- 60

Minimum Number of Lectures 80

Group – I: Pure Theory of International Trade: (Full Marks -30)

1. The Theory of comparative Advantage and gains from Trade:-

- a. The concept of Production possibility curve (PPC) and community indifference curve – autarky equilibrium
- b. Gains from trade and its decomposition into gains due to exchange and gains due to specialisation.
- c. Adam Smith and Absolute advantage theory of trade.
- d. David Ricardo and the theory of comparative advantage – The concept of opportunity cost, Derivation of PPC of trading nation with constant opportunity cost, Gains from trade; Determining the relative price of tradables after trade in terms of relative demands and relative supply curves, Derivation of world PPC, country size and gains from trade, limitations of the Ricardian model.
- e. Offer curve – Definition, Derivation of offer curve, Determination of elasticity of offer curve at a point on offer curve, Determination of free trade Terms of Trade (TOT) in terms of offer curve (multiple equilibria should be avoided), Concept of trade indifference curve only, Ricardian offer curve (concept only)

TEXT – i) Caves, Frankel & Jones – World Trade and Payments (9th Edition), Chapter – 3, 5 (Page 71-81)

ii) Salvatore – International Economics (8th Edition) – Chapter – 2 (Page 33-47), 3 (Page – 59-73), 4 (Page 89-110)

REFERENCES: i) Krugman & Obstfeld: International Economics – Theory and Policy (8th Edition) – Chapter- 3 (Page: 30 -39)

ii) Sodersten-International Economics (2nd Edition) – Chapter – 1

iii) M. Chacholiades - International Economics – Chapter – 2, 3

2. Comparative Advantage in the Heckscher-Ohlin Trade model:

- a. The basic assumptions of the model Factor abundance defined in physical terms and by factor price
- b. Heckscher – Ohlin Theorem (Statement & Proof in terms of physical and price definition of factor abundance)
- c. A comparison of comparative advantage in the Ricardian and in the Heckscher-Ohlin Trade model.

TEXT – i) Salvatore – Chapter – 5 (Page 115-129)

ii) Sodersten – Chapter – 3

REFERENCES: i) Chacholiades - Chapter – 4

3. **Commodity and Factor prices under trade – Factor price Equalisation:**
- Factor price equalization theorem, Basic concept of factor intensity reversal.
 - Empirical testing of H-O theorem : - Leontief paradox
TEXT : Solvatore - Chapter – 5 (Pages 129-134, 138-144, 149-154)
REFERENCES – i) Sodersten – Chapter – 6
ii) Chacholiades - Chapter – 4, 5 (Page 90-97)

Group – II Trade Policy (Full Marks -15)

4. **Instruments of Restrictive trade:-**

- Effect of tariff (import duty) and quota – some partial aspects
- Tariff versus Quota and their equivalence
- Effective rate of protection (the concept only)
TEXT : Solvatore - Chapter – 8 (Page – 235 -247)
Chapter – 9 (Page 274 – 276)
REFERENCES - i) Sodersten – Chapter – 13 (Page 169-172), 14 (Page 187 -190)
ii) Chacholiades - Chapter – 7 (Page 141-146)
Chapter – 9 (Page 194 – 200)

5. **Tariff under optimal market conditions:-**

- Tariffs and income distribution: The Stolper – Samuelson theorem
- Tariff, the terms of trade and domestic prices – the Metzler’s paradox (concept only)
- Tariff and the national income – the optimum tariff
TEXT : Solvatore - Chapter – 8 (Page – 249-271)
REFERENCES – i) Sodersten – Chapter – 13 (Page 173-183)
ii) Chacholiades - Chapter – 7 (Page 146-161)

Group – III - The Balance of Payments and International Economic Policy: (Full Marks -15)

6. **The Balance of payment: (BOP)**

- BOP accounting principles; Current and capital account transaction, Statistical discrepancy
- Equilibrium and Disequilibrium in the BOP – autonomous and accommodating transactions
TEXT: Sodersten – Chapter – 23
REFERENCE – Salvatore - Chapter – 13 (Page – 429-444)

7. **The determination of national income in an open economy - Foreign trade multiplier (with and without repercussion effect)**

TEXT: Caves, Jones and Frankel (9th Edition) – Chapter 17 (Page 315-328)

8. **Theory of Exchange Rate, Devaluation and Trade Balance:**

- Imports, Exports and foreign exchange market - demand – supply framework.
- Different types of exchange rate system, fixed and flexible (clean or managed float) exchange system. (Concepts only)
- The working of fixed and flexible exchange rate system with special reference to – (i) foreign exchange risk, (ii) Inflation

- d. Concept of Internal and external balance - The swan diagram – Expenditure switching and expenditure adjustment policies – Marshall – Lerner condition for successful devaluation of home currency. (Statement and implication only, no rigorous proof is required)

TEXT – i) Caves, Jones & Frankel: Chapter-18 (Page 335-345, 360-361)

ii) Salvatore: Chapter – 16 (Page – 547-555, 572-573);

Chapter – 17 (Page 588-600, 611-613)

Chapter – 20 (Page 695-705 – 528)

REFERENCE: i) S. Sikder (Principles of Macroeconomics); Chapter–7(Page 97-104)

ii) Sodersten : Chapter – 22

GROUP B: PUBLIC FINANCE

Full Marks- 40

Minimum Number of Lectures 55

1. Economic Role of the State: Public goods and market failure, Distinction between private goods and public goods, Samuelson’s solution for the optimal provision of public goods, Lindahl’s Equilibrium for optimal tax sharing, Free rider problem, Justification of Government expenditure in defense, education, health, infrastructure.

TEXT -Musgrave & Musgrave – Public finance in theory & Practice [2004] (page 3-5), Chapters – 10, 11

REFERENCE (i) Due & Friedlaender – Govt. Finance (1997) –Chapters- 3, 8 (Page 179-194)

(ii) Maddala & Miller – Microeconomics, Chapter – 19 (page 545)

(iii) S.R. Chakraborty – Microeconomics, (page 690-691)

(iv) Ambar Ghosh & Chandana Ghosh – The Economics of Public Sector [2008]

(v) Ulbirsch – Public finance (2004) (on justification of Govt. Exp.) Chapters- 4, 16, 19 (page 342)

2. Principles of Taxation: Ability to pay and benefit approaches, Horizontal and vertical equity.

TEXT -Musgrave & Musgrave

REFERENCE: Ulbirsch – Public Finance – Chapter – 6 (Page 117 -118, 172-175)

3. Direct and indirect Taxation: Effect of Income tax on work effort, Saving and risk bearing, Incidence of sales and excise tax – excess burden of indirect taxation, value added tax.

TEXT -Musgrave & Musgrave, (page 235-236, 280-281)

REFERENCE: (i) Due & Friedlaender (spite effect & purchase effect, page 354), (sales tax, page375), (Taxation on capital gains, page 262)

(i) Ghosh & Ghosh- chapter 6

(ii) Ulbrich – chapter-8 (page 164)

4. Public debt: Internal and external burden- Different concepts of deficit in Government's budget – Burden of internal public debt, Burden of public debt on future generation, External public debt, comparison of internal and external public debt.

TEXT -Musgrave & Musgrave – Chapter 32

REFERENCES: (i) Ghosh & Ghosh – Chapter 9 (Page 270-293)

(ii) Abel & Bernanke – Macroeconomics – Chapter 15

PAPER- VI: INDIAN ECONOMIC PROBLEMS AND PLANNING

Full Marks: 100

Minimum No. of Lectures:126

1. Structure of Indian Economy: Changes in the pattern of inter sectoral distribution of national income, changes in the pattern of occupational structure.(A)
2. Agriculture: Farm size and productivity- controversial Indian experience, Marketable Surplus and Marketed Surplus of food grains, prices and acreage elasticity of Marketed Surplus (B). Different aspects of New Agricultural Strategy (Green Revolution)-output, employment and distribution of income & wealth(C). Land Reforms. Food security and government intervention in food grains. Problems of Institutional Credit in Indian agriculture. Impact of globalization in Indian agriculture.(D)
3. Growth and Stagnation in Indian Industries.(E). State initiative in industrialization. Evaluation of Industrial policies including Licensing Policies, Role, Performances and Weaknesses of Public Sector Industries. New Industrial policy in the post- globalization era. Disinvestment Policy.(F)
4. Unemployment and Poverty: Nature and types of unemployment in India. Problems related to the measurement of Unemployment in India (G). Problems related to female and child labour in India (H). Poverty in India-Different estimates of poverty (I). Evaluation of different policies and programmes aiming at eradication of poverty.(J)
5. Money and Capital Market: Reserve Bank of India and Indian Money market. Monetary policies in recent years. Relation between Money Market and Capital Market in India. Nationalization of commercial Banks and problems associated with Nationalized Banking Sector. Reforms in Monetary Sector and Capital Market in India.(K)
6. Indian Public Finance: Trends problems and Reforms. Central-State allocation of Financial Resources- Controversies, Recommendation of different committees in resolving this controversy (L).
7. External Sector- Composition, Direction, and Trend in Foreign Trade. Problems related to the Balance of Payments. EXIM Policies and other recent measures (such as convertibility of rupee) to improve BOP (M).
8. Rationale of Planning and Mixed Economy. Five Year Plans- Objective, achievement and failure. Financing of Five Year Plans (N): Special focus on 2nd, 7th and 9th plans.

References:

1. Poverty and Development. Primit Chaudhuri
2. Contribution to India's Economic Analysis. Bhagwati & Chakrabarty
3. Some Problems of India's Economic Policy. Ed. By Charan Wadhva.
4. Development Planning; Indian Experiences, S. Chakrobarty.
5. Planning in India. Desai
6. Recent Development and Future Prospect: Ed. By Lucas & Papanek.
7. Employment, Technology & Development. A.K.Sen.
8. The Indian Economy: Bimal Jalan.
9. On Economic Liberalisation. Deepak Nayar.
10. Planning for Industrialisation. Bhagwati & Desai.
11. Political Economy of Indian Agriculture. Ashok Rudra.
12. Essays in Honour of Manmohan Singh. Montek S. Ahluwalia.

Advance Reading

- A.1. Changing Structure of the Indian Economy. VKRV. Rao, Indian Economy since Independence. Ed by Uma Kapila
- A.2. Savings behaviour in India and Implication for Policy- IZ Bhatti & MTR Sharma, Some Problems of India's Economic Policy. Ed. By Charan Wadhva.
- B.1. A Note on elasticity of marketable Surplus of a Subsistence crop. Raj Krishna, Some Problems of India's Economic Policy. Ed. By Charan Wadhva.
- B.2. A Note on elasticity of marketable Surplus of a Subsistence crop-A Comment Vahid.F. Nowshirvani. Some Problems of India's Economic Policy. Ed. By Charan Wadhva.
- C.1. Poverty and Development. Primit Chaudhuri
- C.2. Distribution and Growth in Indian Agriculture. J. Mohan Rao. The Indian Economy. The Indian Economy Major Debates since Independence- Ed by Terence J. Byres
- C.3. Green Revolution and the Peasants- a study of income distribution in Punjab Agriculture. E.P.W. May15&22, 1982
- C.4. India's Political Economy, 1947-2004 – Francine. R. Frankel
- C.5. Fifty Years of Indian Agriculture Vol-I, Production and Self-sufficiency, Abdul Ali Mohammad & Hifazur Rahaman.
- D.1. Challenges of Globalisation: Bibek Debroy (Ed).
- D.2. India's Agricultural Development Policy- A. Vaidyanathan, E.P.W. May13,2000
- E.1. Industrial policy and Industrial Performance in India. The Indian Economy. Isher Judge Ahluwalia. Recent Development and Future Prospect: Ed. By Lucas & Papanek.
- E.2. Structural Retrogression in the Indian Economy since mid sixties, S.L.Shetty. E.P.W. Annual Number-1978.
- F.1. Challenges of Globalisation: Bibek Debroy (Ed).
- G.1. Peasant Dualism With or Without Surplus Labour, A.K.Sen Journal of Political Economy 7, October, 1966.
- H.1. India Economic Development and Social Opportunity, Dreze and Sen

- I.1. Poverty in India, Gustav Papanek. Recent Development and Future Prospect: Ed. By Lucas & Papanek.
- J.1. Poverty Alleviation Programme in India some Issues of Macro Policy. S.C. Jain, Indian Journal of Agriculture Economics July-Sept 2000.
- K.1. Monetary and Financial Sector Reform in India. Y. Venugopal Reddy
- K.2. Institutional changes in Indian Capital Market. Ajay Shah. E.P.W. June 16-23 1997.
- L.1. essays on Development Strategy- Regional Disparities and Centre-State Financial Relation in India. CH Hanumantha Rao.
- M.1. The External Sector: the Problem Areas, Jayati Ghosh. Recent Development and Future Prospect: Ed. By Lucas & Papanek.
- M.2. India's Balance of Payments Problem. C. Rangarajan. Recent Development and Future Prospect: Ed. By Lucas & Papanek.
- M.3. Foreign Trade and Trade Policies. V.R. Panchamukhi. Recent Development and Future Prospect: Ed. By Lucas & Papanek.
- N.1. Development Planning: The Indian Experiences, S. Chakrabarty.
- N.2. Plan Documents (different years) Planning Commission of India.

Text Books:

1. Indian Economy: Mishra & Puri
2. Indian Economy: R. Dutt & K.P.M. Sundharam.
3. Indian Economy: A.N. Agarwal

PAPER VII: QUANTITATIVE TECHNIQUES FOR ECONOMICS - II

Full Marks- 100

Total Number of Lectures 125 to 130

Group A: STATISTICS - II

Full Marks- 50

Minimum Number of Lectures 70

1. PROBABILITY THEORY AND DISTRIBUTION: (i) Elements of Probability Theory: Sample space & events, Meaning of probability, Classical definition, Addition rule, Multiplication rule, Theorems of total probability – Mutually and non-mutually exclusive events, Conditional and statistical independence, Limitations of the classical definition, An axiomatic approach, Bayes' formula, Random variables, Probability mass and density functions, Marginal and conditional distributions, Expectations and variances of random variables (for random sampling with or without replacements)
TEXT – Goon, Gupta & Dasgupta – Basic Statistics (1999) – Chapter – 7
(ii) Some Univariate Probability Distributions: Binomial distribution, Poisson distribution, Normal distribution, Standard Normal distribution – mean, variance, moment generating function (MFG), Skewness and kurtosis, Limiting forms of Binomial and Poisson distribution, Importance of normal distribution in statistics.

TEXT- Goon, Gupta & Dasgupta – Chapter- 8

2. ELEMENTARY SAMPLING THEORY: Populations and sample, Parameter and statistic, Random sampling, Practical methods of drawing random samples, Random sampling measures, Sampling distribution of expectation and standard error.

TEXT- Goon, Gupta & Dasgupta – Basic Statistics - Chapter 11

3. CLASSICAL STATISTICAL INFERENCE: Basic concepts of Estimation, desirable properties of estimators, Unbiasedness, Minimum variance, Simple methods of point estimation, Confidence interval, Testing of hypothesis, P-value, Type 1 and Type 2 errors, Simple application of tests for mean and variance of a Univariate normal population

TEXT: Goon, Gupta & Dasgupta – Basic Statistics – Chapter – 12

REFERENCES:

- (i) Mathai & Rathi – Probability and Statistics
- (ii) Nagar & Das - Basic Statistics, Chapters – 8, 9, 10
- (iii) N.G. Das – Statistical Methods, (Vol II) [2005] – Chapters- 11, 12, 13, 14
- (iv) Gupta & Kapoor – Fundamentals of Mathematical Statistics [Vol I] [1980]
Chapters – 4, 5, 7, 8, 15, 16

: MATHEMATICAL ECONOMICS II

Full Marks- 50

Minimum Number of Lectures - 70

1. Static equilibrium analysis and comparative statics:
Meaning of partial and general equilibrium, Comparative static analysis using Cramer's rule
Applications: Simple Keynesian and IS-LM models, Rybczynski theorem and Stolper – Samuelson theorem (Liner Model)
TEXT – Chiang – Fundamental Methods of Mathematical Economics (3rd edition)
Ch. 3
REFERENCES: i) Silberberg – The Structure of Economics (2nd edition) – Ch. 15
(Sec 15.3, 15.4)
ii) Caves & Jones – International Economics (9th edition) – Ch. 7
(Appendix)
iii) Archibald & Lipsey – A Mathematical Treatment of Economics (3rd edition), Ch. 16
2. Integration and dynamic analysis:
 - a. Techniques of integration (definite and indefinite integral)
Applications: from marginal function to total function, consumer's surplus, producer's surplus, investment and capital formation, present value
TEXT - Chiang – Ch. 13
 - b. First order and second order differential equations:
Applications: Time path of price and quantity in competitive markets, time path of income in simple Keynesian model, Stability analysis, Time path of inflation and unemployment rates, Solow growth model.
TEXT - Chiang – Ch. 14, 15
REFERENCES: Henderson & Quandt – Microeconomic Theory (3rd edition) – Ch. 6
 - c. First order and second order difference equations: Applications: Cobweb model, Market model with inventory, Samuelson's multiplier – accelerator interaction model, inflation and unemployment in discrete case.
TEXT - Chiang – Ch. 16, 17
REFERENCES: Henderson & Quandt – Ch. 6
3. Input – output analysis
A two sector Leontief static open model, Assumptions, Output solutions, Hawkins – Simon conditions and its economic interpretations, Linear programming interpretation, Consumption possibility Locus, Price system in LSOM.
TEXT–Dorfman, Samuelson & Solow–
Linear Programming & Economic Analysis–Ch. 9
REFERENCE: Chiang – Ch. 5 (Sec 5.7)

4. Linear Programming (LP)

The LP problem, Duality and economic interpretation, simplex method, complementary slackness relationship of primal and dual.

Application: Diet problem, Transportation problem

TEXT – Chiang – Ch. 19, 20

REFERENCES – i) Silberberg – Ch. 15

ii) Chakraborty & Ghosh – Linear Programming – Ch. 1, 5, 7, 8

5. Game Theory – Structure of Game, Pay off matrix, Two person zero sum game, saddle point, Pure strategy, Mixed strategy.

REFERENCES – i) Pindyck and Rubinfeld – Micro economics

ii) Varian – Intermediate Micro economics.

APER VIII: INDIAN ECONOMIC HISTORY, COMPUTER APPLICATION & PROJECT WORK

Full Marks- 100

Minimum No. of Lectures - 130

GROUP A: INDIAN ECONOMIC HISTORY & COMPUTER APPLICATION

Full Marks- 50 (25+25)

Minimum Number of Lectures - 70

GROUP A –I : INDIAN ECONOMIC HISTORY

Impact of British rules with special reference to (i) De-industrialization (ii) Commercialization of agriculture (iii) Economic drain.

1. Aspect of British Imperial policy: i) Land policy, ii) Railways & irrigation iii) Policy of discriminating protection

REFERENCES: i) Dharma Kumar (ed.) Cambridge Economic History [Vol II]
ii) V. B. Singh (ed.) Economic History of India
iii) Dhires Bhattacharyya A Concise Economic History of India
iv) Amiya Bagchi Private Investment in India (1900-1939)

GROUP A – II : COMPUTER APPLICATION

1. Basics of computer application in economics
2. Operating systems, data entry
3. Use of application software for solving statistical and quantitative problems in economics.

Evaluation will be made on the basis of practical examination at the end of the course, i.e. in the third year and on the basis of continuous evaluation.

References: 1. Computers Today: D.H. Sanders

2. Analysis of Economic Data: Gary Koop

GROUP B: PROJECT WORK

Full Marks - 50 (40 + viva 10)

1. Problem searching and literature survey
2. Methodology (sampling design and survey as per need)
3. Data Analysis
4. Findings and Interpretation
5. Viva

Evaluation will be on the basis of report preparation on the relevant topic to be submitted at the end of third year and viva voce in lieu of continuous assessment as in the case of computer application.

**Topics of Project Work (To be undertaken in a specific Municipal
Ward/Gram Panchayet)**

1. The Economic role of public bodies (Govt. and Semi Govt.) in preventing contamination of arsenic in ground water.
2. Efficacy of Govt. measures for the economic benefit of the people living below the poverty line.
3. Literacy rate among economically deprived section of the society
4. Issues in primary education
5. Evaluation of NREGA programme during last financial year.
6. Socio economic appraisal of the landless agricultural worker
7. Alternative sources of employment in rural and urban economy
8. Inequalities in income distribution among different income groups.
9. Economic effect of degradation in environment daily life
10. Annual household income of minority community
11. Micro finance as development strategy

WEST BENGAL STATE UNIVERSITY

Syllabus for Three Year B.A. /B.Sc. GENERAL in ECONOMICS

PART – I

Paper-I Microeconomics (100)

1. Basic Concepts:

Concept of Market,
Demand & Supply – Market equilibrium. Elasticity of Demand : Price elasticity of Demand-Factors affecting the price elasticity of demand -Measurement of point price elasticity of demand and Arc elasticity- Income elasticity of demand.

2. Consumers' Behaviour

Marginal Utility- Law of Diminishing Marginal Utility- Law of demand and law of supply
Derivation of demand curve from marginal utility curve- Consumers' surplus.
Indifference curve: Definition and Characteristics – Budget line –Consumers'Equilibrium-
Income effect and Substitution effect- Graphical presentation to show Price effect is the summation of Income effect and Substitution effect- Inferior goods and Giffen goods.

3. Producers' Behaviour (15 hours)

Concept of Production- Factors of Production- Production Function: Concepts of TP, AP and MP. Derivation of AP and MP curve graphically from TP curve- Law of Variable Proportions- Isoquants and its Properties- Expansion Path- Laws of Returns to Scale

4.Revenue and Cost of Production.

Concepts of Revenue- TR, AR, MR. Derivation of AR and MR curve from TR curve – Relation concerning AR, MR and Elasticity of Demand.
Cost of Production –Money cost ,Real cost and Opportunity cost- Fixed cost and Variable cost –Shape of the Short-run cost curves- Relation between AC and MC –LAC is the envelope of SACs.

5. Perfect Competition: Characteristics of Perfectly Competitive Market. Short –run and Long-run equilibrium of Perfectly Competitive firm and industry.

6.Monopoly: Concept and Characteristics of Monopoly Market – Degree of Monopoly Power. Price and output determination under monopoly Absence of supply curve under monopoly- concept of price discrimination- concept of Duopoly and Oligopoly .

7 . Theory of Distribution

Marginal Productivity Theory of Distribution

Rent : (a) Ricardian Theory , (b) Modern Theory , (c) Quasi- Rent.

Wage: Marginal Productivity Theory of Wages – Distinction between money Wage and Real wage - Role of Trade Union in Wage determination under Competitive Set up.
Interest: Real and Monetary Interest Rate – Lovable Fund Theory of Interest Rate – Liquidity Theory of Interest Rate.

Profit: Gross Profit and Net Profit – Difference Between Profit and Other Factor Incomes –Theories of profit

Recommended Books:

1. Lipsey ,R.G – An Introduction to Positive Economics . Widenfeld and Nicholson , London.
2. Ahuja , H.L – Advanced Economic Theory.
3. Stonier Hague – Economics
4. Mukherjee, Debes – Essentials of Micro and Macroeconomics
New Central Book Agency (P) Ltd.
5. Dewett , K.K –Modern Economic Theory

PART –II

PAPER –II Macroeconomics (100)

1. National Income: Distinction between GNP and NNP, GNI and NNI, GNP and GDP
Derivation of National income from GNP, National Income and its measurement-
different methods and their drawbacks.
2. Consumption : Simple Keynesian Model (SKM) of Income Determination-
Consumption Function– Relation between Average and Marginal Propensity to
Consume - Multiplier Theory .
3. Investment : Concepts of Investment – Marginal Efficiency of Capital, Accelerator
theory of investment
4. Say's Law of Markets:
Classical Macro economic theory and Keynesian Theory of Output and Employment
determination.
5. Money
Functions of Money – Value of Money Different Concepts of Money : M_1 , M_2 , M_3
and M_4 . Quantity Theory of money.
6. Inflation : Concepts of Inflation, Deflation and Stagflation – Inflationary Gap –
Distinction between Demand Pull and Cost Push Inflation- Effects of Inflation – Anti-
inflationary Fiscal and Monetary Policies.
7. Banking
Concepts of Bank and Non-bank Financial Intermediaries – Functions and Credit
Creation of Commercial Banks – Central Bank-Functions and Credit Control Measures.
8. Taxation:
Concepts of tax- Distinction between direct and indirect tax-concepts of progressive,
proportional and regressive tax- impact and incidence of tax.
Public debt – internal and external Burden of Public debt.
9. International Trade:
Absolute advantage Theory, Comparative Advantage Theory-Gains from trade – Free
trade versus protection.

Suggested Readings:

1. Gupta , S.B – Monetary Economics , S.Chand& Co. , New Delhi
2. Ahuja , H.L - Macroeconomics
3. Mukherjee ,Debes – Essentials of Micro and Macroeconomics, New Central Book Agency (P) Ltd.

PAPER – III

Problems of the Indian Economy (100)

1. Nature of underdeveloped Indian Economy, Causes of underdevelopment.
2. Concept and estimation of national income; Causes of income inequality : Poverty line and poverty eradication program.
3. The problem of over population, Causes of rapid population growth , population policy
4. Agriculture: Causes for low productivity, Land Reforms- Effects of GATT on Indian Agriculture.
5. Industry: Role of small scale-scale and cottage industry, problems of scale-scale and cottage industry ,problems of large scale industries ;Industrial policy and industrial finance.
6. Objective of nationalization of commercial banks; credit control policy of Reserve Bank of India ;composition and direction of foreign. trade of India in post –liberalization.
7. Sources of Revenue and Expenditure of Union and State Government. Union-State Financial Relation. Centre-State Conflict on Finances.
8. Foreign trade Need for foreign capital, case for and against for and against foreign aid to india.
9. Success and failure of India's Five year plans.

Suggested Readings:

1. Dutta R. and K.P.M. Sundaram: Indian Economy, S. Chand and Co. New Delhi
2. Misra S.K.V. K. Puri: Indian Economy, Himalayas Publishing Co. Mumbai.
3. Agarwal A.N: Indian Economy, Vikash Publishing Co. Delhi
4. Gupta, S.B.: Monetary Planning in India, Oxford University Press, Delhi.

PART-III
PAPER –IV
DEVELOPMENT ECONOMICS AND ELEMENTARY STATISTICS

GROUP –A
Development economics
FULL MARKS-50

1. Basic Concepts of Development:

Distinction between Economic Growth and Economic Development-Growth indicators- NNI and PCI, Concept and formulation of HDI. Gender Development Index , Gender related Development index , gender empowerment measure and Human.

2. Population and Economic Development:-- The Two Way Relation

3. Gender Related Issues in work and opportunities and in socio economic outlook.
–concept of GDI & instances of Gender Discrimination in the society

4. Concept and Role of Domestic Capital Formation in an Underdeveloped Country;
The Problems -Incentives for Savings and Investment.

5. Foreign Investment: Different forms -Their roles in Economic Development.

6. Role of International Institutions:IMF & World Bank in economic development of the LDCS.

Suggested Readings:

1. Todaro, M.P.: Economic Development in the Third World, Longman, New York.
2. Salvatore, D. and E. Dowling: Development Economics, Schaum's, Outline Series in Economics, McGraw Hill, New York.
3. Agarwala, A.N. and S.P. Singh: Economics of Underdevelopment, (eds.) Oxford University Press, London.
4. Meier, G.M. (ed.): Leading Issues in Economic Development, Oxford University Press, New York.
5. United Nations Development Programme, Human Development Report (Recent Years)

GROUP-B
ELEMENTARY STATISTICS
FULL MARKS -50

1. Meaning and scope of statistics, Variable, Attribute, Primary and Secondary Data, Population and Sample, Census and Sample Survey, Classification of data and Tabulation.
2. Charts and Diagrams : Meaning and functions of Graphs – Types of Charts and Diagrams – Line Diagram, Bar Diagram, Pie Diagram and Pictogram.
3. Frequency Distributions : Frequency distribution of an Attribute, Frequency distribution of a discrete variable, Frequency distribution of a continuous variable, Construction of Frequency distribution from raw data; Histogram, Frequency Polygon and Ogive.
4. Measures of Central Tendency: Arithmetic Mean (AM), Geometric Mean (GM), Harmonic Mean (HM), Median, Mode
5. Measures of Dispersion: (15 hours)
Meaning and necessity, Range, Quartile Deviation (QD), Mean Deviation (MD), Standard Deviation (SD), Coefficient of Variation (CV). Relative measures of dispersion: coefficient of Variation.

Suggested Readings:

1. Dutta R. and K.P.M. Sundaram: Indian Economy, S. Chand and Co. New Delhi
2. Misra S.K.V. K. Puri: Indian Economy, Himalayas Publishing Co. Mumbai.
3. Agarwal A.N: Indian Economy, Vikash Publishing Co. Delhi
4. Gupta, S.B.: Monetary Planning in India, Oxford University Press, Delhi.

West Bengal State University
Berunanpukuria, Barasat, Kolkata 700126

**Curricula for Three-Year Under-Graduate
Advanced (Honours) [EDCA] and General Degree [EDCG] Programmes in
EDUCATION**

1. Preamble

The present Curricula for three-year Advanced (Honours) and General Degree Programmes in Education have been designed following the recommendations of national documents, viz., NPE (1986), POA (1992), NCF (2005) and CRR of UGC. Simultaneously, Curricula of other State Universities and the unique socio-cultural nature of the University jurisdiction have also been considered in course of developing the present curricular framework. Since the establishment of the University in 2008 this is the first attempt in developing curricula for three-year Advanced (Honours) and General Degree Programmes in Education to be effective from the session 2013-14. The main rationale behind the present curricular frame is to develop the Educational base as a liberal academic discipline among the under-graduate learners both in Advanced (Honours) and General levels.

2. UG Degree Programmes in Education

The University offers two types of UG programmes in the broad domain of liberal Education discipline through its affiliated Degree Colleges – (i) Three-year Advanced (Honours) Degree Programme and (ii) Three-year General Degree Programme.

2.3 General Degree Programme

2.3.1 The Course Structure

Year	Course No. EDCG	Course Title	Group	Suggested Class-hour per Week	Maximum Marks
	01	Philosophical and Sociological Foundations in Education	A. Educational Philosophy	03	50
			B. Educational Sociology	03	50
	02	Psychological foundations in education	A Psychology and development	03	50
			B Psychology of learning	03	50
	03	Development of educational policies and contemporary issues in Indian	Development of educational policies	03	50

		education	contemporary issues in Indian education	03	50
	04	Evaluation and Guidance-Counseling in Education	A: Evaluation in Education	03	50
			B Guidance-Counseling in Education	03	50

2.3.2 Course Detail

B.A. PART- I CURRICULA EDUCATION (GENERAL) EDCG

Revised Course (EDCG 01): Philosophical and Sociological Foundations in Education

[Full Marks: 100; Class per Week: 04 Hours; Minimum Class per Year: 120 Hours]

P-I

Group-A: Educational Philosophy

[Marks: 50; Class per week: 04 Hours; Minimum Class per Year: 60 Hours]

Unit-I: Concept and Scope of Education (20 Hours)

- Concept nature and scope of Education; (4 Hours)
- Factors of Education; (6 Hours)
- Forms of Education – Informal, Formal and Non-formal and Open Education; (6 Hours)
- Aims of Education – Individualistic and Socialistic view of Education. (4 Hours)

Unit-2: National Values and Education (20 Hours)

- Democracy, Equity, Justice, Secularism and Fraternity; (10 Hours)
- Life-centrism and Child-centrism in Education; (6 Hours)
- Human Resource Development and Value Education. (4 Hours)

স্বাধীনতা, সত্য, ন্যায়িক
মনোভা, সৌভা

Unit – 3: Great Educators (20 Hours)

- R. N. Tagore, (5 Hours)
- Swami Vivekananda, (5 Hours)
- M. K. Gandhi, (5 Hours)
- F. W. A. Froebel. (5 Hours)

Selected References:

- Aggarwal, J.C & Gupta, S. (2008); Great Philosophers and Thinkers on Education, Shipra Publications, New Delhi.

- Sharma, S.N – Philosophical and Sociological Foundations of Education; Kanishka Publishers Distributers, New Delhi.
- Sharma, Y.K – Sociological Philosophy of Education; Kanishka Publishers Distributors, New Delhi.
- Tarafdar, M – SikshaShrayeeSamajBiginan; K Chakraborty Publication, Kolkata.

B.A. PART- II CURRICULA EDUCATION (GENERAL) EDCG

Course (EDCG 02): Psychological foundations in education
 [Full Marks: 100; Class per Week: 04 Hours; Minimum Class per Year: 100 Hours]

Group-A Psychology and development

Full Marks: 50; Class per Week: 02 Hours; Minimum Class per Year: 50 Hours.

P-II

AM Unit I: Introduction to Educational Psychology [15 class hours]

- a. Relationship between Psychology and Educational Psychology- concept, nature,scope of Educational Psychology. [10 class hours]
- b. Contribution of Psychology to Education[5 class hours]

Unit 2 : Psychology of Human Development and Education [35 class hours] PR

- a. Human Development – concept, principles, types and stages. [7 class hours]
- b. Physical and motor development and its significance in Education. [7 class hours]
- c. Cognitive development (Piaget) and its significance in Education.[7 class hours]
- d. Moral development (Kohlberg) and its significance in Education. [7 class hours]
- e. Personality – concept, nature, Psychoanalytic theory by Freud. [7 class hours]

Group-B Psychology of learning

Full Marks: 50; Class per Week: 02 Hours; Minimum Class per Year: 50 Hours. PR

Unit 1: Intelligence and Creativity [28 class hours] PR

- a. Intelligence – concept and scope. [7 class hours]
- b. Theories of Intelligence – Guilford, Gardner.[7 class hours]
- c. Measurement of Intelligence.[7 class hours]
- d. Creativity – concept, scope and characteristics of Creative Persons.[7 class hours]

Unit 2: Psychology of Learning [22 class hours]

- Learning – concept and scope [4 class hours]
- Factors influencing learning – memorization, attention, emotion and motivation. [8 class hours]
- Theories of learning – SR theories (brief introduction to Thorndike, Pavlov, Skinner), Cognitive Learning by Gestalt. [10 class hours]

Selected References:

- Adhikari, S.R. – *Sikshay Monobidya, Classique Books, Kolkata.*
- Aggarawal. J.C.- *Essentials of Educational Psychology, Vikash Publishing house Pvt. Ltd.*
- Arun Ghosh-Shiksha-Shrai Monobigyan; *Educational Enterprises, Kolkata*
- Chauhan. S.S. - *Advanced Educational psychology: Vikash Publishing House Pvt. Ltd.*
- Clifford.C.Morgan. Richard. A. King, John R. Weisz, John R. Schopler – *Introduction to*
- Dandapani, S. – *A text Book of Advanced Psychology, Anmol Publications. New Delhi.*
- Diane. E., Papalia and Sally Wendkos Olds - *Human Development: McGraw-Hill.*
- Elizabeth, B., Hurlock,- *Child Development, McGraw-Hill Book Company.*
- Fernandes, M.M. – *The Advanced Educational Psychology: Psychology of the Learner: Himalaya Publishing House, Mumbai.*
- Hilgard, E.R. & Bower, G.H. - *Theories of Learning, Prentice-Hall of India, New Delhi.*
- Kundu, C.H. and Tutoo, D.N. - *Educational Psychology, Sterling Publication.*
- Mangal S.K. – *Advanced Educational Psychology; Prentice Hall of India Pvt. Ltd. New Delhi.*

New Delhi

- শিক্ষণবিদ্যার কাশরুদ্রা - অধ্যাপক নূরুন ইসলাম

Course (EDCG 03): Development of educational policies and contemporary issues in Indian education

[Full Marks: 100; Class per Week: 04 Hours; Minimum Class per Year: 100 Hours]

P-II

Group A- Development of educational policies

Full Marks: 50; Class per Week: 02 Hours; Minimum Class per Year: 50 Hours.

XXX

Unit 1: Development of Education in Ancient and Medieval India- [10 class hours]

Salient features of Brahmanic, Buddhistic and Islamic Education with respect to:-

- Aims of education. [3 class hours]
- Curriculum and Method of teaching. [3 class hours]
- Centers of learning. (concept only) [1 class hours]
- Women Education.[3 class hours]

Unit 2: **Development of Education from 1813 to 1947-** [22 class hours]

- Charter Act of 1813 [4 class hours]
- Wood's Despatch. [4 class hours]
- Bengal Renaissance and the contribution of Rammohan, Vidyasagar & Derozio. [6 class hours]
- Hunter Commission (1882-83). [4 class hours]
- Calcutta University Commission (1917-19). [4 class hours]

Unit 3: **Development of Education from 1947 to 1970-** [18 class hours]
(Brief Outlines of the recommendations only)

- University Education Commission, 1948-49. [6 class hours]
- Secondary Education Commission, (Mudaliar), 1952-53. [6 class hours]
- Indian Education Commission, (Kothari), 1964-66. [6 class hours]

Group – B Contemporary Issues

Full Marks: 50; Class per Week: 02 Hours; Minimum Class per Year: 50 Hours.

Unit 1: **Development of Education from 1970 to 2010-** [14 class hours]

- National Education Policy- 1986. [7 class hours]
- DPEP and SSM, 1990-2010. [7 class hours]

Unit 2: **Social Issues : 1986 onwards** [14 class hours]

- Problems of Education of Backward Classes; SC/ST/OBC/MC [7 class hours]
- Problems of Women Education. [7 class hours]

Unit 3: **Current issues-**[22 class hours]

- Problems of Equalization of Educational Opportunities. [7 class hours]
- Structure & Functions of UGC, NCTE, NAAC and NCERT [8 class hours]
- Right to Education Act, 2009 (concept only) [7 class hours]

Selected References:

- Aggarwal, J.C. (2013); Recent Development And Trends in Education, Shipra Publications, New Delhi.
- Banerjee, J.P. (2010); Bharatiya Sikshar Itihas, Central Library, Kolkata.
- Chaube, S. (2010); History And Problems of Indian Education, Agrawal Publication, Agra.
- Chauhan, C.P.S. (2010); Modern Indian Education : Policies, Progress, and Problems, Kanishka Publishers, New Delhi.
- Ghosh, R. (2012); Adhunik Bharater Sikshar Vikash, Soma Book Agency, Kolkata.
- Gupta, A. (2013); Education in the 21st Century, Shipra Publications, New Delhi.
- জৈবতীয়া শিক্ষার বাস্তবতা - অধ্যাপক ডক্টর সুনীল কুমার

B.A. PART- III CURRICULA EDUCATION (GENERAL) EDCG

Course (EDCG 04): Evaluation and Guidance-Counseling in Education

B.A.GENERAL, Education, Paper-IV.

[Full Marks: 100; Class per Week: 04 Hours; Minimum Class per Year: 100 Hours]

Group A: Evaluation in Education

Full Marks: 50; Class per Week: 02 Hours; Minimum Class per Year: 50 Hours.

Unit 1: *Evaluation and measurement* [15 Class-hours]

- a. Concept , scope and importance of evaluation [3 Class-hours]
- b. Comparison between evaluation and measurement [1 Class-hours]
- c. Basic principles of evaluation [2 Class-hours]
- d. Scales of measurement [2 Class-hours]
- e. Tools of evaluation – Questionnaire, Interview, Observation, & CRC. [7 Class-hours]

Unit 2: *Standardisation of a test* [15 Class-hours]

- a. Test theory – Educational and psychological tests – concept, classification, characteristics of a good test. [5 Class-hours]
- b. Reliability – concept, characteristics, causes of low reliability, Types. [5 Class-hours]
- c. Validity – concept, causes of low validity, types. [5 Class-hours]

Unit 3: *Statistics* [20 Class-hours]

- a. Statistics – concept, utility, score, tabulation. [4 Class-hours]
- b. Measures of central tendency – concept, properties, uses, calculation [5 Class-hours]
- c. Measures of variability – concept, types (concept), uses, calculation of SD. [5 Class-hours]
- d. Graphical representation of data – bar graph, frequency polygon, histogram, pie chart – uses [6 Class-hours]

Selected References:

- Bhat, S. & Chakrabarty, S.C. (2013); *Research Methodology And Statistics in Education*, Aaheli Publishers, Kolkata.
- Chakrabarty, A. (2014); *Sikshay Parimap O Mulyan*, Classique Books, Kolkata.
- Das, N.G. (2011), *Statistical Methods (Vol.II)*, Tata McGraw Hill Education Private Limited, New Delhi.
- Dhali, S. (2009), *Sikshay Parimap O Mullayan*, Pravati Library, Dhaka.
- Garrett, H.E. (1981), *Statistics in Psychology & Education*, Vakils Feffer and Simons Ltd, Mumbai.
- Jamaluddin, M and Chowdhury, M.S, (1998), *Siksha Mullayan O Nirdešana*, Banglaacademy, Dhaka.
- ✓ Mangal, S.K. (2008); *Statistics In Education & Psychology*, PHI Learning Pvt Ltd. New Delhi.
- ✓ Roy, Sushil. (2005), *Mullayan: Niti O Kousal*, Soma Book Agency, Kolkata.
- S. Kaberi, (2012), *Statistics In Education & Psychology*, Asian Books Pvt Ltd. New Delhi.
- ✓ Sidhu, K.S. (2007); *Statistics In Education & Psychology*, Sterling Publishers Pvt Ltd. New Delhi.

Group – B Guidance-Counseling in Education

Full Marks: 50; Class per Week: 02 Hours; Minimum Class per Year: 50 Hours.

Unit 1: Guidance [16 Class-hours]

- a. Guidance – meaning, definition, scope, need and importance of guidance. [6 Class-hours]
- b. Different types of guidance – educational, vocational and personal (nature, purpose, functions). [6 Class-hours]
- c. Basic data necessary for guidance. [4 Class-hours]

Unit 2: counseling [16 Class-hours]

- a. Meaning, nature, scope and importance of counseling. [6 Class-hours]
- b. Types of counseling – directive, non directive, eclectic, individual and group counseling. [8 Class-hours]
- c. Compare between guidance and counseling. [2 Class-hours]

Unit 3: Adjustment and Maladjustment. [18 Class-hours]

- a. Concept of adjustment – definition, scope, need for adjustment, criteria of good adjustment; defense mechanisms. [7 Class-hours]
- b. Concept of maladjustment – types and causes [7 Class-hours]

c. Role of Education for adjustment.[4 Class-hours]

Selected References:

- Dutta, G & Nag, S. (2014); *SangatibidhaneNirdeshana O Paramarshadan*, Rita Publications, Kolkata.
- Ghosh, S.K. (2013); *SikshaySangatiApasangati O Nirdeshana*, Classique Books, Kolkata.
- Kochhar, S.K. (2000), *Guidance and Counselling in College & Universities*, Sterling Publishers Pvt. Ltd. New Delhi.
- Pal, A.K. (2014); *Guidance & Counseling*, Abhijeet Publications, Nw Delhi.
- Pal, D. (2010); *Nirdeshana O Paramarsha*, Central Library, Kolkata.
- Roychowdhury, A. (2001), *Manuser Mon*, West Bengal State Book Council.

2.3.3 Evaluation Scheme

Course Type	Item Type	To answer Items	Out of Items	How to set Items	Marks
Theoretical [Courses EDCG [1 to 4]	1. SA 2. LA	1.Four (approx. 200 words each) 2.Two (no word limit)	1.Eight 2.Four	At Random	1. 5x4=20 2. 15x2=30

B.Sc._Electronics_ General_ Syllabus

WEST BENGAL STATE UNIVERSITY

BARASAT, 24 PARGANAS (N)



B. Sc. in Electronics (General) (1+1+1) Years Syllabus

WEST BENGAL STATE UNIVERSITY

SYLLABUS FOR B.Sc. THREE-YEAR (GENERAL) COURSE IN ELECTRONICS

The present syllabus for B.Sc. three year General Course in electronics has been formed with a view to train up the students with the basic concept of Electronics and its practical application in different areas that undergraduates having Electronics as a paper would be suitable for various types of technical jobs in the Electronics and Computer industries of our country. With this objective some advanced and application oriented topics in Electronics such as microprocessors, communication and microwaves have been incorporated in the syllabus.

Distribution of Papers, Marks and Lectures/Periods

Part-I		F.M: 100	
	Paper I	Marks	Lectures/periods
Theory	ELTG 122 101A. Electron Device & Passive Circuits	50	50
	ELTG 122 101B. Linear Active Circuits	50	50
Part-II		F.M: 200	
	Paper II	Marks	Lectures/periods
Theory	ELTG 122 201A. Digital Electronics	50	50
	ELTG 122 201B. Modern Electronic Instrumentation	50	50
	Paper III		
Practical	ELTG 122 202A. Semiconductor Device & Circuits (35(Exam.)+5(LNB)+10(Viva Voice))	50	50
	ELTG 122 202B. Instrumentation & Digital Electronics (35(Exam.)+5(LNB)+10(Viva Voice))	50	50
Part-III		F.M: 100	
	Paper IV	Marks	Lectures/periods
Theory	ELTG 122 301A. Electronic Communication & Microwaves	50	50
	ELTG 122 301B. Microprocessors & Their Application	30	30
Practical:	ELTG 122 302. Microprocessor based Laboratory Experiments (10(Exam.)+5(LNB)+5(Viva Voice))	20	20

ELTG 122 101A- Electron Device & Passive Circuits

- (a) **Physics of Semiconductors:** Energy band theory of crystal, Metals, Insulators and Semiconductors, Intrinsic Semiconductors, Impurity Semiconductors, p-type and n-type Semiconductors, Indirect band gap Semiconductors, Charge Carrier density, Mobility, Effective mass, Diffusion and Recombination of carriers, Photo-conductivity (Qualitative)
- (b) **P-N Junction in Semiconductor:** Space charge region in a semiconductor junction, potentials and fields, Band diagram, p-n junction, Current components, V-I characteristics, Temperature effects, Varactors, Metal-semiconductor junctions, Reverse breakdown, Zener Diodes (No derivation of expression needed) and application, Light emitting diodes.
- (c) **Bipolar Transistors:** The junction transistor, Current components, Current gain, Transistor as an amplifier, Common base configuration, Static characteristics; Saturation, Active and Cut off regions.
Two port parameters: Relationship between Input and Output voltages and currents; Impedance and admittance parameters; hybrid parameters; Voltage gain, Current gain, Output impedance, Attenuations, Gain, Phase shift, Emitter Follower, Darlington Connection.
- (d) **Field effect and Metal-Oxide Semiconductor Devices:** The junction Field effect transistors (JFET): Structure and static characteristics; structure of MOSFET; Enhancement and Depletion MOSFET; p and n-channel MOSFETs; CMOS; Common Source and Common drain configuration; Small signal AC equivalent circuits; FET as an amplifier; CS and CD amplifiers; High frequency responses; JFET equivalent circuit; Other applications.
- (e) **Transformer:** Construction; Equivalent Circuits; Frequency Response; Autotransformer, Application in Electronic Circuits.
- (f) **Circuit and Network Theory:** Kirchoff's voltage and current laws; Example of loop and nodal analysis, T- Π transformation, Simple problem, Superposition, Reciprocity, Thevenin, Norton, Maximum Power Transfer, Miller, Milman, Bisection theorems, Series and Parallel resonance of LCR circuits; Effect of resistance; Q-factor, Simple problems.

ELTG 122 101B- Linear Active Circuits

- (g) **Diode as a circuit element:** half wave and full wave (using center tap transformer and bridge).
- (h) **Transistor Biasing:** Fixed and Self-Bias, Stability Factor, Operating Points.
- (i) **Power Amplifiers:** Class A, B, and C amplifiers: Direct coupled, Transformer Coupled amplifier; Push-pull amplifiers; Class A and B Push Pull circuits; Harmonic Distortion; Complimentary Symmetry Amplifier (Qualitative).
- (j) **Feedback in Amplifiers:** General theory of feedback, Negative and Positive feedback; Advantage of Negative feedback; type of Negative feedback in transistor amplifier; Voltage series, Voltage shunt, Current series, Current shunt amplifier; Darlington amplifier (Qualitative).
- (k) **Oscillator Circuits:** Positive feedback and oscillation; Hartley, Wien Bridge and RC-phase shift oscillator.
- (l) **Operational amplifiers:** OPAMPs; Ideal OPAMP; characteristics, Inverting and Non-inverting characteristics, Basic OPAMP application: Adder, phase shifter, AC voltage follower, Comparator, Integrator and Differentiator, Schmitt trigger.

BOOKS RECOMMENDED

1. Electronic Device and Circuit theory: Boylestad and Nashelaky (Prentice Hall).
2. Electronic Devices and Circuits: Bell (Prentice Hall)
3. Integrated Electronics: Millman and Halkias (Mc- Graw Hill)
4. Electronics: Fundamentals & Application: D. Chattapadhyay and P. C. Rakshit.
5. Circuit Theory: D. Chattapadhyay and P. C. Rakshit.
6. Network Problems: Edminister
7. Circuits and Networks: A. Sudhakar (Tata Mc- Graw Hill)
8. Theory and Problems of Circuit Analysis: Iyer (Tata Mc- Graw Hill)
9. Applications and Design with Analog Integrated Circuits: Jacob (Prentice Hall)

ELTG 122 201A - Digital Electronics

- (a) **Number Systems:** Decimal number; Binary number; Hexadecimal numbers; BCD Numbers; Conversions between two number systems. Arithmetic operations.
- (b) **Boolean Algebra:** Boolean Relations: Commutative, Associative and Distributive laws; OR and AND operation; De Morgan's theorems; Sum of Product Method.
- (c) **Logic Gates:** Inverters; OR Gates; AND Gates, NOR Gates; NAND Gates; Exclusive OR and Exclusive NOR gates; Use of Boolean Algebra and De Morgan's theorems in describing operation of Gates.
- (d) **Elements of Logic Families:** Digital Integrated Circuits; levels of Integration; Diode-Transistor Logic; Transistor- Transistor Logic.
- (e) **Combinational Logic:** TTL Circuits: TTL Overview; Implementing Logic Circuits with NAND and NOR Gates; Standard Gate Assemblies; Binary Adder; Half Adder; Full Adder, Arithmetic Function; Decoder; Multiplexer; Encoder.
- (f) **Sequential Circuits:** R-S Latch; Clock Pulse; D Latches; Edge Triggered D Flip Flop; Edge Triggered J-K Flip Flop; J-K Master- Slave Flip Flop; Registers; Shift Registers; Ripple Counters; Synchronous Counters; Ring Counters; Mod-N Counters; Application of Counters; Read only Memory; Random Access Memory.

ELTG 122 201B- Electronic Instruments:

- (g) **Electronic Voltmeter:** DC Voltmeters; AC Voltmeters; RMS Voltmeters; General Characteristics of DVM, Ramp type DVM.
- (h) **Regulated Power Supply:** Use of Filters in Rectifiers; Principle of Regulation; Regulated Power Supply using Zener and Transistors; Regulated Power Supply using ICs; short Circuit Protection; Constant Current Supply; Positive and Negative Supplies.
- (i) **LCR Bridges:** General form of AC Bridges; Scherring Bridges; Maxwell Bridges; Anderson's Bridge.

B.Sc._Electronics_ General_ Syllabus

- (j) **Waveform Generator:** Generation of Triangular and Square Wave and Single Pulse (Monostable) by IC 741 Chip; Introduction to Signal Generator.
- (k) **Cathode Ray Oscilloscope:** Basic CRO Operation; Block Diagram of a CRO; cathode Ray Tube; Construction; Brief Idea about Principle of Focusing and Deflection of Electron Beam; CRT Screens; Vertical Deflection Systems; Basic Elements, Attenuator, Vertical Amplifier, Delay Line; Horizontal Deflection Systems; Sweep Generator; Synchronization of Sweep, Horizontal, Horizontal Amplifier. CRO probes; Application of CRO; Dual Trace and Dual Beam CRO.
- (l) **Q-Meter and Frequency Counter :** Basic Q- Meter Circuits; Q-Measurement Method, Review of Electronic Counter; Principle of Frequency Measurement.

BOOKS RECOMMENDED

- 10. Digital Design: Mano (Prentice Hall).
- 11. Digital Circuits (Vol.I and II): D.R. Chaudhury (Platinum)
- 12. Digital Systems: Principle and Application, Tocci (Prentice Hall)
- 13. Digital Fundamentals: Floyd (Prentice Hall).
- 14. Modern Digital Electronics: R.P.Jain (Tata Mc- Graw Hill).
- 15. Digital Systems: Salibahanan
- 16. Electronic Instrumentation and Measurement Techniques: Cooper (Prentice Hall).
- 17. Electronic Instrumentation and Measurement Techniques: H.S.Kalsi (Tata Mc- Graw Hill)

ELTG 122 202A- Semiconductor Device and Circuits (Practical)

(1) Study of P-N Junction Diode:

- i) To draw V-I Characteristics for *Forward Bias* and Calculation of *Impedance*.
- ii) To Study Load and Line *Regulation* of half and full Wave rectifier.
- iii) To Study *Ripple Factor* of Half-Wave and Full-Wave Rectifier with *π* type Filters; to Study waveform on *CRO*.
- iv) To Study Reverse Bias Characteristics of a *Zener Diode*.
- v) To Study Load and Line Regulation of a Zener Diode as *Voltage Regulator*.
- vi) To Study Load Regulation of Power Supply with *Zener* or *IC* as Voltage Regulator.
- vii) To Study Percentage *Regulation* and *Ripple Factor* Of stabilized Variable Power Supply.

(2) Study of Transistor:

- i) To Draw the Static Characteristic of a *PNP* or *NPN* transistor in *CB/ CC/CE* Mode.
- ii) To find the *hybrid parameters* of a transistor in *DC* mode.
- iii) To Study *R-C* Coupled Amplifier. (To plot Frequency Response and to find the Bandwidth)

ELTG 122 202B-Instrumentation and Digital Electronics (Practical)

(3) Study with CRO:

- i) Study of Multivibrators.
 - (a) To generate Square wave using *Astable Multivibrator* and to see waveform on *CRO*.
 - (b) To measure the *frequency* of Square wave on *CRO*.
 - (c) To Study the effect of changing *base resistor* or *coupling capacitor* on the frequency of the square wave.
- ii) Measurement of *Phase and Frequency* with *CRO*.

(4) Experiments with Linear I.C. (741):

- i) Offset voltage, Offset current.
- ii) Adder, Differentiator, Integrator, Comparator.

(5) Experiments with Digital I.C. s:

- i) Verification of Basic Truth table of Basic Gates.
- ii) Verification of Boolean Expressions
- iii) Study the Half and full Adder using logic gates.
- iv) Study the J-K and D type flip flop

- v) Decade Counter & Divide by N Counter.

ELTG 122 301A- Communication Electronics and Microwave:

Telephony:

Telephone, Side-Tone, Automatic and Electronic Exchanges, Traffic and Trucking, Modes of colling, Power Line Communication.

Modulation:

Types of Modulation, Spectrum and Power in amplitude modulated (AM) signal, Amplitude Modulation, Double side band, Amplitude modulated double side band, Suppressed carrier, power calculation Amplitude modulated single side band, Frequency and Phase modulation, Band width requirements.

Noise:

Elementary physical ideas about various types of noise, Noise figure, noise in diodes, Equivalent noise band-width, noise figure of an amplifier, noise figure of a transistor amplifier, calculation of noise figure, noise temperature, Equivalent noise resistance.

Transmission Lines:

Transmission Line theory, Variation of input impedance, Propagation, Attenuation and phase constants, Wavelength and velocity of propagation, Line distortion, Distortionless line, Standing wave ratio(SWR), Determination of SWR.

Wave Guide:

Types of waveguides, various modes of propagation in waveguides, guide wavelength. Characteristics of waveguide coupling, hybrid junctions, direction coupler.

Antenna:

Antenna, basic radiation mechanism, directivity, gain, effective height, bandwidth, Radiation resistance, radiation pattern etc, effect of ground, relation between directive gain and effective aperture.

Radio wave propagation:

Characteristics of electromagnetic waves, propagation of radio waves at different frequencies, structure of atmosphere, ground wave propagation, sky wave propagation, critical frequency and virtual height, maximum usable frequency and skip distance.

BOOKS RECOMMENDED

1. Electronic Communications: D. Roody and J. Coolen
2. Communication Systems: S. Haykin
3. Communication Systems: A. B. Carlson
4. Principle of Communication Systems: H. Taub and D.L. Schilling
5. Modern Digital and Analog Communication Systems: B. P. Lathi
6. Electromagnetic Waves & Radiating Systems: E. C. Jordan and K.G. Balmain
7. Foundation for Microwave Engineering: Robert E. Collin
8. Microwave Engineering: David M. Pozar
9. Microwave Engineering: Peter A. Rizzi
10. Microwave Engineering: Annapurna Das
11. Microwave devices and circuits: S. Y. Liao
12. Antennas: J. D. Kraus
13. Antennas and Wave Propagation: G. S. N. Raju

ELTG 122 301B- Microprocessors and their Applications:

The Microprocessor System :

Basic Architecture of 8085, CPU, Arithmetic logic section, Accumulator, Status registers, ALU, General purpose registers, Control registers, Program counter, Stack pointer, Timing and control unit, The clock, Reset, Interrupt, Hold, Read and write, IOR,IOW and IO/M^l, Address Latch Enable.

INTEL 8085 Assembly Language Programming:

Instruction set for 8085/8085A, Data movement instructions, PUSH and POP, Increment/Decrement, Rotate/Shift, Set, Compliment and Decimal adjustment, Add , Subtract and compare, AND, OR, EXCLUSIVE-OR, JUMP, CALL AND RESTART, CONDITIONAL JUMP, CALL AND RETURN, Loops in programs, Uses of Subroutine, Delay subroutine.

Interfacing of simple memory and I/O devices:

Microprocessor Application and development of on line Real Time system:

Voltage measurement, current measurement, frequency measurement, Temperature measurement (Basic idea only).

BOOKS RECOMMENDED

1. Microprocessor Architecture, Programming & Application-R. Gaonkar, Wiley
2. 8085 Microprocessor Programming & Interfacing- N.K Srinath-PHI
3. Microprocessor-Theory & Application-M. Rafiquezzaman;PHI
4. Microprocessor- B.RAM

ELTG 122 302. Microprocessor based (PRACTICAL)

Microprocessors-based Laboratory Experiments:

The Experiments are to be performed:

- Expt. No. 1 : Addition of two 8-bit and 16-bit numbers.
- Expt. No. 2 : Detection of even and odd numbers.
- Expt. No. 3 : Subtraction of two 8-bit numbers.
- Expt. No. 4 : Multiplication of two 8-bit numbers by repeated addition method.
- Expt. No. 5 : To arrange an Array of N numbers in Ascending/Descending orders.
- Expt. No. 6 : To transfer a block of data from one memory zone to the others.
- Expt. No. 7 : Exchange of two arrays.

WEST BENGAL STATE UNIVERSITY
DEPARTMENT OF ENGLISH

B. A. English (Honours)

Effective from academic session 2013-2014

Part I

Paper I :Old English, Middle English, Elizabethan and Jacobean Literature, and Philology

Old English Literature:

- Old English Poetry- Background of the age, culture, structure of the epic, style, theme. A passage from *Beowulf* (see appendix I). The idea is to use an extract and from there work into the context and analyze how that shapes the writing.
- Non-epic, secular, elegiac poetry, theme, style, social picture, language, style : *Deor's Lament* (see appendix I)
- Christian poetry- Caedmon's hymn; Cynewulf, *Dream of the Rood* (see appendix I)
- Old English Prose - An overview

Middle English Literature:

- The Norman conquest and transition, the romance tradition, the alliterative revival (See appendix I), the Black Death, Langland, Gower, Lydgate; Chaucer, General background, literary career, extracts from the Prologue (see appendix I), Metrical Romances, Malory, Caxton. Prose, Wyclif and Mandeville.

Elizabethan and Jacobean Literature:

- The historical, political, socio-cultural background, literary/intellectual details. The generic/social history of poetry and poetic forms (to be tied up with the poems of the period that are being taught).
- The following poems are for detailed study:

Sidney, 'Loving in truth'

Spenser, 'One day I wrote her name upon the strand'

Shakespeare, Sonnets 18, 73, 130

Donne, 'Cannonization'

Marvell, 'To His Coy Mistress'

Vaughan, 'Peace'

- Elizabethan/Jacobean Prose- The phenomenal growth of English prose from late medieval religious prose, through the translations from Latin that culminated in the issue of *King James's Bible*. Other categories of prose, secular romances, narratives, travelogues to be tied up with a close reading of Bacon's essays *Of Friendship & Of Death*, and short extract from Robert Burton's *Anatomy of Melancholy* (See appendix I; online versions are available; the extract to be used has been selected)

Philology:

Sec I. Growth and Structure of English Language

- Latin, Greek, Scandinavian, French influences, Native Resources, Philological notes.

[Suggested Books:

- ❖ Otto Jespersen—*Growth and Structure of the English Language*
- ❖ C.L.Wren- *The English Language*
- ❖ A.C. Baugh- *A History of the English Language*
- ❖ James Bradstreet Greenough, George Lyman Kittredge- *Words and their Ways in English Speech*]

Sec. II. Growth and Structure of Indian English

- Borrowings into Indian English :
 - Loanwords and loan translations
 - Hybrids
 - Adaptations
 - Diffusions

[Suggested Books:

- ❖ Yule, H. & A.C. Burnell, *Hobson-Jobson: A Glossary of Colloquial Anglo Indian Words and Phrases, and of Kindred Terms, Etymological, Historical, Geographical and Discursive*, Delhi, Rupa& Co., 1990, First Published 1886.
- ❖ Sethi, J., *Standard English and Indian Usage: Vocabulary and Grammar*, Second Edition. Prentice Hall ,2011]
- Students will be asked to write philological notes on the following Indian English words: peon, guru, lathicharge, tiffin-box, military hotel, 420, communal, out of station, batchmate, match box.

Usual Pattern of Questions

- Group A (Old & Middle English Literature)

One essay type question of 15 marks (1x15=15)

Three short questions of 5 marks each. (3x5=15)

Total: 30

- Group B (Elizabethan & Jacobean Literature)

Two essay type questions of 15 marks each (Marks: 2x15=30)

Two short questions of 5 marks each. (2x5=10)

Total : 40

- Group C (Philology)

Two essay type questions of 10 marks each (Marks 2x10=20)

Five philological notes, each of 2 marks (5x2=10)

Total: 30

Paper II: The Civil War, Restoration and Eighteenth Century Literature, Precursors of the Romantics, Rhetoric, Prosody.

- History, politics and socio-cultural background, and its impact on literature. Poetry with special reference to the change and the emergence of new forms and styles, verse satire, neoclassical norms. The impact of science and empirical thinking, democratic social and political trends, secular interests and dominant intellectual discourses that were reflected on writing during the period.
- Restoration: Milton, *Paradise Lost, Book 1*
- Augustan literature: Alexander Pope, *The Rape of the Lock, Cantos 1-3*
- Precursors of the Romantics: Gray- 'Elegy Written in a Country Churchyard'; Cowper- 'The Solitude of Alexander Selkirk'; Blake- 'Introduction' to *Songs of Innocence*, 'The Lamb'; 'The Tyger', 'London' from *Songs of Experience*.
- Rhetoric & Prosody (Unseen passages to be set for both).

Usual Pattern of Questions

- Group A (Milton's *Paradise Lost BK.I*):

One essay type question of 15 marks (1x15=15)

Two short questions and/or annotations of 5 marks each (2x5= 10)

Total: 25

- Group B (Pope's *The Rape of the Lock*)

One essay type question of 15 marks (1x15=15)

Two short questions and/or annotations of 5 marks each (2x5=10)

Total: 25

- Group C (Precursors of the Romantics)

One essay type question of 15 marks (1x15=15)

Three short questions and/or annotations of 5 marks each (3x5= 15)

Total: 30

- Group D (Rhetoric & Prosody)

Rhetoric (15).An unseen passage to be selected from which at least 5 figures of speech can be identified. Marks will be allotted for identifying, defining and explaining. (5x3)

Prosody (5)- An unseen passage to be set.

Total: 20

Part II

Paper III: Beginnings, Development and Trends in English Drama up to the Nineteenth Century

Group A.

Beginnings of drama , the development in the Elizabethan and Jacobean age; changes in theatre and drama after the Restoration and the opening of the theatres; Restoration Comedy; Heroic Tragedy, Sentimental and Anti-sentimental Comedy, a brief overview of the drama of the Romantic period.

Group B

The following plays are for detailed study:

Tamburlaine Part I by Christopher Marlowe or *Macbeth* by William Shakespeare

Twelfth Night by William Shakespeare or *Alchemist* by Ben Jonson

The Man of Mode by George Etherege or *She Stoops to Conquer* by Oliver Goldsmith

Group C

Literary terms used in connection with drama:

Aside/anagnorisis/catharsis/ catastrophe/ chorus/character/ climax/comic relief/conflict/denouement/ deus ex machine/ exposition/ farce/ hubris/ hamartia/ irony/ masque/peripeteia/plot/ unities

Usual Pattern of Questions

Group A: 4 out of 6 questions to be answered, each within 200 words.

Marks: $4 \times 5 = 20$

Group B: 3 essay type questions with internal choice from the assigned plays to be answered in about 500 words.

Marks: $3 \times 15 = 45$

Explanations/short questions: 3 out of 6 questions to be answered, each in about 200 words.

Marks: $3 \times 5 = 15$

Group C: Short notes on literary terms. 5 out of 7 terms to be explained, each in about 100 words.

Marks: $5 \times 4 = 20$

Total: $20 + 45 + 15 + 20 = 100$

Paper IV: The Rise and Development of the Novel and Prose from the Eighteenth century to the Victorian Age

Group A: Rise and development of the novel from the eighteenth century to the Victorian age with particular references to the major movements and subgenres of the time.

Group B: Fiction of the Period. The following texts are for detailed study:

Pride and Prejudice by Jane Austen or, *Jane Eyre* by Charlotte Bronte

Far from the Madding Crowd by Thomas Hardy or, *David Copperfield* by Charles Dickens

Group C: Non-fictional Prose. The following essays are for detailed study:

‘The Scope of Satire’ by Joseph Addison

‘Knowledge its own End’ by Cardinal Newman

‘Dream Children’ by Charles Lamb

‘Modern Elements in Literature’ by Matthew Arnold

Group D: Literary terms related to fiction and non-fictional prose: flat and round character/ stock character/ art of characterization/ gothic novel/ bildungsroman/ epistolary novel/ historical novel/ sentimental novel/ epic novel/ point of view/ narrator/ first person narrator/ narrative style/ omniscient narrator / setting/ / picaresque/ irony/ theme/ realism/ subplot/ personal essay/

Usual Pattern of Questions

Group A: 4 out of 6 questions to be answered, each within 200 words.

Marks: $4 \times 5 = 20$

Group B: 2 essay type questions with internal choice from the assigned novels to be answered in 500 words

Marks: $2 \times 15 = 30$

Group C: 3 essay type questions out of 4 to be set from the 4 essays to be answered in 400 words.

Marks: $3 \times 10 = 30$

Group D: Short notes on literary terms. 5 out of 7 terms to be explained, each in about 100 words.

Marks: $5 \times 4 = 20$

Total: $20 + 30 + 30 + 20 = 100$

Part III

Paper V: Nineteenth & Twentieth Century Poetry

Group A. Backgrounds to Romantic, Victorian and Modern poetry—trends, traditions and techniques and a general overview of poets and their works. Social, political and intellectual developments that left an impact on poetry.

Group B. Romantic Poetry

William Wordsworth- 'Tintern Abbey'

S.T. Coleridge- 'Kubla Khan'

P.B. Shelley- 'Ode to the West Wind'

John Keats—'When I have fears that I may cease to be', 'Ode on a Grecian Urn'

Byron- 'Don Juan', Canto I.

Group C. Victorian Poetry

A. Tennyson- 'Ulysses'

Robert Browning- 'Fra Lippo Lippi'

Matthew Arnold- 'Dover Beach'

Emily Bronte- 'No Coward Soul is Mine'.

Group D. Modern Poetry

T.S. Eliot- 'The Love Song of J. Alfred Prufrock'

W.B. Yeats- 'The Second Coming'

Wilfred Owen- 'Spring Offensive'

W.H. Auden- 'Musée des Beaux Arts'

Dylan Thomas- 'And Death Shall Have No Dominion'

Ted Hughes- 'The Thought Fox'

Usual Pattern of Questions

- 4 out of 5 questions from Group A, each question carries 5 marks. $4 \times 5 = 20$
- One essay type question from each of the three groups- B, C, D- carrying 15 marks each
 $3 \times 15 = 45$
- Locate & annotate/ Comment questions, 5 out of 8 to be set from all three groups B, C, D. Each carries 5 marks.

$$5 \times 5 = 25$$

- 5 out of 8 objective questions to be set from groups B, C, D. Each carries 2 marks
 $5 \times 2 = 10$

$$\text{Total: } 20 + 45 + 25 + 10 = 100$$

Paper VI: Modern Drama

Group A

Background and development of British and Irish drama, trends in European drama, changes in theatre and production.

Group B

All 3 of the following plays are to be taught.

G.B. Shaw- *Major Barbara*

J.M. Synge—*Riders to the Sea*

Harold Pinter – *The Birthday Party*

Group C

The students will have to write the substance of and critically appreciate an unseen poem/prose extract.

Usual Pattern of Questions

- History of Literature, 4 questions of 5 marks each
 $4 \times 5 = 20$
- Essay type questions, one from each play with internal choice, carrying 15 marks.
 $3 \times 15 = 45$
- Locate, annotate/Comment Questions to be set from all three plays, each carrying 5 marks.
 $3 \times 5 = 15$
- Unseen
Substance-10
Critical appreciation-10

$$\text{Total: } 20 + 45 + 15 + 20 = 100$$

Paper VII: Modern Fiction & Short Story

Group A. Background for modern British and European fiction. The development of the novel and the short story forms in the 20th century.

Group B. Any 2 of the following novels to be taught.

D.H. Lawrence- *The Rainbow*

Joseph Conrad- *Heart of Darkness*

James Joyce—*A Portrait of an Artist as a Young Man*

Group C. All 4 short stories to be taught.

Virginia Woolf- *Kew Gardens*

Katherine Mansfield- *Bliss*

E.M.Forster- *The Eternal Moment*

Graham Greene- *Across the Bridge*

Group D. Literary Essay, 1 out of 4 topics.

Usual Pattern of Questions

- History of Literature , 4 questions of 5 marks each from Group A
 $4 \times 5 = 20$
- Essay type questions from 2 novels with internal choice, each carrying 15 marks .
 $2 \times 15 = 30$
- Essay type questions from the short stories, 2 out of 4, each carrying 10 marks.
 $2 \times 10 = 20$
- Literary Essay: 30 marks

Total: $20 + 30 + 20 + 30 = 100$

Paper VIII: Optional Course- American Literature/ Indian Writing

Section-I

Modern Critical Theory (unchanged):

Feminism,

Marxism,

Modernism and Postmodernism,

Postcolonialism,

Structuralism.

Section- II (optional courses)

American Literature

Group A- Poetry

Walt Whitman- 'Crossing Brooklyn Ferry'

Emily Dickinson- 'Because I could not Stop for Death'

Robert Frost- 'Desert Places'

e. e. cummings- 'Somewhere I have never Travelled'

Langston Hughes- 'The Negro Speaks of Rivers'

Bob Dylan- 'How Many Roads must a Man Walk Down'

Sylvia Plath- 'Mirror'

Group B- Novels

F. Scott Fitzgerald --*The Great Gatsby*

OR

Alice Walker-- *The Color Purple*

Group C- Short Stories

Nathaniel Hawthorne—‘The Ambitious Guest’

Edgar Allan Poe—‘The Cask of Amontillado’

O. Henry- ‘The Cactus’

Kate Chopin- ‘Regret’

Group D- Drama

Arthur Miller- *Death of a Salesman*

Indian Writing

Group A- Poetry

Michael Madhusudan Dutt- ‘The Captive Ladie’

Toru Dutt – ‘The Lotus’

Swami Vivekananda—‘Kali, the Mother’

Sri Aurobindo—‘The Tiger and the Deer’

Sarojini Naidu- ‘Caprice’

Nissim Ezekiel- ‘Enterprise’

Kamala Das—‘In Love’

A. K. Ramanujan—‘Another View of Grace’

Jayanta Mahapatra—‘Hunger’

Meena Alexander—‘Muse’

Group B- Novels

Raja Rao--*The Serpent and the Rope*

OR

Amitav Ghosh—*The Shadow Lines*

Group C--Short Stories

Mulk Raj Anand—‘The Lost Child’

R.K. Narayan—‘A Horse and Two Goats’

Anita Desai—‘The Accompanist’

Salman Rushdie-- ‘Chekov and Zulu’

Group D—Drama

Mahesh Dattani-- *Tara*

OR

Asif Currimbhoy-- *The Refugee*

Usual Pattern of Questions

Common theoretical portion: 20 marks

One questions of 15 mark from each of the 4 groups: $15 \times 4 = 60$

Locate & annotate/Comment, 1 question from each group: $4 \times 5 = 20$

Total: $20 + 60 + 20 = 100$

APPENDIX I (extracts specifically mentioned in the syllabus for Part I)

Beowulf

http://www.rado.sk/old_english/texts/Beowulf.htm

XI

THEN from the moorland, by misty crags,

with God's wrath laden, Grendel came.

The monster was minded of mankind now

sundry to seize in the stately house.

Under welkin he walked, till the wine-palace there,

gold-hall of men, he gladly discerned,

flashing with fretwork. Not first time, this,

that he the home of Hrothgar sought, --

yet ne'er in his life-day, late or early,

such hardy heroes, such hall-thanes, found!

To the house the warrior walked apace,

parted from peace;[\[35\]](#) the portal opened,
though with forged bolts fast, when his fists had
struckit,and baleful he burst in his blatant rage,
the house's mouth. All hastily, then,
o'er fair-paved floor the fiend trod on,
ireful he strode; there streamed from his eyes
fearful flashes, like flame to see.
He spied in hall the hero-band,
kin and clansmen clustered asleep,
hardy liegemen. Then laughed his heart;
for the monster was minded, ere morn should dawn,
savage, to sever the soul of each,
life from body, since lusty banquet
waited his will! But Wyrd forbade him
to seize any more of men on earth
after that evening. Eagerly watched
Hygelac's kinsman his cursed foe,
how he would fare in fell attack.
Not that the monster was minded to pause!
Straightway he seized a sleeping warrior
for the first, and tore him fiercely asunder,
the bone-frame bit, drank blood in streams,
swallowed him piecemeal: swiftly thus
the lifeless corse was clear devoured,
e'en feet and hands. Then farther he hied;
for the hardy hero with hand he grasped,
felt for the foe with fiendish claw,

for the hero reclining, -- who clutched it boldly,
prompt to answer, propped on his arm.
Soon then saw that shepherd-of-evils
that never he met in this middle-world,
in the ways of earth, another wight
with heavier hand-gripe; at heart he feared,
sorrowed in soul, -- none the sooner escaped!
Fain would he flee, his fastness seek,
the den of devils: no doings now
such as oft he had done in days of old!

Then bethought him the hardy Hygelac-thane
of his boast at evening: up he bounded,
grasped firm his foe, whose fingers cracked.
The fiend made off, but the earl close followed.
The monster meant -- if he might at all --
to fling himself free, and far away
fly to the fens, -- knew his fingers' power
in the gripe of the grim one. Gruesome march
to Heorot this monster of harm had made!
Din filled the room; the Danes were bereft,
castle-dwellers and clansmen all,
earls, of their ale. Angry were both
those savage hall-guards: the house resounded.
Wonder it was the wine-hall firm
in the strain of their struggle stood, to earth
the fair house fell not; too fast it was
within and without by its iron bands

craftily clamped; though there crashed from sill
many a mead-bench -- men have told me --
gay with gold, where the grim foes wrestled.
So well had weened the wisest Scyldings
that not ever at all might any man
that bone-decked, brave house break asunder,
crush by craft, -- unless clasp of fire
in smoke engulfed it. -- Again uprose
din redoubled. Danes of the North
with fear and frenzy were filled, each one,
who from the wall that wailing heard,
God's foe sounding his grisly song,
cry of the conquered, clamorous pain
from captive of hell. Too closely held him
he who of men in might was strongest
in that same day of this our life.

Deor's Lament

http://www.rado.sk/old_english/texts/Deor.htm

Welund tasted misery among snakes.

The stout-hearted hero endured troubles
had sorrow and longing as his companions
cruelty cold as winter - he often found woe

5 Once Nithad laid restraints on him,
supple sinew-bonds on the better man.

That went by; so can this.

To Beadohilde, her brothers' death was not
so painful to her heart as her own problem

10 which she had readily perceived
that she was pregnant; nor could she ever
foresee without fear how things would turn out.

That went by, so can this.

We have learnt of the laments of Mathild,
15 of Geat's lady, that they became countless
so that the painful passion took away all sleep.

That went by, so can this.

For thirty years Theodric possessed
theMaring's stronghold; that was known to many.

20 That went by, so can this.

We have heard of Eormanric's
wolfish mind; he ruled men in many places
in the Goths' realm - that was a grim king.

Many a man sat surrounded by sorrows,
25 misery his expectation, he often wished
that the kingdom would be overcome.

That went by, so may this.

A heavy-hearted man sits deprived of luck.

He grows gloomy in his mind and thinks of himself
30 that his share of troubles may be endless.

He can then consider that throughout this world
the wise Lord often brings about change
to many a man, he shows him grace
and certain fame; and to some a share of woes.

35 I wish to say this about myself:

That for a time I was the Heodenings' poet,

dear to my lord - my name was "Deor".

For many years I had a profitable position,

a loyal lord until now that Heorrenda,

40 the man skilled in song, has received the estate

which the warriors' guardian had given to me.

That went by, so can this.

Translated by Steve Pollington.

Alternatively the following website may be consulted

[:http://home.ix.netcom.com/~kyamazak/myth/beowulf/deor-ae.htm](http://home.ix.netcom.com/~kyamazak/myth/beowulf/deor-ae.htm)

http://www.rado.sk/old_english/texts/Hymn.html

Cædmon's Hymn

Now shall we praise the heavenly kingdom's Guardian,

the Creator's ability and his wisdom,

3 work of the glorious Father, so he wonder each,

eternal Lord, origins created.

He first created the earth for the children

6 Heaven as a roof, holy Creator;

then the earth mankind's Guardian,

eternal Lord afterwards created

9 for men as earth, Lord almighty.

The Dream of the Rood

<http://www.lightspill.com/poetry/oe/rood.html>

Manuscript: The Vercelli Book (chapter library of the cathedral at Vercelli, Codex CXVII). Editions: Krapp, George Philip, ed. *The Vercelli Book*. ASPR 2. New York: Columbia UP, 1932; Dickens, Bruce, and Alan S. C. Ross, eds. *The Dream of the Rood*. Methuen's Old English Library. New York: Appleton, 1966; Swanton, Michael, ed. *The Dream of the Rood*. Manchester Old and Middle English Texts. New York: Barnes (for Manchester UP), 1970. Pope, John C., ed. *Seven Old English Poems*. 2nd ed. New York: Norton, 1981. It will be obvious that I have relied heavily on Swanton's edition in my notes (click on the hyperlinked superscripts in the text to go to the notes). A general observation should be made here: this poem is remarkable for its extensive use of hypermetric lines, "used contrapuntally to accommodate significantly more complex thematic material" (Swanton 61).

Hyperlinks to [annotations](#) are added in-line in the text, in bolded brackets. See also my notes on [The Dream of the Rood](#).

Listen! The choicest of visions I wish to tell,
which came as a dream in middle-night,
after voice-bearers lay at rest.
It seemed that I saw a most wondrous tree
born aloft, wound round by light,⁵
brightest of beams. All was that beacon
sprinkled with gold. Gems stood
fair at earth's corners; there likewise five
shone on the shoulder-span [[1](#)]. All there beheld the Angel of God [[2](#)],
fair through predestiny [[3](#)]. Indeed, that was no wicked one's gallows,¹⁰
but holy souls beheld it there,
men over earth, and all this great creation.
Wondrous that victory-beam--and I stained with sins,
with wounds of disgrace. I saw glory's tree
honored with trappings, shining with joys,¹⁵
decked with gold; gems had
wrapped that forest tree worthily round.
Yet through that gold I clearly perceived
old strife of wretches [[4](#)], when first it began
to bleed on its right side. With sorrows most troubled,²⁰
I feared that fair sight. I saw that doom-beacon [[5](#)]
turn trappings and hews: sometimes with water wet,
drenched with blood's going; sometimes with jewels decked.
But lying there long while, I,
troubled, beheld the Healer's tree,²⁵
until I heard its fair voice.
Then best wood spoke these words:
"It was long since--I yet remember it--
that I was hewn at holt's end,
moved from my stem. Strong fiends seized me there,³⁰
worked me for spectacle; cursèd ones lifted me [[6](#)].
On shoulders men bore me there, then fixed me on hill;
fiends enough fastened me. Then saw I mankind's Lord
come with great courage when he would mount on me.
Then dared I not against the Lord's word³⁵
bend or break, when I saw earth's
fields shake. All fiends
I could have felled, but I stood fast.
The young hero stripped himself--he, God Almighty--
strong and stout-minded. He mounted high gallows,⁴⁰
bold before many, when he would loose mankind.
I shook when that Man clasped me. I dared, still, not bow to earth,
fall to earth's fields, but had to stand fast.
Rood was I reared. I lifted a mighty King,
Lord of the heavens, dared not to bend.⁴⁵
With dark nails they drove me through: on me those sores are seen,
open malice-wounds. I dared not scathe anyone.
They mocked us both, we two together [[7](#)]. All wet with blood I was,
poured out from that Man's side, after ghost he gave up.
Much have I born on that hill⁵⁰
of fierce fate. I saw the God of hosts
harshly stretched out. Darknesses had

wound round with clouds the corpse of the Wielder,
bright radiance; a shadow went forth,
dark under heaven. All creation wept,⁵⁵
King's fall lamented. Christ was on rood.
But there eager ones came from afar
to that noble one. I beheld all that.
Sore was I with sorrows distressed, yet I bent to men's hands,
with great zeal willing. They took there Almighty God,⁶⁰
lifted him from that grim torment. Those warriors abandoned me
standing all blood-drenched, all wounded with arrows.
They laid there the limb-weary one, stood at his body's head;
beheld they there heaven's Lord, and he himself rested there,
worn from that great strife. Then they worked him an earth-house,⁶⁵
men in the slayer's sight carved it from bright stone,
set in it the Wielder of Victories. Then they sang him a sorrow-song,
sad in the eventide, when they would go again
with grief from that great Lord. He rested there, with small company.
But we there lamenting a good while⁷⁰
stood in our places after the warrior's cry
went up. Corpse grew cold,
fair life-dwelling. Then someone felled us
all to the earth. That was a dreadful fate!
Deep in a pit one delved us. Yet there Lord's thanes,⁷⁵
friends, learned of me,.
adorned me with silver and gold.
Now you may know, loved man of mine,
what I, work of baleful ones, have endured
of sore sorrows. Now has the time come⁸⁰
when they will honor me far and wide,
men over earth, and all this great creation,
will pray for themselves to this beacon. On me God's son
suffered awhile. Therefore I, glorious now,
rise under heaven, and I may heal⁸⁵
any of those who will reverence me.
Once I became hardest of torments,
most loathly to men, before I for them,
voice-bearers, life's right way opened.
Indeed, Glory's Prince, Heaven's Protector,⁹⁰
honored me, then, over holm-wood [[8](#)].
Thus he his mother, Mary herself,
Almighty God, for all men,
also has honored over all woman-kind.
Now I command you, loved man of mine,⁹⁵
that you this seeing [[9](#)] tell unto men;
discover with words that it is glory's beam
which Almighty God suffered upon
for all mankind's manifold sins
and for the ancient ill-deeds of Adam.¹⁰⁰
Death he tasted there, yet God rose again
by his great might, a help unto men.
He then rose to heaven. Again sets out hither
into this Middle-Earth, seeking mankind
on Doomsday, the Lord himself,¹⁰⁵
Almighty God, and with him his angels,
when he will deem--he holds power of doom--

everyone here as he will have earned
for himself earlier in this brief life.
Nor may there be any unafraid¹¹⁰
for the words that the Wielder speaks.
He asks before multitudes where that one is
who for God's name would gladly taste
bitter death, as before he on beam did.
And they then are afraid, and few think¹¹⁵
what they can to Christ's question answer [[10](#)].
Nor need there then any be most afraid [[11](#)]
who ere in his breast bears finest of beacons;
but through that rood shall each soul
from the earth-way enter the kingdom,¹²⁰
who with the Wielder thinks yet to dwell."
I prayed then to that beam with blithe mind,
great zeal, where I alone was
with small company [[12](#)]. My heart was
impelled on the forth-way, waited for in each¹²⁵
longing-while. For me now life's hope:
that I may seek that victory-beam
alone more often than all men,
honor it well. My desire for that
is much in mind, and my hope of protection¹³⁰
reverts to the rood. I have not now many
strong friends on this earth; they forth hence
have departed from world's joys, have sought themselves glory's King;
they live now in heaven with the High-Father,
dwell still in glory, and I for myself expect¹³⁵
each of my days the time when the Lord's rood,
which I here on earth formerly saw,
from this loaned life will fetch me away
and bring me then where is much bliss,
joy in the heavens, where the Lord's folk¹⁴⁰
is seated at feast, where is bliss everlasting;
and set me then where I after may
dwell in glory, well with those saints
delights to enjoy. May he be friend to me
who here on earth earlier died¹⁴⁵
on that gallows-tree for mankind's sins.
He loosed us and life gave,
a heavenly home. Hope was renewed
with glory and gladness to those who there burning endured.
That Son was victory-fast [[13](#)] in that great venture,¹⁵⁰
with might and good-speed [[14](#)], when he with many,
vast host of souls, came to God's kingdom,
One-Wielder Almighty: bliss to the angels
and all the saints--those who in heaven
dwelt long in glory--when their Wielder came,¹⁵⁵
Almighty God, where his homeland was.

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Annotations

[1] shoulder-span. OE *eaxlegespanne*. Of this *hapax legomenon*, Swanton writes: "It would be tempting to identify this with the 'axle-tree' or centre-piece of the cross, although 'axle' in this sense of wheel-centre is not otherwise recorded before the thirteenth century. . . . It might . . . simply refer to the beam of the gallows along which Christ's arms were stretched, although the 'crux gemmata' normally has jewels along all four arms."

[2] All . . . God. Most editors assume that *engel* 'angel' is the subject of the sentence, but I follow Swanton in treating *ealle* 'all' as subject and *engel* as object. Swanton considers this to cause difficulties about identifying the *engel*, but the OE word can carry the sense 'messenger,' which obviously suggests that the Cross itself is the *engeldryhtnes* 'angel/messenger of God.'

[3] fair . . . predestiny. OE *fægereþurhforðgesceaft*, an ambiguous phrase, *forðgesceaft* being used elsewhere to mean both 'creation' and 'future destiny.' See Swanton for a discussion of the possibilities. My translation indicates that I take it to mean 'what is preordained.' Thus the Rood is part of an eternal plan, like "the Lamb slain from the foundation of the world" (Rev. 13:8)

[4] old strife of wretches. OE *earmraergewin*, lit. 'of wretches ere-strife.' The phrase, in this context, appears to refer to the whole battle between Christ and Satan, Good and Evil; more immediately, of course, it refers to Christ's Passion, viewed as battle.

[5] doom-beacon. OE *fusebeacen*. Considering that "the word *fus* is commonly associated with death," Swanton notes: "Clearly, within the poet's vision we must recognize not simply the church year hastening to its sacrificial end, but a concrete symbol of death and the doom to come. This *beacen* is at once an emblem of death (Christ's) and of doom (that of the dreamer and world). At Judgement Day it is this symbol that will be seen again in the heavens. . . ."

[6] cursèd . . . me. As Swanton observes, the syntax could conceivably support the rendering "made me lift cursèd ones."

[7] both . . . together. OE *uncbutuætgedere* 'we two both together.' *Unc* is dual in number, underscoring the close relationship--the near identification--of Cross and Christ in the poem.

[8] holm-wood. OE *holmwudu*, a *hapax legomenon* and obscure. Swanton notes three possible ways to find meaning in the term: (1) interpret it as 'sea-wood' (either 'ship' or--more understandably--*lignum vitae* 'tree of life,' which grows by the waters of Paradise); (2) emend to *holtwudu* 'forest wood'; or (3) take *holm* in the OS sense 'hill,' providing a "powerful oblique reference to the gallows of Golgotha."

[9] seeing. OE *gesyhð* 'thing seen, vision' (> NE *sight*), clearly referring to the dreamer's vision of the Cross. B. Huppé, *Web of Words*, entitles this poem "Gesyhþrodes."

[10] Christ's . . . answer. More literally: "what they may begin to say to Christ."

[11] most afraid. OE *unforht*, usually emended to *anforht* 'fearful'; Swanton retains the MS reading *un-* as an intensive: 'very afraid.'

[12] small company. See line 69. This is one of the numerous echoes set up to link Christ, Cross, and Dreamer.

[13] victory-fast. I.e., secure in or sure of victory.

[14] with . . . good-speed. OE *mihtigondspedig* 'mighty and successful' (the latter being the original meaning of *speedy*).

The Canterbury Tales : Prologue

<http://www.fordham.edu/halsall/source/ct-prolog-para.html>

Here bygynneth the Book
of the tales of Caunterbury

1: Whan that aprill with his shouressoote
2: The droghte of march hath perced to the
roote,
3: And bathed every veyne in swichlicour
4: Of which vertuengendred is the flour;
5: Whanzepirus eek with his sweetebreeth
6: Inspired hath in every holt and heeth
7: Tendrecroppes, and the yongesonne
8: Hath in the ram his halve coursyronne,
9: And smalefowelesmakenmelodye,
10: That slepen al the nyght with open ye
11: (so priketh hem nature in hircorages);
12: Thanelongen folk to goon on
pilgrimages,
13: And palmeres for to
sekenstraungestrondes,
14: To fernehalwes, kowthe in sondrylondes;
15: And specially from every shires ende
16: Of engelond to caunterbury they wende,
17: The hoolyblisfulmartir for to seke,
18: That hem hath holpenwhan that they were
seeke.
19: Bifil that in that seson on a day,
20: In southwerk at the tabard as I lay
21: Redy to wenden on my pilgrymage
22: To caunterbury with ful devout corage,
23: At nyght was come into that hostelrye
24: Welnyne and twenty in a compaignye,
25: Of sondry folk, by aventurefalle
26: In felawshipe, and pilgrimes were they
alle,
27: That toward caunterburywoldenryde.
28: The chambres and the stables werenwyde,
29: And wel we werenesedattebeste.
30: And shortly, whan the sonne was to reste,
31: So hadde I spoken with hem everichon
32: That I was of hirlaweshipe anon,
33: And made forward erly for to ryse,

Here begins the Book
of the Tales of Canterbury

When April with his showers sweet with fruit
The drought of March has pierced unto the
root
And bathed each vein with liquor that has
power
To generate therein and sire the flower;
When Zephyr also has, with his sweet breath,
Quickened again, in every holt and heath,
The tender shoots and buds, and the young sun
Into the Ram one half his course has run,
And many little birds make melody
That sleep through all the night with open eye
(So Nature pricks them on to ramp and rage)-
Then do folk long to go on pilgrimage,
And palmers to go seeking out strange strands,
To distant shrines well known in sundry lands.
And specially from every shire's end
Of England they to Canterbury wend,
The holy blessed martyr there to seek
Who helped them when they lay so ill and
weal
Befell that, in that season, on a day
In Southwark, at the Tabard, as I lay
Ready to start upon my pilgrimage
To Canterbury, full of devout homage,
There came at nightfall to that hostelry
Some nine and twenty in a company
Of sundry persons who had chanced to fall
In fellowship, and pilgrims were they all
That toward Canterbury town would ride.
The rooms and stables spacious were and
wide,
And well we there were eased, and of the best.
And briefly, when the sun had gone to rest,
So had I spoken with them, every one,
That I was of their fellowship anon,
And made agreement that we'd early rise

34: To take oureweyther as I yow devyse.	To take the road, as you I will apprise.
35: But nathelees, whil I have tyme and space,	But none the less, whilst I have time and space,
36: Er that I ferther in this tale pace,	Before yet farther in this tale I pace,
37: Me thynketh it acordaunt to resoun	It seems to me accordant with reason
38: To telle yow al the condicioun	To inform you of the state of every one
39: Of ech of hem, so as it semed me,	Of all of these, as it appeared to me,
40: And whiche they weren, and of what degree,	And who they were, and what was their degree,
41: And eek in what array that they were inne;	And even how arrayed there at the inn;
42: And at a knyght than wol I first bigynne.	And with a knight thus will I first begin.

PORTRAIT OF THE WIFE OF BATH

[From The General Prologue]

Pollard, Alfred W., ed. *Chaucer's Canterbury Tales*. Vol II.
London: Macmillan and Co., Ltd., 1907. 24-25.

<http://www.luminarium.org/medlit/wifeport.htm>

A GOOD WIF was ther of biside BATHE,	445
But she was som-del deaf and that was scathe.	
Of clooth-makyng she haddeswichan haunt	
She passed hem of Ypres and of Gaunt.	
In al the parisshe wif ne was ther noon	
That to the offryng bifore hire sholde goon,	450
And if therdide, certeyn so wrooth was she,	
That she was out of allecharitee.	
Hircoverchiefsfulfyneweren of ground,—	
I dorsteswere they weyeden ten pound,—	
That on a Sondag weren upon hir heed.	455
Hir hosen weren of fyn scarlet reed	
Fulstreite y-teyd, and shoes fulmoyste and newe;	
Boold was hir face and fair and reed of hewe.	
She was a worthy womman al hirlyve,	
Housbondes at chirchedore she hadde fyve,	460
Withouten oother compaignye in youthe,—	
But ther-of nedethnat to speke as nowthe,—	
And thrieshadde she been at Jerusalem;	
She hadde passed many a straungestrem;	
At Rome she hadde been and at Boloigne,	465
In Galice at SeintJame, and at Coloigne,	
She koudemuchel of wandrynge by the weye.	
Gat-tothed was she, soothly for to seye.	
Upon an amblereesily she sat,	
Y-wympledwel, and on hir heed an hat	470

As brood as is a bokeler or a targe;
 A foot mantel aboutehirhipes large,
 And on hir feet a paire of spores sharpe.
 In felawshipewelkoude she laughe and carpe;
 Of remedies of love she knew per chaunce, 475
 For she koude of that art the oldedaunce.

446. *som-del*, somewhat.
scathe, scaith, harm.
447. *haunt*, practice.
448. *Gaunt*, Ghent.
450. *to the offrynge*, offerings in kind or money at mass and other services were presented by the people going up in order to the priest.
453. *coverchiefs*, kerchiefs, head-dresses, worn under the hat.
459. *worthy*, well-to-do, respectable.
460. *atchirchedore*, the first part of the marriage service used to be read at the church door.
461. *Withouten*, besides.
462. *nowthe*, now.
465. *Boloigne*, Boulogne, where an image of the B. Virgin was exhibited to pilgrims.
466. *In Galice at S. Jame*, *i. e.* at the shrine of St. James of Compostella in Galicia in Spain.
Coloigne, to the shrine of the Three Kings of the East at Cologne.
467. *koude*, knew.
468. *Gat-tothed*, gate-toothed, *i.e.* with teeth wide apart; according to a piece of folk-lore quoted by Prof. Skeat, "a sign she should be lucky and travel."
 But in the Wife's Prologue she says:
- "Gat-tothed I was, and that bicam me weel,
 I hadde the prente of seïnt Venus seel:"
- which points rather to the derivation "goat-toothed," *i.e.* lascivious.
472. *foot mantel*, according to the illustration in the Ellesmere MS. this took the form of leggings stretching from the hips down over the boots. The spurs were fastened over it.
474. *carpe*, chatter.
476. *koude the oldedaunce* ("Qu'elscettoute la vielle dance," *Rom. de la Rose*), knew the ancient custom.

[Modern Translation for reference:

<http://pages.towson.edu/duncan/chaucer/duallang5.htm>

There was a housewife come from Bath, or near,
 Who- sad to say- was deaf in either ear.
 At making cloth she had so great a bent
 She bettered those of Ypres and even of Ghent.
 In all the parish there was no goodwife
 Should offering make before her, on my life;
 And if one did, indeed, so wroth was she
 It put her out of all her charity.
 Her kerchiefs were of finest weave and ground;
 I dare swear that they weighed a full ten pound
 Which, of a Sunday, she wore on her head.
 Her hose were of the choicest scarlet red,
 Close gartered, and her shoes were soft and new.
 Bold was her face, and fair, and red of hue.

She'd been respectable throughout her life,
With five church'd husbands bringing joy and strife,
Not counting other company in youth;
But thereof there's no need to speak, in truth.
Three times she'd journeyed to Jerusalem;
And many a foreign stream she'd had to stem;
At Rome she'd been, and she'd been in Boulogne,
In Spain at Santiago, and at Cologne.
She could tell much of wandering by the way:
Gap-toothed was she, it is no lie to say.
Upon an ambler easily she sat,
Well wimpled, aye, and over all a hat
As broad as is a buckler or a targe;
A rug was tucked around her buttocks large,
And on her feet a pair of sharpened spurs.
In company well could she laugh her slurs.
The remedies of love she knew, perchance,
For of that art she'd learned the old, old dance.]

Sir Gawain and the Green Knight

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<http://www.poetryintranslation.com/PITBR/English/GawainAndTheGreenKnight.htm>

Part I

3

This king lay at Camelot nigh on Christmas
with many lovely lords, of leaders the best,
reckoning of the Round Table all the rich brethren,
with right ripe revel and reckless mirth.
There tourneyed tykes by times full many,
jousted full jollily these gentle knights,
then carried to court, their carols to make.
For there the feast was alike full fifteen days,
with all the meat and mirth men could devise:
such clamour and glee glorious to hear,
dear din in the daylight, dancing of nights;
all was happiness high in halls and chambers
with lords and ladies, as liked them all best.
With all that's well in the world were they together,
the knights best known under the Christ Himself,
and the loveliest ladies that ever life honoured,
and he the comeliest king that the court rules.
For all were fair folk and in their first age
still,
 the happiest under heaven,
 king noblest in his will;
 that it were hard to reckon
 so hardy a host on hill.

While New Year was so young it was new come in,
 that day double on the dais was the dole served,
 for the king was come with knights into the hall,
 and chanting in the chapel had chimed to an end.
 Loud cry was there cast of clerics and others,
 Noel nurtured anew, and named full oft;
 and see the rich run forth to render presents,
 yelled their gifts on high, yield them to hand,
 argued busily about those same gifts.
 Ladies laughed out loud, though they had lost,
 while he that won was not wrath, that you'll know.
 All this mirth they made at the meal time.
 When they had washed well they went to be seated,
 the best of the barons above, as it seemed best;
 with Guinevere, full gaily, gracing their midst,
 dressed on the dais there, adorned all about –
 splendid silk by her sides, and sheer above
 of true Toulouse, of Tartar tapestries plenty,
 that were embroidered, bright with the best gems
 that might be price-proved with pennies
 any a day.

the comeliest to descry
 glanced there with eyen grey;
 a seemlier ever to the sight,
 sooth might no man say.

But Arthur would not eat till all were served,
 he was so joyous a youth, and somewhat boyish:
 he liked his life lively, he loved the less
 either to long lie idle or to long sit,
 so busied him his young blood and his brain wild.
 And also another matter moved him so,
 that he had nobly named he would never eat
 on such dear days, before he had been advised,
 of some adventurous thing, an unknown tale,
 of some mighty marvel, that he might believe,
 of ancestors, arms, or other adventures;
 or else till someone beseeched for some sure knight
 to join with him in jousting, in jeopardy to lay,
 lay down life for life, allow each to the other,
 as fortune might favour them, a fair advantage.
 This was the king's custom when he in court was,
 at each fine feast among his many friends
 in hall.

Therefore with fearless face
 he stands straight and tall;
 full lively at that New Year
 much mirth he makes with all.

Thus there stands straight and tall the king himself,
 talking at the high table of trifles full courtly.

There good Gawain was graced by Guinevere beside,
and Agravain *a la dure main* on the other side sits,
both the king's sister-sons and full sure knights;
Bishop Baldwin above, he begins the table,
and Ywain, Urien's son, ate alongside him.
These sat high on the dais and deftly served,
and many another sat sure at the side-tables.
Then the first course came with crack of trumpets,
with many a banner full bright that thereby hung;
new noise of kettledrums and noble pipes,
wild warbles and wide wakened echoes,
that many a heart full high heaved at their notes.
Dainties drawn in therewith of full dear meats,
foods of the freshest, and in such files of dishes
they find no room to place them people before
and to set the silver that holds such servings
on cloth.

Each his load as he liked himself,
there ladled and nothing loath;
Every two had dishes twelve,
good beer and bright wine both.

7

Now will I of their service say you no more,
for each man may well know no want was there
another noise full new neared with speed,
that would give the lord leave to take meat.
For scarce was the noise not a while ceased,
and the first course in the court duly served,
there hales in at the hall door a dreadful man,
the most in the world's mould of measure high,
from the nape to the waist so swart and so thick,
and his loins and his limbs so long and so great
half giant on earth I think now that he was;
but the most of man anyway I mean him to be,
and that the finest in his greatness that might ride,
for of back and breast though his body was strong,
both his belly and waist were worthily small,
and his features all followed his form made
and clean.

Wonder at his hue men displayed,
set in his semblance seen;
he fared as a giant were made,
and over all deepest green.

[A prose translation of the above extracted portion is also provided for reference

SIR GAWAIN AND THE GREEN KNIGHT

Translated by JESSIE L. WESTO

<http://www.lib.rochester.edu/CAMELOT/sggk.htm>

[After the siege and the assault of Troy, when that burg was destroyed and burnt to ashes,

and the traitor tried for his treason, the noble Æneas and his kin sailed forth to become princes and patrons of well-nigh all the Western Isles. Thus Romulus built Rome (and gave to the city his own name, which it bears even to this day); and Ticius turned him to Tuscany; and Langobard raised him up dwellings in Lombardy; and Felix Brutus sailed far over the French flood, and founded the kingdom of Britain, wherein have been war and waste and wonder, and bliss and bale, oftentimes since.

And in that kingdom of Britain have been wrought more gallant deeds than in any other; but of all British kings Arthur was the most valiant, as I have heard tell, therefore will I set forth a wondrous adventure that fell out in his time. And if ye will listen to me, but for a little while, I will tell it even as it stands in story stiff and strong, fixed in the letter, as it hath long been known in the land.]

King Arthur lay at Camelot upon a Christmas-tide, with many a gallant lord and lovely lady, and all the noble brotherhood of the Round Table. There they held rich revels with gay talk and jest; one while they would ride forth to joust and tourney, and again back to the court to make carols; [2](#) for there was the feast holden fifteen days with all the mirth that men could devise, song and glee, glorious to hear, in the daytime, and dancing at night. Halls and chambers were crowded with noble guests, the bravest of knights and the loveliest of ladies, and Arthur himself was the comeliest king that ever held a court. For all this fair folk were in their youth, the fairest and most fortunate under heaven, and the king himself of such fame that it were hard now to name so valiant a hero.

Now the New Year had but newly come in, and on that day a double portion was served on the high table to all the noble guests, and thither came the king with all his knights, when the service in the chapel had been sung to an end. And they greeted each other for the New Year, and gave rich gifts, the one to the other (and they that received them were not wroth, that may ye well believe!), and the maidens laughed and made mirth till it was time to get them to meat. Then they washed and sat them down to the feast in fitting rank and order, and Guinevere the queen, gaily clad, sat on the high dais. Silken was her seat, with a fair canopy over her head, of rich tapestries of Tars, embroidered, and studded with costly gems; fair she was to look upon, with her shining grey eyes, a fairer woman might no man boast himself of having seen.

But Arthur would not eat till all were served, so full of joy and gladness was he, even as a child; he liked not either to lie long, or to sit long at meat, so worked upon him his young blood and his wild brain. And another custom he had also, that came of his nobility, that he would never eat upon an high day till he had been advised of some knightly deed, or some strange and marvellous tale, of his ancestors, or of arms, or of other ventures. Or till some stranger knight should seek of him leave to joust with one of the Round Table, that they might set their lives in jeopardy, one against another, as fortune might favour them. Such was the king's custom when he sat in hall at each high feast with his noble knights, therefore on that New Year tide, he abode, fair of face, on the throne, and made much mirth withal.

Thus the king sat before the high tables, and spake of many things; and there good Sir Gawain was seated by Guinevere the queen, and on her other side sat Agravain, *à la dure main*; [3](#) both were the king's sister's sons and full gallant knights. And at the end of the table was Bishop Bawdewyn, and Ywain, King Urien's son, sat at the other side alone. These were worthily served on the dais, and at the lower tables sat many valiant knights. Then they bare the first course with the blast of trumpets and waving of banners, with the sound of drums and pipes, of song and lute, that many a heart was uplifted at the melody. Many were the dainties, and rare the meats, so great was the plenty they might scarce find room on the board to set on the dishes. Each helped himself as he liked best, and to each two were twelve dishes, with great plenty of beer and wine.

Now I will say no more of the service, but that ye may know there was no lack, for there drew near a venture that the folk might well have left their labour to gaze upon. As the sound of the music ceased, and the first course had been fitly served, there came in at the hall door one terrible to behold, of stature greater than any on earth; from neck to loin so strong and

thickly made, and with limbs so long and so great that he seemed even as a giant. And yet he was but a man, only the mightiest that might mount a steed; broad of chest and shoulders and slender of waist, and all his features of like fashion; but men marvelled much at his colour, for he rode even as a knight, yet was green all over.]

http://oregonstate.edu/instruct/phl302/texts/bacon/essays_contents.html

1601 THE ESSAYS

by Francis Bacon

<http://ebooks.adelaide.edu.au/b/burton/robert/melancholy/S1.1.1.html#S1.1.1.1>

Robert Burton

Anatomy of Melancholy

THE FIRST SECTION, MEMBER, SUBSECTION.

Man's Excellency, Fall, Miseries, Infirmities; The causes of them.

Man's Excellency.] Man the most excellent and noble creature of the world, the principal and mighty work of God, wonder of Nature, as Zoroaster calls him; audacis natura miraculum, the [820] marvel of marvels, as Plato; the [821] abridgment and epitome of the world, as Pliny; microcosmus, a little world, a model of the world, [822] sovereign lord of the earth, viceroy of the world, sole commander and governor of all the creatures in it; to whose empire they are subject in particular, and yield obedience; far surpassing all the rest, not in body only, but in soul; [823] imaginis imago, [824] created to God's own [825] image, to that immortal and incorporeal substance, with all the faculties and powers belonging unto it; was at first pure, divine, perfect, happy, [826] created after God in true holiness and righteousness; Deo congruens, free from all manner of infirmities, and put in Paradise, to know God, to praise and glorify him, to do his will, Utdiis consimiles parturiat deos (as an old poet saith) to propagate the church.

Man's Fall and Misery.] But this most noble creature, Heu tristis, et lachrymosa commutatio ([827] one exclaims) O pitiful change! is fallen from that he was, and forfeited his estate, become miserabilis homuncio, a castaway, a caitiff, one of the most miserable creatures of the world, if he be considered in his own nature, an unregenerate man, and so much obscured by his fall that (some few relics excepted) he is inferior to a beast, [828] Man in honour that understandeth not, is like unto beasts that perish, so David esteems him: a monster by stupend metamorphoses, [829] a fox, a dog, a hog, what not? Quantum mutatus ab illo? How much altered from that he was; before blessed and happy, now miserable and accursed; [830] He must eat his meat in sorrow, subject to death and all manner of infirmities, all kind of calamities.

A Description of Melancholy.] [831] Great travail is created for all men, and an heavy yoke on the sons of Adam, from the day that they go out of their mother's womb, unto that day they return to the mother of all things. Namely, their thoughts, and fear of their hearts, and their imagination of things they wait for, and the day of death. From him that sitteth in the glorious throne, to him that sitteth beneath in the earth and ashes; from him that is clothed in blue silk and weareth a crown, to him that is clothed in simple linen. Wrath, envy, trouble, and unquietness, and fear of death, and rigour, and strife, and such things come to both man and beast, but sevenfold to the ungodly. All this befalls him in this life, and peradventure eternal misery in the life to come.

Impulsive Cause of Man's Misery and Infirmities.] The impulsive cause of these miseries in man, this privation or destruction of God's image, the cause of death and diseases, of all temporal and eternal punishments, was the sin of our first parent Adam, [832] in eating of the forbidden fruit, by the devil's instigation and allurements. His disobedience, pride, ambition, intemperance, incredulity, curiosity; from whence proceeded original sin, and that general corruption of mankind, as from a fountain, flowed all bad inclinations and actual transgressions which cause our several calamities inflicted upon us for our sins. And this belike is that which our fabulous poets have shadowed unto us in the tale of [833] Pandora's box, which being opened through her curiosity, filled the world full of all manner of diseases. It is not curiosity alone, but those other crying sins of ours, which pull these several plagues and miseries upon our heads. For

Ubipeccatum, ibiprocella, as [834]Chrysostom well observes. [835]Fools by reason of their transgression, and because of their iniquities, are afflicted.

820. Magnum miraculum.

821. Mundi epitome, naturaedeliciae.

822. Finis rerum omnium, cuisublunariaserviunt. Scalig. exercit. 365. sec. 3. Vales. desacr. Phil. c. 5.

823. Ut in numismateCaesaris imago, sic in homine Dei.

824. Gen. 1.

825. Imago mundi in corpore, Dei in anima. Exemplumque dei quisque est in imagine parva.

826. Eph. iv. 24.

827. Palanterius.

828. Psal. xlix. 20.

829. Lasciviasuperatequum, impudentiacanem, astuvulpem, furoreleonem. Chrys. 23. Gen.

830. Gen. iii. 13.

831. Ecclus. iv. 1, 2, 3, 4, 5, 8.

832. Gen. iii. 17.

833. Illa cadenstegmenmanibusdecussit, etunaperniciemimmisitmiserismortalibusatram. Hesiod. 1. oper.

834. Hom. 5. ad pop. Antioch.

835. Psal. cvii. 17.

English General Part I, Paper I

Details of Course

➤ Poems:

- Wordsworth- Education of Nature; The World is too much with Us
- Shelley- Ode to the West Wind
- Keats- Ode to Nightingale
- Tennyson-Ulysses
- Browning—Porphyria’s Lover
- Hardy- In Time of Breaking of the Nations
- Arnold- Dover Beach
- Owen- Strange Meeting
- Yeats- Lake Isle of Innisfree
- Auden - Musee de Beaux Arts

➤ Figures of Speech

Questions to be Answered

- This paper comprises 2 groups: A, B,

Group A

- Q 1] Essay type questions (4x15=60)
- Q 2] Short questions (3x5=15)

Group B

- Identifying figures of speech (5x2=10)
 - Unseen: Formal/Official Letter (15)
-

Appendix- English General

The World Is Too Much With Us

William Wordsworth

The world is too much with us; late and soon,
Getting and spending, we lay waste our powers;—
Little we see in Nature that is ours;
We have given our hearts away, a sordid boon!
This Sea that bares her bosom to the moon;
The winds that will be howling at all hours,
And are up-gathered now like sleeping flowers;
For this, for everything, we are out of tune;
It moves us not. Great God! I'd rather be
A Pagan suckled in a creed outworn;
So might I, standing on this pleasant lea,
Have glimpses that would make me less forlorn;
Have sight of Proteus rising from the sea;
Or hear old Triton blow his wreathèd horn.

CLXXIX. The Education of Nature

THREE years she grew in sun and shower;
Then Nature said, "A lovelier flower
On earth was never sown:
This child I to myself will take;
She shall be mine, and I will make 5
A lady of my own.

"Myself will to my darling be
Both law and impulse; and with me
The girl, in rock and plain,
In earth and heaven, in glade and bower, 10
Shall feel an overseeing power
To kindle or restrain.

"She shall be sportive as the fawn
That wild with glee across the lawn
Or up the mountain springs; 15
And hers shall be the breathing balm,
And hers the silence and the calm
Of mute insensate things.

"The floating clouds their state shall lend
To her; for her the willow bend; 20
Nor shall she fail to see
Ev'n in the motions of the storm
Grace that shall mould the maiden's form
By silent sympathy.

"The stars of midnight shall be dear 25
To her; and she shall lean her ear
In many a secret place,
Where rivulets dance their wayward round,
And beauty born of murmuring sound
Shall pass into her face. 30

"And vital feelings of delight
Shall rear her form to stately height,
Her virgin bosom swell;
Such thoughts to Lucy I will give,
While she and I together live 35
Here in this happy dell."

Thus Nature spake—the work was done—
How soon my Lucy's race was run!
She died, and left to me
This heath, this calm and quiet scene; 40
The memory of what has been,
And never more will be.

In Time of 'The Breaking of Nations

Thomas Hardy

Only a man harrowing clods
In a slow silent walk
With an old horse that stumbles and nods
Half asleep as they stalk.

Only thin smoke without flame
From the heaps of couch-grass;
Yet this will go onward the same
Though Dynasties pass.

Yonder a maid and her wight
Come whispering by:
War's annals will cloud into night
Ere their story die.

The Lake Isle Of Innisfree

William Butler Yeats

I WILL arise and go now, and go to Innisfree,
And a small cabin build there, of clay and wattles made:
Nine bean-rows will I have there, a hive for the honeybee,
And live alone in the bee-loud glade.
And I shall have some peace there, for peace comes dropping slow,
Dropping from the veils of the morning to where the cricket sings;
There midnight's all a glimmer, and noon a purple glow,
And evening full of the linnet's wings.
I will arise and go now, for always night and day
I hear lake water lapping with low sounds by the shore;
While I stand on the roadway, or on the pavements grey,
I hear it in the deep heart's core.

Musee des Beaux Arts

W. H. Auden

About suffering they were never wrong,
The old Masters: how well they understood
Its human position: how it takes place
While someone else is eating or opening a window or just walking dully along;
How, when the aged are reverently, passionately waiting
For the miraculous birth, there always must be
Children who did not specially want it to happen, skating
On a pond at the edge of the wood:
They never forgot
That even the dreadful martyrdom must run its course
Anyhow in a corner, some untidy spot

Where the dogs go on with their doggy life and the torturer's horse
Scratches its innocent behind on a tree.

In Breughel's Icarus, for instance: how everything turns away
Quite leisurely from the disaster; the ploughman may
Have heard the splash, the forsaken cry,
But for him it was not an important failure; the sun shone
As it had to on the white legs disappearing into the green
Water, and the expensive delicate ship that must have seen
Something amazing, a boy falling out of the sky,
Had somewhere to get to and sailed calmly on.

**WEST BENGAL STATE UNIVERSITY
DEPARTMENT OF ENGLISH**

B. A. English (General)

Effective from academic session 2013-2014

PAPER I: to be uploaded by February, 2016.

PAPER II: FICTIONAL & NON-FICTIONAL PROSE (F.M.100)

Fiction:

Charles Dickens: *David Copperfield*

Short Stories :

D. H. Lawrence, *The Prussian Officer* (Available at Project Gutenberg of Australia)

H.E. Bates: *The Ox*

Katherine Mansfield: *The Fly*

Somerset Maugham: *The Lotus Eater*

Essays:

Francis Bacon: 'Of Travel' text to be provided

Joseph Addison: 'The Aim of Spectator'

Charles Lamb: 'Dream Children: A Reverie'

George Orwell: 'Shooting an Elephant'

Literary terms related to fiction: flat and round character/ stock character/ art of characterization/ gothic novel/ bildungsroman/ epistolary novel/ historical novel/ sentimental novel/ epic novel/ point of view/ narrator/ first person narrator/ narrative style/ omniscient narrator / setting/ / picaresque/ irony/ theme/ realism/ subplot/ personal essay/

Unseen: Comprehension and Story Writing

PROPOSED MARKS STRUCTURE:

Novel – 1 question of 15 marks within 500 words

Short Story – 1 question of 15 marks, 2 explanations of 5 marks each (25 marks)

Essay -- 1 question of 10 marks, 2 explanations of 5 marks each; (20 marks)

Literary Terms: attempt any five, each of 2 marks (10marks)

Unseen comprehension, 15 marks & Story Writing, 15 (30 marks)

PAPER – III: DRAMA (F.M. 100)

William Shakespeare: *The Tempest*

George Bernard Shaw: *Pygmalion*

Literary Terms related to drama: aside/anagnorisis/catharsis/ catastrophe/ chorus/character/ climax/comic relief/conflict/denouement/ deus ex machine/ exposition/ farce/ hubris/ hamartia/ irony/ masque/peripeteia/plot/ unities

Unseen: Dialogue Writing & Composition

PROPOSED MARKS STRUCTURE:

Drama: 2 questions of 15 marks each from two plays (15x2=30)

2 explanations, each 5 marks (2x5=10)

10 Short questions, each 2 marks from the plays (10x2=20)

Literary Terms: attempt any 5, each 2 marks (5x2=10)

Unseen:

Dialogue (10 marks)

Composition (20 marks)

Part III

Paper IV/

Group A- Indian Short Fiction & Poetry (50marks)

Short Stories:

‘Iswaran’ - R.K.Narayan

‘The Tiger in the Tunnel’ - Ruskin Bond

‘Hungry Stones’ - Rabindranath Tagore

Poetry:

‘An Introduction’ - Kamala Das

‘Sita’ - Toru Dutt

‘The Golden Light’ - Sri Aurobindo

‘Dawn at Puri’ - Jayanta Mahapatra

‘A River’ - A.K. Ramanujan

Group B- Unseen (50 marks)

Precis

CV Writing

Comprehension

Proof Reading

Pattern of Questions:

Group A

Essay type question from fiction: 1x15

Locate & annotate from fiction: 2x5=10

Essay type question from poetry: 1x15

Locate & annotate from poetry: 2x5=10

Group B

Precis: 10

CV Writing : 10

Proof Reading: 10

Comprehension: 20

Total: 25+25+50=100

Draft Syllabus for BA/BSc Course in Geography

TO BE EFFECTIVE FROM THE ACADEMIC SESSION 2009-2010

FRAMED AT THE WORKSHOP HELD ON 20.4.2009 AND 21.4.2009



West Bengal State University

Berunanpukuria, Malikapur

Barasat, North 24 Parganas

West Bengal – 700126

General Papers

Section 1: Course Structure

Part	Type	Paper	Subject	Marks	Exam Time
I	Theoretical	I	Physical Geography	100	3 hours
II	Theoretical	II	Human and Regional Geography of India	100	3 hours
	Practical	III	Applied Geographical Techniques	100	
III	Theoretical	IV A	Applied Geography	70	
	Practical	IV B	Applied Geography Practical	30	

Section 2: Syllabus with Details of Marks Division

Part-I Paper

/// PAPER-I: PHYSICAL GEOGRAPHY

Full Marks: **100**

Examination Time: **3 hours**.

Number of Questions to be answered

Marks division of each group	Category wise marks	Number of questions to be answered	
		Category A (10marks)	Category B (5 marks)
Gr A = 40 Marks	20 + 20	2 out of 4	4 out of 7
Gr B = 30 Marks	10 + 20	1 out of 2	4 out of 7
Gr C = 30 Marks	10 + 20	1 out of 2	4 out of 7

GROUP A: GEOMORPHOLOGY

(40 MARKS)

1. Structure of the earth
2. Influence of rocks on topography: Limestone and Granite
3. Broad outline of plate tectonics and major crustal formations – fold mountains, trenches and island arcs.
4. Evolution of landforms under fluvial process, Normal Cycle of Erosion.
5. Processes of formation of erosional and depositional landforms: coastal and aeolian

GROUP B: CLIMATOLOGY

(30 MARKS)

1. Insolation and Heat Budget.
2. Horizontal and Vertical distribution of temperature and pressure.
3. Greenhouse effect.
4. Atmospheric disturbances: Tropical and Mid-latitude cyclones.
5. Characteristics of Monsoonal rainfall
6. Climatic classification after Köppen.

GROUP C: BIO-GEOGRAPHY

(30 MARKS)

1. Factors of soil formation.
2. Development of an ideal soil profile and eluviation and illuviation
3. Properties of soil: Physical (texture, structure) and Chemical (pH, organic matter).
4. Concept of zonal, azonal and intrazonal soils
5. Concept of Ecosystem and Biomes – i) Tropical Rainforest, ii) Hot Desert
6. Plant types and distribution (Halophyte, Xerophytes, Hydrophite, Mesophite).

Part-II Papers

/// PAPER-II: HUMAN GEOGRAPHY AND REGIONAL GEOGRAPHY OF INDIA

Full Marks: 100

Examination Time: 3 hours.

Number of Questions to be answered

Marks division of each group for examination	Category wise marks	Number of questions to be answered	
		Category A (10marks)	Category B (5 marks)
Gr A = 30 Marks	10 + 20	1 out of 2	4 out of 7
Gr B = 30 Marks	10 + 20	1 out of 2	4 out of 7
Gr C = 40 Marks	20 + 20	2 out of 4	4 out of 7

GROUP-A: POPULATION AND SOCIAL GEOGRAPHY

(30 Marks)

1. Factors of growth and distribution of world population.
2. Fertility, mortality and age-sex structure of population with reference to India.
3. Migration: Types, causes and consequences.
4. Contemporary Social issues: Literacy and poverty.

GROUP-B: ECONOMIC GEOGRAPHY

(30 Marks)

1. Sectors of the economy: primary, secondary, tertiary and quaternary: Changing emphasis through time.
2. Types of agriculture:

- a) Shifting cultivation of India.
 - b) Intensive subsistence rice farming in India.
 - c) Plantation farming in India: Tea and Coffee
3. Scales of production: cottage, small scale and large-scale industries — general characteristics and examples.
4. Location, problems and prospects of Indian industries.
- a) Cotton textile industry.
 - b) Heavy engineering industry: locomotive.
 - c) Petroleum refining industry

GROUP-C: REGIONAL GEOGRAPHY AND ENVIRONMENTAL ISSUES OF INDIA

(40 Marks)

1. Regions of India:
 - a) Concept of regions: formal and functional
 - b) Broad physiographic regions of India: special reference to Deccan Trappe
 - c) Agricultural Regions of India: special reference to Punjab-Haryana wheat belt,
 - d) Industrial Regions of India: special reference to Asansol-Durgapur industrial belt.
2. Indian monsoon and its impact: problem of flood, drought and cyclone.
3. Forest resources of India: issues concerning deforestation and social forestry.
4. Causes and consequences of soil erosion in India.

/// PAPER-III (PRACTICAL): APPLIED GEOGRAPHICAL TECHNIQUES

Full Marks: 100.

• *Group A to C*: Internal Assessment: 80 marks. • *Group D*: Evaluation of Field Report: 10 marks + Viva-voce on Field Report: 5 Marks • *Group E*: Viva-voce on Practical Notebook by external examiner: 5 marks.

GROUP-A: CARTOGRAPHY

1. Scales: Concept of scales, drawing of linear scales. (10 Marks)
2. Projections: Concept and major classification. Construction may be done graphically or mathematically (15 Marks)
 - a) Simple conic with one standard parallel
 - b) Cylindrical Equal Area
 - c) Polar Zenithal Gnomonic.
3. Cartograms: Choropleth, pie-graphs and square diagrams with proportional scales. (15 Marks)

GROUP-B: MAP INTERPRETATION

(20 Marks)

1. Basis of numbering and scale of Survey of India Topographical sheets.
2. Interpretation of 1:50,000 topographical sheets under the following heads:
 - I. Interpretation of relief and drainage from topographical maps with profiles and sketches.
 - II. Interpretation of communication and settlement from topographical maps with sketches.
 - III. Relationship between physical and cultural features with the help of transect chart.

GROUP-C: STATISTICS

(20Marks)

1. Nature and classification of data.

2. Process of tabulation and graphical representation: histogram, frequency polygon, cumulative frequency curve.
3. Measures of central tendency: mean, median and mode.

GROUP-D: FIELD REPORT

(Report 10 + 5 viva voce = 15 Marks)

Field Report on either a rural mouza or an urban ward (to be conducted during field excursion)

Guidelines for field report on rural mouza

One rural mouza is to be selected and the followings are to be done:

- (a) Landuse survey
- (b) Collection of socio-economic and physical data
- (c) Classification and tabulation of data
- (d) Preparation of landuse map on cadastral map
- (e) Preparation of maps and diagrams showing broad Physiography, drainage, settlement, demographic characteristics etc.

The report is to be prepared preferably under the following sections:

- (a) Introduction: Objective, extent and space relations, sources of information, methodology.
- (b) Physical components: drainage, surface condition, slope, climate, soil vegetation, etc.
- (c) Population: Number, FMR, literacy, occupational structure, religious composition, language, media exposure, per capita income (based on availability of data).
- (d) Settlement: Number of houses, building materials, number and size of rooms, amenities (based on availability of data)
- (e) Agriculture: irrigational facilities, general landuse, cropping intensity, production and marketing (based on availability of data).
- (f) Other economic activities: Fishing, horticulture, brick-making industries (based on availability of data).
- (g) Problems, prospects, suggestions and conclusion.
- (h) Bibliography.

Guidelines for field report on urban area

One urban area is to be selected and the followings are to be done:

- (a) Landuse survey
- (b) Collection of socio-economic data
- (c) Classification and tabulation of data
- (d) Preparation of urban landuse map
- (e) Preparation of maps and diagrams showing urban morphology, sewage networks, communication networks, traffic flow, demographic characteristics, cultural and economic zonation etc.

The report is to be prepared preferably under the following sections:

- (a) Introduction: Objective, extent and space relations, sources of information, methodology etc.
- (b) Physical components: Surface conditions, slope, drainage, climate etc.
- (c) Population: Number, FMR, literacy, occupational structure, religious composition, language, media exposure, per capita income (based on availability of data).
- (d) Town morphology: sectors of landuse.
- (e) Economy: Economic individuality of the town, production and marketing patterns, spatial

differences in occupation and per capita income characteristics (based on availability of data).

(f) Bibliography

Field report is to be hand-written.

Text of the report should not exceed 1500 words.

Maps and diagrams excluding photo-plates should not exceed 15.

GROUP E: VIVA-VOCE ON LABORATORY NOTEBOOK

(5 Marks)

Part-III Papers

/// PAPER-IV: APPLIED GEOGRAPHY

Full Marks: Theoretical: **70**

Practical: **30**

Examination Time: Theoretical: **hours.**

Practical: **hours**

Number of Questions to be answered for theoretical group

Marks division of each theoretical section	Category wise marks	Number of questions to be answered	
		Category A (10marks)	Category B (5 marks)
Gr A Section I = 40	20 + 20	2 out of 4	4 out of 7
Gr A Section II = 30	1 + 20	1 out of 2	4 out of 7

GROUP A: (THEORETICAL): APPLIED GEOGRAPHY

[70 Marks]

Section I: Land use and settlement Geography

(30 Marks)

1. Concept and attributes of land.
2. Objectives and principles of land use.
3. Factors influencing land use and land categories:
 - a) Agricultural land use.
 - b) Non-agricultural landuse.
4. Rural settlements: evolution, nature and effect of physical environment,
5. Urban settlements: definition, morphology and function.

Section II: Remote Sensing and Geographical Information System

(40Marks)

1. Concept of Remote Sensing, different methods of remote sensing – aerial photo and satellite imagery.
2. Aerial Photo: Types and interpretation keys; concept of principal point, fiducial marks, flight line, photo overlap.
3. IRS images: Sensors, different types of resolution and their applicability.
4. Concept of GIS and its applicability: Spatial and attribute data, raster and vector data structure and concept of information layers in GIS.

GROUP B: (PRACTICAL): APPLIED GEOGRAPHY

[30 Marks]

• *Item 1 to 2:* Internal Assessment: 24 marks. • *Item 4:* Evaluation of practical note book and viva-voce on Practical Notebook by external examiner: 6 marks.

1. Interpretation of Daily Weather Maps published by India Meteorological Department – Monsoon season (10 Marks)
2. Preparation of thematic maps: (7 Marks)
 - i) Flow diagram and ii) Determination of Detour Index
3. Aerial photo interpretation for identification of broad physical and cultural features. (7 Marks)
4. Laboratory Note Book and Viva-voce (3 + 3 = 6 Marks)

Section 3: Suggested books

/// PAPER-I:

Bandyopadhyay T and Sil A. K: Adhunik Bhu Porichoy, Chhaya Prakashani

Basu S.R and Maity R: Adhunik Bhumirupbigyan

Das P and Basu Swapna: Mrityikar kotha o Damodar Upatyakar Mrityika Khoyer Ruprekha

Dash, M.C., Fundamentals of Ecology, 2nd edition, Tata McGraw-Hill, New Delhi.

De, N.K. and Chattopadhyay, S. Jib Bhugol, Sribhumi Publishing Co.

De, N.K. Mrittika Bhugol, West Bengal State Book Board.

Lal, D.S. Climatology, 3rd edition, Chaitanya Pub. House, New Delhi.

Mukhopadhyay, S.C and Das, R.K. Bhumiruper Udbhab O Prakiti, Volumes 1 & 2, West Bengal State Book Board

Saha, P. Adhunik jalabauibidya, West Bengal State Book Board.

Sidhartha K: Biogeography

Singh, S : Physical Geography, Prayag Pustak Bhawan, Allahabad

Singh, S. Geomorphology, Prayag Pustak Bhavan, Allahabad: 390p.

/// PAPER-II:

Bandyopadhyay, T. and Mallik, G. Arthanaitik Sampad Samiksha, Chhaya Prakashani

Bhattacharyya, A and Bhattacharyya, B. Samaj Bijniya Bhugol, West Bengal State Book Board.

Chattopadhyay, A. Sampad Samiksha / Arthanaitik Bhugol O Sampad Shastrer Parichay, TD Publications

Guha, J .L. and Chatteraj, P.R. 1998. A New Approach to Economic Geography: A Study of Resources, 15th edition, World Press, Calcutta.

Hartshorn, T.A. and Alexander, J.W. 1988. Economic Geography, 3rd edition, Prentice- Hall India Ltd., New Delhi.

Khullar, D.R. 1999. A Comprehensive Geography of India, Kalyani Publishers, New Delhi.

Leong, G.C. and Morgan, G.C. 1982. Human and Economic Geography, 2nd edition, Oxford University Press, Oxford.

/// PAPER-III (Practical):

Das D and Hazra J. Snatok Byaboharik Bhugol. Chhaya Prokashoni

Sarkar A. Practical Geography. Revised edition. Orient Blackswan Private Ltd.

/// PAPER-IV:

Group-A (Theoretical):

Sen Jyotirmoy. Janabasati Bhugol

Rajan, M.S. Space Today, 2nd edition, National Book Trust, New Delhi.

De N.K. Land – multifaceted appraisal and management

Pradhan N and Bhattacharya D. Adhunik Bhu-bigyan

Group-B (Practical):

Das D and Hazra J. Snotok Byaboharik Bhugol. Chhaya Prokashoni

Sarkar A. Practical Geography. Revised edition. Orient Blackswan Private Ltd.

Honours Papers

Section 1: Course Structure

Part	Type	Paper	Subject	Marks	Exam Time
I	Theoretical	I	Geotectonics, Geomorphology & Hydrology	100	4 hours
		II	Economic & Population Geography	100	4 hours
II	Theoretical	III	Climatology, Soil Geography & Biogeography	100	4 hours
	Practical	IV	Applied Geographical Techniques	100	6 hours
III	Theoretical	V	Social, Political and Regional Geography	100	4 hours
		VI	Philosophy of Geography and Contemporary Issues in Geography	100	4 hours
	Practical	VII	Applied Geographical Techniques and Field Report	100	6 hours
		VIII	Statistical Techniques and Practical on Contemporary issues in Ggeography	100	6 hours

Section 2: Syllabus with Details of Marks Division

Part-I Papers

/// PAPER-I: GEOTECTONICS, GEOMORPHOLOGY & HYDROLOGY

Full Marks: 100

Examination Time: 4 hours.

Number of Questions to be answered

Marks division of each group	Category wise marks	Number of questions to be answered	
		Category A (10marks)	Category B (5 marks)
Gr A = 30 Marks	10 + 20	1 out of 4	4 out of 7
Gr B = 40 Marks	20 + 20	2 out of 4	4 out of 7
Gr C = 30 Marks	10 + 20	1 out of 2	4 out of 7

GROUP A: GEOTECTONICS

(30 MARKS)

1. Geological timescale
2. Structure of the earth: crust and interior.
3. Isostasy: concepts postulated by Pratt and Airy.
4. Continental Drift, Sea Floor Spreading.
5. Plate Tectonics as explanation of mountain building, volcanism and earthquakes.

GROUP B: GEOMORPHOLOGY

(40 MARKS)

1. Processes of weathering and mass wasting and their impact on landforms
2. Influence of lithology on landforms: Granite and Basaltic landforms.
3. Definition and classification of folds and faults.
4. Evolution of landforms in Uniclinal, Folded and Faulted Structures.
5. Development of landforms: Fluvial, Glacial, and Coastal.
6. Cyclic and non-cyclic concepts of landscape evolution: Davis, Penck and Hack.

GROUP C: HYDROLOGY AND OCEANOGRAPHY

(30 MARKS)

1. Global hydrological cycle and its significance.
2. Aspects of runoff, infiltration, evaporation and transpiration, Runoff cycle.
3. Factors influencing ground water movement and storage.
4. Ocean sediments: origin, classification.
5. Salinity and temperature of ocean water.

/// PAPER-II : ECONOMIC & POPULATION GEOGRAPHY

Full Marks: 100

Examination Time: 4 hours.

Number of Questions to be answered

Marks division of each group	Category wise marks	Number of questions to be answered	
		Category A (10marks)	Category B (5 marks)
Gr A = 60 Marks	20 + 40	2 out of 4	8 out of 11
Gr B = 40 Marks	20 + 20	2 out of 4	4 out of 7

GROUP A: ECONOMIC GEOGRAPHY

(60 MARKS)

1. Resource: Concept and classification. Economic and environmental approaches of resource utilisation.
2. Different sources of energy resources, production and consumption with special reference to coal, petroleum, solar and wind.
3. Characteristic of economies:
 - a) Fishing, b) Agricultural, c) Manufacturing
4. Selected production systems:
 - a) Intensive rice farming: India and South East Asia.

- b) Extensive wheat farming: USA and Canada.
 - c) Plantation farming: Tea in India and rubber in SE Asia.
 - d) Cotton textile industry: India and USA.
 - e) Iron and Steel industry: India and Japan.
 - f) Petrochemical industry: India and USA.
 - g) Paper industry: India and Canada.
5. Economic models:
- a) Agricultural: Von Thunen
 - b) Industrial: A. Weber
 - c) Developmental: S. Myrdal

GROUP B: POPULATION GEOGRAPHY

(40 MARKS)

1. Concept of Human resources.
2. Population structure — a) age and b) sex.
3. Population composition — a) economic and b) linguistic.
4. Population distribution and density: World and India.
5. Population growth and its related problems: India and China.
6. Fertility and Mortality.
7. Migration : Types, causes and consequences
8. Theories of population growth: a) Malthus, b) Marx, c) Demographic transition
9. Concept of optimum population, overpopulation and under-population. Population explosion and its impact on physical and cultural environment

Part-II Papers

/// PAPER-III: CLIMATOLOGY, SOIL GEOGRAPHY & BIOGEOGRAPHY

Full Marks: 100

Examination Time: 4 hours.

Number of Questions to be answered

Marks division of each group for examination	Category wise marks	Number of questions to be answered	
		Category A (10marks)	Category B (5 marks)
Gr A = 40 Marks	20 + 20	2 out of 4	4 out of 7
Gr B = 30 Marks	10 + 20	1 out of 2	4 out of 7
Gr C = 30 Marks	10 + 20	1 out of 2	4 out of 7

GROUP A: CLIMATOLOGY

(40 MARKS)

1. Nature, composition and layering of the atmosphere.
2. Factors affecting insolation & heat budget of the atmosphere.

3. Horizontal and vertical distribution of temperature, inversion of temperature.
4. Green house effect on global environment, importance of ozone layer.
5. Planetary wind system with special reference to tri-cellular model, Rossby Waves, Jet Streams
6. Genesis of Monsoon and its relation with Jet Stream, El Nino and La Nina.
7. Processes of condensation and mechanism of precipitation: Bergereon-Fiendison, Collision-Coalescence theories. .
8. Tropical and mid latitude cyclones.
9. Climatic classification after Koppen and Thornthwaite.

GROUP B: SOIL GEOGRAPHY

(30 MARKS)

1. Soil: Definition, factors and processes of formation.
2. Concept of zonal, azonal and intra-zonal soils, profile development under different conditions – Podzols, Chernozems and Laterites.
3. Physical properties of soil: texture, structure, colour and moisture.
4. Chemical properties of soil: pH and organic matter.
5. Soil erosion: types, factors and management.
6. Principles of soil classification: Genetic and Taxonomical – with special reference to India.
7. Principles of land classification: USDA

GROUP C: BIO-GEOGRAPHY

(30 MARKS)

1. Definitions of biosphere and biogeography. Concept of ecosystem – basic ecological principles – ecotone, communities, niche, succession, and habitat.
2. Ecosystem and energy: Energy sources, laws of energy exchange, food chains and food web.
3. Concept of Biomes: study of Tropical rainforest, Taiga, Savannah, Desert, Tundra and Temperate grasslands.
4. Spatial distribution of world fauna.
5. Concept of Biodiversity and wildlife conservation in India, Projects and their importance – Project Tiger and Man and Biosphere Programme.

/// PAPER-IV (PRACTICAL): APPLIED GEOGRAPHICAL TECHNIQUES

Full Marks: 100.

Examination Time: 6 hours. Pattern of setting Questions: • *Topic 1 to 6:* Six compulsory questions are to be set, one from each topic • *Topic 7:* Evaluation of Practical Notebook: 5 marks. Viva-voce: 5 marks.

1. **Scales:** Linear, diagonal and vernier, enlargement and reduction of map (10 Marks)
2. **Megascopic analysis of minerals and rocks :** (10 marks)
 - a) Rocks – Granite, Basalt, Dolerite, Shale, Sandstone, Limestone, Conglomerate, Slate, Phyllite, Schist, Marble, Quartzite, Gneiss.
 - b) Minerals and ores – Talc, Gypsum, Calcite, Mica, Feldspar, Quartz,

Chalcopyrite, Hematite, Magnetite, Bauxite, Galena.

3. **Interpretation of topographical maps of Plateau region with R.F 1: 50,000:** (20 marks)
- a) Demarcation of drainage basin (not more than 4th order, based on Strahler)
 - b) Construction of profiles: superimposed, projected, composite and long profile of river (length of the river not more than 10 km).
 - c) The morphometric analysis to be done in 10 X 12cm grid
 - i Drainage density (to be shown by isopleth)
 - ii Average slope (Wentworth's method to be shown by isopleth)
 - iii Relative Relief (to be shown by isopleth)
 - d) Road density (to be shown gridwise).
 - e) Interpretation of relief, drainage and vegetation characteristics.
 - f) Interpretation of settlement, transport and communication systems.
 - g) Relationship between physical and cultural elements (Transect Chart, not more than 8 km).
4. **Cartograms and thematic mapping :** (10 Marks)
- a) Choropleth showing density of population
 - b) Dots and Spheres diagram showing distribution of rural and urban population.
 - c) Proportional pie-diagrams representing economic data and landuse data.
5. **Projections:** (20 Marks)
- a) Concept, classification, constructions and suitability
 - b) Construction and properties of:
Zenithal Gnomonic and Stereographic (Polar Case), Simple Conic (with one standard parallel), Bonne's, Sinusoidal, Polyconic, Cylindrical Equal Area and Mercator's Projections.
6. **Survey:** (20 Marks)
- a) Closed traverse survey by Prismatic Compass.
 - b) Levelling by Dumpy Level with at least one change point: Drawing of profile and determination of gradient.
7. **Laboratory Note Book + Viva voce** (5 + 5 = 10 Marks)

Part-III Papers

/// PAPER-V: SOCIAL, POLITICAL AND REGIONAL GEOGRAPHY

Full Marks: **100**

Examination Time: **4 hours.**

Number of Questions to be answered

Marks division of each group	Category wise marks	Number of questions to be answered	
		Category A (10marks)	Category B (5 marks)
Gr A = 60 Marks	20 + 40	2 out of 4	8 out of 11
Gr B = 40 Marks	20 + 20	2 out of 4	4 out of 7

GROUP A: SOCIAL, CULTURAL AND POLITICAL GEOGRAPHY

(60 MARKS)

Social and Cultural Geography

1. Concept of culture and its components with special emphasis on India: language, religion and ethnicity.
2. Social geography of rural India: caste structure and social stratification; tribe – Santhals and Lepcha.
3. Urban social Geography — Social ecology and social space.
4. Rural settlements – its forms, site and situations.
Urban settlement – morphology and hierarchy.

Political Geography

5. Concept of Political Geography and geo-politics; concept of frontier and boundary
6. Concept of cold war; bi-polarisation and unipolarisation.
7. Political geography of India: Administrative settings of India, problem of border states, partition and its geo-political implications.

GROUP B: REGIONAL GEOGRAPHY

(40 Marks)

1. Concepts of regions; basis of regionalization with reference to India physical, economic and planning.
2. a) Physiographic Regions of India with special reference to Kashmir Himalaya
b) Agricultural Region of India of India with special reference to Punjab-Haryana
c) Industrial Region of India with special reference to Mumbai-Pune industrial belt
3. Regional disparities in India: causes and implications

/// PAPER-VI: PHILOSOPHY OF GEOGRAPHY AND CONTEMPORARY ISSUES

FULL MARKS: 100

Examination Time: 4 hours.

Number of Questions to be answered

Marks division of each group	Category wise marks	Number of questions to be answered	
		Category A (10marks)	Category B (5 marks)
Gr B = 40 Marks	20 + 20	2 out of 4	4 out of 7
Gr A = 60 Marks	20 + 40	2 out of 4	8 out of 11

GROUP A: PHILOSOPHY OF GEOGRAPHY

(40 MARKS)

1. Definition and nature of Geography.
2. Selected contributors in the evolution of geographical thought Humboldt, Vidal de la Blache, Carl Sauer and David Harvey
3. Major postulates: Determinism, Possibilism, Regional differentiation, location, time and space.
4. Changing approaches and methodology: Positivism, Quantitative Revolution, Welfare-Behavioural approach, Structural and radical approach

GROUP B: CONTEMPORARY ISSUES IN GEOGRAPHY

(60 marks)

Section -1: Natural hazards and their management in the Indian Sub-continent:

5. Concept of hazards and disasters: Natural, quasi-natural and man-made hazards, different approaches in hazard management.
6. Climatic hazards: Flood, drought and cyclone mechanism – environmental impact and management.
7. Geomorphic hazards: landslide, river bank erosion, coastal erosion environmental impact and management.
8. Edaphic and biotic hazards: Deforestation, desertification, loss of bio-diversity — environmental impact and management.

Section-2: Economic and human development in the Third World

9. Concept of third world, concept of development and under development: Basic indicators of economic, human and gender development.
10. Problems of third world – Poverty, Population explosion, food security and hunger, unemployment, malnutrition and child labour.
11. Globalization and sustainable development.
12. Problem of urbanization.

PAPER VII: APPLIED GEOGRAPHICAL TECHNIQUES (PRACTICAL)

FULL MARKS: 100

Examination Time: 6 hours.

13. Interpretation of geological maps and drawing of sections: Uniclinal, folds with unconformity and igneous intrusions (20 marks)
14. Interpretation of Indian Daily Weather Maps – Monsoon and Post Monsoon. (15 marks)
15. Remote Sensing (15 marks)
 - a. Basic concept of remote sensing, EMR, Band
 - b. Types of satellites and sensors with special reference to IRS series of satellites; types of resolutions and their applicability
 - c. Principles of preparing standard false colour composite, landuse and land cover mapping from standard FCC with header information.
 - d. Interpretation of aerial photograph – basic principles of aerial photography, side lap, end lap, flight line, air base, fiducial marks, Principle Point, Nadir Point, Conjugate Principal Point,
 - e. Preparation of aerial photo mosaics, demarcation of effective area, extraction of cultural and physiographic features within this area with preparation of interpretation key.
16. Geographical Information System. (15 marks)
 - a. Concept of GIS and its applicability: Spatial and attribute data, raster and vector data structure and concept of information layers in GIS.
 - b. Georeferencing of scanned maps and ascribing projection (Polyconic/ UTM)
 - c. Digitisation of point, line and polygon layers; Attachment of appropriate attribute tables.
 - d. Preparation of thematic maps from attached data: choropleth, pie chart and bar graphs.
17. Field Report: (10 report + 15 viva = 25 marks)

Guidelines for field report on rural mouza

 - One rural mouza is to be selected and the followings are to be done:
 - Landuse survey and preparation of landuse map
 - Collection of socio-economic and physical data
 - Classification and tabulation of data
 - Preparation of maps and diagrams showing broad Physiography, drainage, settlement, demographic characteristics etc.
 - The report is to be prepared preferably under the following sections:
 - Introduction: Objective, extent and space relations, sources of information, methodology.
 - Physical components: drainage, surface condition, slope, climate, soil vegetation, etc.
 - Population: Number, literacy, occupational structure, religious composition, language, media exposure, per capita income (based on availability of data).
 - Settlement: Number of houses, building materials, number and size of rooms, amenities (based on availability of data)
 - Agriculture: irrigational facilities, general landuse, cropping intensity, production and marketing (based on availability of data).
 - Other economic activities: Fishing, horticulture, brick-making industries (based on availability of data).

- Problems, prospects, suggestions and conclusion.
- Bibliography.
- Appendix

Guidelines for field report on urban area

- One urban area is to be selected and the followings are to be done:
- Landuse survey and preparation of urban landuse map
- Collection of socio-economic data
- Classification and tabulation of data
- Preparation of maps and diagrams showing urban morphology, communication networks, traffic flow, demographic characteristics, cultural and economic zonation etc.
- The report is to be prepared preferably under the following sections:
- Introduction: Objective, extent and space relations, sources of information, methodology etc.
- Physical components: Surface conditions, slope, drainage, climate etc.
- Population: Number, literacy, occupational structure, religious composition, language, media exposure, per capita income (based on availability of data).
- Town morphology: sectors of landuse.
- Economy: Economic individuality of the town, production and marketing patterns, spatial differences in occupation and per capita income characteristics (based on availability of data).
- Urban waste and its management: Types of wastes generated, network of drains, efficiency of waste removal and sewage treatment. peoples' perception of pollution problem (based on availability of data).
- Bibliography
- Appendix
- Maps and diagrams can be hand-drawn or done in computer
- Field report can be hand-written or computer printed.
- Page limit: maps/diagrams excluding photographs not to exceed 20 pages, text not to exceed 5000 words.

18. Laboratory Note Book and viva-voce

(5 + 5 = 10 Marks)

PAPER-VIII: STATISTICAL TECHNIQUES AND CONTEMPORARY ISSUES IN GEOGRAPHY (PRACTICAL)

FULL MARKS: 50 + 50 = 100

Group-A: Statistical Techniques

(50 Marks)

1. Nature of statistical data: discrete, continuous, parametric and non-parametric data.
2. Tabulation and classification of statistical data.
3. Frequency distribution: histogram, frequency polygon, ogive, normal and skewed distribution, measures of skewness.
4. Measures of central tendency: mean, median, mode, partition values : quartile, decile, percentile.
5. Measures of dispersion: mean deviation, quartile deviation, semi-quartile range, standard deviation and co-efficient of variation.

6. Simple bivariate correlation and regression trend line.
7. Time series analysis.
8. Laboratory Note Book and viva-voce (5+5=10 Marks)

Group-B: Contemporary issues in Geography (50Marks)

Section-A : Representation of climatic and hydrological data of the Indian Sub-continent.

1. a) Preparation and Interpretation of a climatic chart showing relationship between rainfall, temperature, pressure and relative humidity of a station for three months, preparation and interpretation of Taylor's Climograph and Hythergraph.
b) Preparation of station models for different meteorological stations of India with the help of Synoptic chart.
2. Preparation and interpretation of rating curves, hydrographs and unit hydrographs of rivers flowing through the Indian Sub-continent.

Section-B: Economic and Human Development in Third World.

Questions to be set on any two items of the following exercises:

3. Computation of Human and Gender Development Index and ranking of countries/states/districts based on HDI and GDI.
4. Preparation of questionnaire schedule for assessment of development and for perception survey.
5. Measures of Spatial and size-class distribution.
6. a) Dominant-distinctive function.
b) Rank-size rule.
c) Lorenz curve.
7. Laboratory Note Book and via-voce (5+5=10 Marks)

Section 3: Suggested Readings

PAPER-I: GEOTECTONICS, GEOMORPHOLOGY & HYDROLOGY

Geotectonics

- Cox, A. and Hart, R.B. 1986. *Plate Tectonics: How it Works*, Blackwell Scientific Publications, Oxford.
- Duff, P.M.D. (Editor) 1994. *Holmes' Principles of Physical Geology*, English Language Book Society / Chapman & Hall, London.
- Keary, P. and Vine, M. 1997. *Global Tectonics*, 2nd edition. Blackwell Scientific Publications, Oxford: ix+302p.
- Powell, J. 2001. *Mysteries of Terra Firma: The Age and Evolution of the Earth*, Free Press, London: 272p.

Geomorphology

- Ahmad, E. 1990. *Geomorphology*, Kalyani Pub. New Delhi.
- Bloom, A.L. 1998. *Geomorphology: A Systematic Analysis of Late Cenozoic Landforms*, 3rd edition, Prentice Hall India Ltd. New Delhi.
- Dayal, P. 1990. *A Textbook of Geomorphology*, Shukla Book Depot, Patna.
- Fairbridge, S.W. *Encyclopaedia of Geomorphology*, Reinhold Corp. Ltd.
- Faniran, A. and Jeje, L.K. 1983. *Humid Tropical Geomorphology*, Longman, London.
- Kale, V.S. and Gupta, A. 2001. *Introduction to Geomorphology*, Orient Longman Ltd., Hyderabad.
- Selby, M.J. 1985. *An Introduction to Geomorphology*, Clarendon, Oxford.
- Singh, S. 2000: *Geomorphology*, 2nd edition, Prayag Pustak Bhavan, Allahabad..
- Stahler and Strahler 2002: *Geography and Man's Environment*, John Wiley, New York.
- Summerfield, M.A. (Editor) 1991. *Global Geomorphology : An Introduction to the Study of Landforms*, John Wiley and Sons Ltd., New York.
- Thornbury, W.D. 1969. *Principles of Geomorphology*, 2nd edition, Wiley Eastern Limited, New Delhi.
- Woolridge, S.W. and Morgan, R.S. 1959. *Outline of Geomorphology: The Physical Basis of Earth*, Longman, London.

Hydrology and Oceanography

- Chorley, R.J. and Kates, R.W. (Editors) 1969. *Water Earth and Man*, Methuen, London.
- Chow, V. T, Maidment, D. R. and Mays, L. W. 1988 : *Applied Hydrology*, McGraw Hill, New York
- Meinzer, O. E. 1942 : *Hydrology*, Dover Publication Inc. New York.
- Sharma, R.C. and Vatal, M. *Oceanography for Geographers*, Chaitanya Pub. House, Allahabad.
- Todd, D. K. 1959 : *Ground Water Hydro-logy*, John Wiley and Sons, New York.

PAPER-II: ECONOMIC GEOGRAPHY & POPULATION GEOGRAPHY

- Brock and Webb. *Geography of Mankind*.
- Chand and Puri: *Regional Planning*.
- Chandna, R.C. 2000. *Population*, Kalyani Publishers, New Delhi.
- Clark, G.L., Gertler, M.S. and Feldman, M.P. 2003. *The Oxford Handbook of Economic Geography*, Oxford University Press, Oxford.
- Guha, J. L. and Chattoraj, P.R. 1998. *A New Approach to Economic Geography: A Study of Resources*, 15th edition, World Press, Calcutta.
- Guha, J. L. and Charraraj, P. R. 1992 : *Human and Economic Geography*, World Press, Calcutta.
- Hartshorn, T.A. and Alexander, J.W. 1988. *Economic Geography*, 3rd edition, Prentice- Hall India Ltd., New Delhi.

Jones and Darkenwald: Economic Geography

Khullar India, Janasankha Bhugol. Rajya Pustak Parishad.

Leong, G. C. and Morgan, G. C. 1982 : Human and Economic Geography, Oxford University Press, Kuala-Lumpur.

Leong, G.C. and Morgan, G.C. 1982. Human and Economic Geography, 2nd edition, Oxford University Press, Oxford.

Mamoria, C. B. 1984 : Economic and Commercial Geography of India, Shivlal Agarwal Publication Co. Agra.

Sharma, T. C. and Coutinho, 1988 : Economic and Commercial Geography of India, Vikas Publishing House, New Delhi.

United Nations Populations Fund 1997. India Towards Population and Development Goals, Oxford University Press, New Delhi.

Weddell, B.J. 2002. Conserving Living Natural Resources in the Context of a Changing World, Cambridge University Press, Cambridge: 442p.

/// PAPER-III: CLIMATOLOGY, SOIL GEOGRAPHY & BIOGEOGRAPHY

Climatology

Barry, R.G. and Chorley, R.T. Atmosphere, Weather and Climate, 7th edition, Routledge, London.

Critchfield, H.J. 1983: General Climatology, 4th edition, Prentice Hall India Ltd., New Delhi..

Das, P.K. 1995. Monsoons, 2nd edition, National Book Trust, New Delhi..

Lal, D.S. 1993. Climatology, 3rd edition, Chaitanya Pub. House, New Delhi..

Sidhartha, K: Atmosphere, weather and climate

Trewartha, G.T: An Introduction to Climatology.

Soil Geography

Biswas, T.D. and Mukherjee, S.K. 1987. Textbook of Soil Science, Tata-McGraw-Hill..

Brady, N.C. and Weil, R.R. 1996. The Nature and Properties of Soil, 11th edition, Longman, London.

Floth, H.D. 1990. Fundamentals of Soil Science, 8th edition, John Wiley and Sons, New York.

Morgan, R.P.C. 1995. Soil Erosion and Conservation, 2nd edition, Longman, London.

Joffe J.S: ABC of soil, Pub Oxford Book Company

Biogeography

Chapman J.L. and Reiss, M.J. 1993. Ecology: Principles and Applications, Cambridge University Press, Cambridge.

Dash, M.C., 2001. Fundamentals of Ecology, 2nd edition, Tata McGraw-Hill, New Delhi.

Kormondy, E.J. 1996. Concepts of Ecology, 4th edition, Prentice-Hall, India, New Delhi.

Odum, E.P. 1997. Ecology: A Bridge between Science and Society, Sinaur Associates Inc. Publishers, Sunderland.

Sharma. P.D. 1996. Ecology and Environment, 7th edition, Rastogi Publications, Mirat..

Simmons I.J: Ecology of Natural Resource.

Simmons, I. G. 1980: Biogeographical Processes, George Alien and Unwin, London.

Spellerberg, I.F and Sawyer, J.W.D. 1999. An Introduction to Applied Biogeography, Cambridge University Press, Cambridge..

World Wide Fund for Nature-India (Eastern Region) 1995. Nature Conservation Handbook, Calcutta.

/// PAPER-IV (PRACTICAL) : CARTOGRAPHIC TECHNIQUES IN GEOGRAPHY

Kanetkar, T.P. and Kulkarni, S.V. 1988. Surveying and Levelling, Part I, Pune Vidyarthi Griha Prakashan, Pune: 608p.

Kellaway, G.P. 1979. Map Projections, 1st Indian edition, B.I. Publication, Delhi.

Monkhouse F.J. and Wilkinson, H.R. 1971. Maps and Diagrams: Their Compilation and Construction, B.I. Publications Private Limited, New Delhi: 527p.

Roy, P. 1988. An Analytical Study of Map Projections, Volume 1, Pub?, Kolkata.

Sarkar, A.. Practical Geography: A Systematic Approach, Orient Longman Ltd., Hyderabad: p.

Suggested Readings for Part III under preparation

WEST BENGAL STATE UNIVERSITY

B.A. (HONS)

HISTORY (108)



SYLLABUS
(Introduced from 2011)

PART I

Paper I: History of India from Earliest Times to C.650 AD

Paper II: History of India from 650 to 1556 AD

PART II

Paper III: History of India from 1556 to 1857 AD

Paper IV: Transformation of Europe from 15th to 17th Centuries

PART III

Paper V: History of India from 1857 to 1971 AD

Paper VI: History of Europe from 1789 to 1919 AD

Paper VII: World since 1919

Paper VIII: Optional Paper (any one of the following)

(A) History of East Asia since 1839

(B) Aspects of the History of Modern Southeast Asia

Paper I: History of India from Earliest Times to C.650AD

1. Geographical Background – Sources and approaches to ancient Indian history: literary sources – Archaeological sources: epigraphy, numismatics, monuments.
2. Prehistory and Protohistory: from Palaeolithic culture to Neolithic Age – Economic and technological developments – Growth of chalcolithic village societies – The Harappan civilization: origin and antiquity, distribution, morphology of major sites, agrarian base, craft production and trade, religious beliefs and practices, art and architecture and the script – The first urbanization; problems of urban decline and the late Harappan Cultures.
3. Background to early historic India: (a) The Aryan problem. (b) Society, economy, polity and religion as reflected in Vedic literature. (c) Iron age cultures.
4. Society and religion: (a) Material and ideological background. (b) Jainism, Buddhism, Ajivikas and other systems. (c) Expansion of settlements and the second urbanization. (c) Social structure.
5. Age of imperial unity: (a) Mahajanapadas and Janapadas – Early monarchical states and ganasanghas – Rise of the Magadhan empire. (b) The Mauryan Empire: nature and bases – Political and cultural relations – Asoka's Dhamma: its nature and propagation. (c) The Mauryan polity and administration – Society and economy — Art and architecture – The decline of the Mauryas.
6. Post-Mauryan developments (c.200 BC- c. 300 AD): (a) Foreign Invasions and their impact: Bactrian Greeks, Scythians, – Tamil chieftains: Chera, Chola, Pandyas. (b) Religion: spread of jainism and Buddhism, Mahayana Buddhism, Vaisnava and Saiva forms of worship, beginning of Tantric practices. (c) Culture: art and architecture, sculpture, literature, scientific and technical treatises. (d) Sangama Age: society, language and literature, Megaliths, Tamilagam.
7. Age of the Guptas: (a) Emergence, expansion and downfall of the Gupta empire. (b) State and administrative institutions – Social and economic changes with special reference to urban patterns, agrarian structure, land grants, coinage and currency system, trade. (c) Cultural developments: art, architecture, sculpture, painting and literature, religion, Sanskrit theatre – cultural contacts with Central Asia.
8. Post- Gupta period: (a) Harshavardhana: political and administrative institutions. (b) Peninsular India: Chalukyas, Rashtrakutas, Pallavas: polity, society and economy – Cultural developments with emphasis on art and architecture. (c) Rise of Sasanka in Bengal.

References

1. Habib, Irfan, *Pre-History (Prak-Itihas in Bengali)*.
2., *The Indus Civilization (Sindhu Savyata in Bengali)*.
3. Chakrabarti, D. K., *India, an Archaeological History, Paleolithic Beginnings to Early Historic Foundations*.
4., *Bharatbarsher Pragitihas (in Bengali)*.
5. Chattopadhyay, B.D. *A Survey of Historical Geography of Ancient India*
6. Allchin, Raymond and Bridget, *The Rise of Civilization in India and Pakistan*.
7. Ratnagar, Shereen, *The Harappan Civilization*.
8., *Harappa Savyatar Sandhane (in Bengali)*.
9. Wheeler, R. M., *The Indus Civilization*.
10. Thapar, Romila, *History of India, 1000 BC-1526 (Bharatbarsher Itihas in Bengali)*.

11., *Asoka and the Decline of the Mauryas* (*Asoke o Mauryader Patan* in Bengali).
12., *Mauryas Revisited*
13. Goyal, S. R., *History of Imperial Guptas*.
14. Raychaudhuri, H. C., *Political History of Ancient India* (*Prachin bharater Rajnaitik Itihas* in Bengali).
15. Kosambi, D. D., *An Introduction to the Study of Indian History* (*Bharat-Itihas Charchar Bhumika* in Bengali).
16. -----, *Culture and Civilization of Ancient India*
17. Basham, A. L., *The Wonder That Was India*.
18. Mukherjee, B. N., *Rise and Fall of the Kushana History*.
19., *Itihaser Alope Arya Samasya* (in Bengali).
20., *Economic Factors in Kushana History*.
21. Majumdar, R. C. et. al. (ed), *History and Culture of the Indian People*, Vol. 1, 2 and 3.
22. Rapson, E. J. (ed), *The Cambridge History of India*, Vol. I.
23. Jha, D. N., *Ancient India in Historical Outline*.
24. Sharma, R. S., *Perspectives in Economic and Social History of Early India* (*Prachin Bharater Samajik o Arthanaitik Itihas* in Bengali).
25. -----, *India's Ancient Past*
26. Chakravarti, Ranabir, *Prachin Bharater Arthanaitik Itihaser Sandhane* (in Bengali).
27. Bhattacharji, Sukumari, *Itihaser Aaloke Vaidik Sahitya* (in Bengali).
28. Majumdar, A. K., *Concise History of Ancient India*, Vol. I.
29. Chattopadhyay, Sunil, *Prachin Bharater Itihas*, Vol. I and II.
30. K.A.N Shashtri, *History of South India*

Paper II: History of India, 650-1556 A.D.

1. (a) Early medieval India: historiography and recent debates. (b) Sources: epigraphy, numismatics and literature.
2. (a) Political developments: nature of regional politics; Pratiharas, Palas, Cholas and their contemporaries. (b) Arab invasions; Ghaznavid and Ghorid invasions: nature and impact.
3. (a) Agrarian economy: land grants and agrarian expansion; changes in land tenure; peasants intermediaries and landed magnates; regional variations. (b) Urban centres, trade and trade networks; craft guilds and manufactures; trade contacts with South East Asia and West Asia; coinage and currencies.
4. (a) Literature: rise and growth of regional languages. (b) Art, architecture, painting and sculpture. (c) Schools of philosophy and religious cults. (d) Science and technology.
5. (a) The Delhi Sultanate: historiography and sources. (b) Political structure in the Turko-Afghan period: overview of political history; ruling elites; military organization; territorial changes; Mongol threats; legitimization of political authority; theories of kingship; symbols and rituals of sovereignty; Sufis, Bhaktas and Nathapanthis; iqta system; relations with rural intermediaries.
6. Society and economy in North India: (a) Environmental context; agricultural production and technology. (b) Rural society and revenue system. (c) Urbanisation and non-agricultural production. (d) Monetisation, market regulations and trade. (e) Indian Ocean trade.
7. Religion and culture: (a) Sufism – doctrines, *silsilas*, practices. (b) Bhakti – Kabir, Nanak and Sant tradition. (c) Religion and religious identities – cults; Vaishnav movement in eastern India; Jagannath cult in Orissa; Warkair movement and Vithoba cult in Maharashtra. (d) Sultanate architecture; regional art and architectural forms. (e) Literature: Persian and Indian languages.

8. (a) Regional political formations: Rajasthan, Vijaynagar, Bengal; historiographical issues; sources – regional chronicles, bardic narratives, Sufi and Bhakti texts; travelogues. (b) Regional society and economy: Vijaynagar and Bahamani kingdoms. (c) Trade and urbanisation in South India.
9. Afghan despotism

References

1. B.D. Chattopadhyay, *The Making of Early Medieval India*
2. R.S. Sharma, *Social Changes in early Medieval India, 500-1200 AD*
3. D.N. Jha, *The Feudal Order: State Society and Ideology in Early Medieval India*
4. K.A.N. Shashtri, *The Cholas*
5. B.N.S. Yadava, *Society and Culture in Northern India in the 12th Century*.
6. Hermann Kulke, ed. *The State in India 1000-1700*.
7. Tapan Raychaudhry, ed. *Cambridge Economic History of India*, vol. 1
8. I.H. Quershi, *Administration of the Sultanate of Delhi*
9. Md. Habib and K.M. Nizami, ed. *Comprehensive History of India*, vol. 5
10. R.S. Tripathi, *Some Aspects of Muslim Administration*
11. Satish Chandra, *Medieval India*, vol. 1
12. N.N. Bhattacharyya, ed. *Medieval Bhakti Movements in India*
13. S.A.A. Rizvi, *History of Sufism in India*
14. Burton Stein, *Vijaynagara*
15. J.N. Sarkar, ed. *History of Bengal*, vol. 2

Paper III: History of India, 1556-1857 A.D.

1. (a) Mughal historiography – different approaches. (b) Sources – Abul Fazl, Badauni, Abdul Hamid Lahori, Bernier.
2. (a) Overview of the growth of Mughal power till Akbar. (b) Evolution of the administrative system under Akbar and his successors: Mansab and Jagir (c) The Mughal ruling class: the imperial family and the nobility. (d) State and religion: Akbar's religious ideas – sulh-i-kul; relations with religious elites; Aurangzeb's relations with religious groups and institutions.
3. Rural economy and society: (a) Environmental context; agricultural zones; agricultural production; agricultural technology and crop patterns; management of water resources; growth of cash nexus and rural credit, and the role of the state. (b) Agrarian structure; revenue system; zamindars, land ownership and land rights; village community and the peasantry.
4. (a) Urban centres; morphology of cities – a survey; administration of cities and towns. (b) Urban economy: crafts, manufactures, *karkhanas*. (c) Urban social structure: merchants, bankers, artisans, craftsmen and labourers. (d) Trade routes and the framework of internal commerce – Indian Ocean trade network in the 17th century. (e) Markets and the monetary system.
5. (a) Language, literature, art and architecture. (b) Religion and culture: the Sufi tradition; 17th century revivalist trends in the time of Jahangir; Vaishnava Bhakti and its regional variants; Sants and their cults; shrines and pilgrimages.
6. Patterns of regional polity: (a) Rise of the Marathas; Shivaji; Mughal-Maratha conflict; the Peshawas. (b) The origins and growth of Sikh power.
7. (a) The decline of the Mughal empire – nature of the crisis. (b) The rise of regional successor states: case studies of Bengal, Awadh and Hyderabad.

8. (a) The emergence of the English East India Company as a political power; Bengal as the 'British bridgehead'; Battle of Buxar and the grant of Diwani. (b) The framework of colonial governance: British parliamentary Acts. (c) The new colonial state and its ideologies: Orientalism, Utilitarianism; classical political thought with respect to India.
9. Economy and society under Company rule: (a) Inland private trade, policy of investment and agency houses. (a) Permanent Settlement and other land revenue settlements. (b) Agrarian social structure.
10. Indian responses to the West: (a) Rammohan, Young Bengal and social regeneration. (b) Social and religious movements in Bengal and other parts of India till 1857.

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1. A.C. Banerjee: *New History of Medieval India*
2. Irfan Habib: *Medieval India: The Study of a Civilization*
3. Irfan Habib: *Akbar and his India*
4. Faruqui: *Aurangzeb and his Times*
5. Irfan Habib and Tapan Roy Choudhury ed., *Cambridge Economic History of India, Vol.I*
6. Irfan Habib: *Agrarian System of the Mughals*
7. A. Nurul Hasan: *Thoughts on Agrarian Relations in Mughal India*
8. W. H. Moreland: *Agrarian System in Moslem India*
9. Aniruddha Roy: *Some Aspects of Mughal Administration*
10. Athar Ali: *The Apparatus of Empire: Awards of Ranks and Titles to the Mughal Nobility*
11. Satish Chandra: *Parties and Politics in Mughal Court*
12. M. Athar Ali: *Mughal Nobility under Aurangzeb*
13. D.E.. Streusand: *Formation of the Mughal Empire*
14. Muzaffar Alam and Sanjay Subramaniam (ed): *The Mughal State*
15. Seema Alavi, ed. *The Eighteen Century in India*
16. P. Marshall, ed. *The Eighteen Century in India*
17. Muzaffar Alam: *The Crisis of Empire in Mughal North India: Awadh and Punjab*
18. M. Athar Ali: *Mughal India: Studies in Polity, Ideas, Society and Culture*
19. S. R. Sharma: *Religious Policy of the Mughal Emperors*
20. R.M. Eaton: *Essays on Islam and Indian history*
21. R. M. Eaton, ed., *India's Islamic Tradition*
22. C.A. Baily: *Rulers Townsmen and Bazaar: North India in the Age of British Expansion (1770-1870)*
23. Ashin Dasgupta and M.N. Pearson, eds., *India and the Indian Ocean (1500-1800)*
24. K. N. Choudhuri, *Trading World of Asia and the English East India Company (1660-1760)*
25. J. F. Richards (ed.): *The Imperial Monetary System and Mughal India*
26. J. N. Sarkar: *Shivaji and his Times*
27. Stuart Gordon: *The Marathas*
28. Sumit Sarkar: *A critique of Colonial India*
29. P.J. Marshall: *East India Fortunes*
30. N. K. Sinha: *Economic History of Bengal , 3 Vols.*
31. Amiya Bagchi: *Private Investment in India*
32. Sugata Bose: *Agrarian Bengal*
33. Ranajit Guha: *Rule of Property in Bengal*
34. David Kopf: *British Orientalism and the Bengal Renaissance*

35. Eric Stokes: *The English Utilitarians and India*
36. Pradip Sinha: *19th Century Bengal: Calcutta in Urban History*
37. Sabyasachi Bhattacharya eds., *Rethinking 1857*
38. *1857: Economic and Political Weekly Special Volume*

Paper IV: Transformation of Europe from 15th to 17th Centuries

1. Fall of Constantinople – the Islamic invasion of southern Europe – the crisis of the empire and its impact on medieval kingship- the redefinition of the relationship between empire and national monarchy: England and France.
2. The Crisis of Feudalism – the nature of the feudal society and its regional dimensions- the 10th century crisis – the collapse of the feudal order in Western Europe and its forms of survival in Eastern Europe.
3. Economic Crisis and Commercial Decline in Europe in the 14th century – the urban decay and the epidemics.
4. Science, technology and the age of discovery – printing revolution – new techniques of warfare and the military revolution – the origins of modern science – the exploration of the world – voyages to Asia.
5. Economic expansion of Europe in the 16th century – the rise of European companies – the new merchant – changes in the urban formation – agricultural expansion and the beginnings of an agricultural revolution? – emergence of capitalism in industry and agriculture.
6. Renaissance and Humanism – rediscovery of the classics – Humanism as a vocation – Humanism as a social ideology – the restoration of the dignity of man – implications for education, art and architecture – reception of Humanism in northern Europe.
7. The formation of the early modern state – King’s officers, a new army, taxation – Germany and Habsburgs – the empire of Charles V – the making of Absolutism – Englands.
8. Reformation and problem of secular authority – Reformation as reinforcement of Absolutism, medieval anti-clericalism – Lutheranism, Calvinism, Reformation in the national contexts – the state and Reformation in England – the Anglican compromise – the French religious wars and the political crisis.
9. The economic expansion of Europe in the 17th century – the agricultural revolution – commercial expansion; overseas merchant trading corporations – banking – the emergence of Europe as the centre of world system.
10. Scientific Revolution and the growth of scientific culture – secularism as a political and social ideology – the origins of Enlightenment.
11. Peace of Westphalia and the emergence of modern European state system.
12. The Crisis of Absolutism – England in the 17th century – Civil War – the political ideas of the Civil War – the settlement of 1688 and the beginnings of Liberalism with special reference to the ideas of John Locke

References

1. Anderson, P, *Lineages of the Absolutist States*
2. Aston, *The Brenner Debate: Agrarian Class Structure and Economic Development in Pre-industrial Europe (Past and Present Publications)*
3. Baron, H., *The Crisis of the Early Italian Renaissance: Civic Humanism and Republican Literati in An Age of Classicism and Tyranny*
4. Bernal, J. D., *Science in History*

5. Black ,J., *Military Revolution*
6. Braudel, F- *Wheels of Commerce: Civilisation and Capitalism*
7. Carus-Wilson, E.M. ed., *Essays in Economic History Vol I*
8. Cipolla, Carlo, *Before the Industrial Revolution: European Society and Economy, 1000-1700*
9. Dickens, A. G., *The German Nation and Martin Luther*
10. Dickens, A.G., *The English Reformation*
11. Ferguson, W.K.- *Europe in Transition (1300-1500)*
12. Gilbert, F, *Machiavelli and Guicciardini: Politics and History in Sixteenth Century France*
13. Goodman, A and Mackay A (eds), *The Impact of Humanism on Western Europe*
14. Haigh, C., *The English Reformation Revised*
15. Henry, J., *The Scientific Revolution and the Origins of Modern Science*
16. Hill, C., *The World Turned Upside Down*
17. Hilton, R, *Transition from Feudalism to Capitalism.*
18. Huizinga, Johann, *Waning of the Middle Ages*
19. Johnson, Paul, *The Renaissance*
20. Lindberg, C., *The European Reformation*
21. Morris, J., *The Nature of the English Revolution*
22. Newert, C. G. Jr., *Humanism and the Culture of Renaissance Europe.*
23. Parry, J. D., *The Age of Reconnaissance*
24. Pocock, J.G.A., *The Machiavellian Moment: Florentine Political Thought and the Atlantic Republican Tradition.*
25. Rich, E. E., and Wilson,C. H., ed, *The Cambridge Economic History of Europe, vol. IV.*
26. Runciman, S., *The Fall of Constantinople, 1453.*
27. Stephens,J., *The Italian Renaissance*
28. Tilly, Charles ed., *Formation of National States in Western Europe*
29. Underdown, David, *Rebel, Riot and Rebellion: Popular Politics and Culture in England, 1630-1660.*
30. Wallerstein, E, *The Modern World-System I: Capitalist Agriculture and the Origins of the European World-Economy in the Sixteenth Century (Studies in Social Discontinuity)*

Paper V: History of India, 1857-1971 A.D.

1. The Revolt of 1857: causes, course and consequences.
2. (a) The Drain of Wealth. (b) Deindustrialisation and the Indian economy. (c) Commercialisation of agriculture. (d) Peasants and landless labour. (e) Rural credit and indebtedness. (f) The tribal dimension.
3. (a) Ideologies of the British Raj. (b) Differential impact of colonialism. (c) Growth of modern education – Rise of a new intelligentsia and the emergence of an Indian public. (d) Growth of early political associations. (e) Socio-religious revivalist/reform movements. (h) Women in modern India.
4. (a) Historiography of Indian nationalism. (b) The founding of the Indian National Congress. (c) The early Congress; the rise of Extremism; Partition of Bengal and the swadeshi movement. (d) Trends in Muslim politics: Aligarh movement, Muslim League, separate electorates and Lucknow pact.
5. (a) Emergence of Gandhi in Indian nationalist politics: Rowlatt Act and Rowlatt Satyagraha; Khilafat and Non Co-operation. (b) Simon Commission, Nehru Report and Round Table Conference. (c) Civil Disobedience movement. (d) Quit India movement. (e) Role of social groups and classes. (f) Ideological trends in the Congress.

6. (a) Revolutionaries and left movements. (b) Trade union and Kisan Sabha agitations. (c) Subhas Chandra Bose, INA trials and RIN mutiny.
7. (a) Working of the provincial ministries. (b) Cripps Mission, Wavell Plan and Cabinet Mission.
8. Communal politics and partition: (a) Hindu fundamentalism and Muslim separatism. (b) Demand for Pakistan. (c) Responses to Pakistan demand: all-India and regional. (d) British policy. (e) Partition and independence.
9. (a) Partition, migration and rehabilitation. (b) Integration of princely states. (c) Agrarian reforms. (d) Framing of the Indian constitution and establishment of parliamentary democracy. (e) Making of Indian foreign policy: Non-alignment and the Third World. (f) The model of planned economy. (g) Social and political movements.
10. (a) Beginning of the Green revolution. (b) Fragmentation of Indian Politics – rise of regional parties. (c) India's role in the Bangladesh Crisis

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1. *1857: Essays from Economic and Political Weekly*
2. Anil Seal, *Emergence of Indian Nationalism*
3. Asim Roy and Mushirul Hasan (ed.), *Living Together Separately: Cultural India in History and Politics*
4. Ayesha Jalal, *The Sole Spokesman: Jinnah, the Muslim League and the Demand for Pakistan*
5. Bipan Chandra, *India's Struggle for Independence*
6. Bipan Chandra, Mridula Mukherjee, Aditya Mukherjee, *India after Independence.*
7. Eric Ericson, *Gandhi's truth: the Origins of the Militant Non-Violence.*
8. F. R. Frankel, *India's Green Revolution: Economic Gains and Political Costs.*
9. Ian Tablot and G. Singh, *The Partition of India.*
10. Iqbal Narain, *Twilight or Dawn: the Political Change in India 1967-71.*
11. Joya Chatterjee, *Bengal Divided.*
12. Joya Chatterjee, *The Spoils of Partition Bengal and India 1947-1967.*
13. Judith Brown, *Gandhi's rise to Power*
14. Mushirul Hasan, *India's Partition: Process, Strategy and Mobilization.*
15. Myron Weiner, *Party Politics in India : The Development of a Multi-party System*
16. P.J. Marshall, *Bengal: The British Bridgehead*
17. Paul Brass, *The Politics of India Since Independence*
18. R. C. Majumdar, ed., *History and Culture of Indian People Vols IX and X.*
19. R.C. Majumdar, ed., *British Paramountcy and Indian Renaissance*
20. Rajni Kothari, *Politics in India*
21. Ramchandra Guha, *India Since Gandhi*
22. S. Gopal, *Jawaharlal Nehru : A Biography (Vols I-III)*
23. S. N. Sen, *1857*
24. Sankar Ghosh, *The Disinherited State: A Study of West Bengal 1967-71.*
25. Sumit Sarkar, *Modern India*
26. Sumit Sarkar, *Swadeshi Movement in Bengal*

Paper VI: History of Europe from 1789 to 1919 AD

1. The Idea of Europe: The 18th century background – society, economy, politics, enlightenment – role of the philosophers.
2. Trends in French Revolution: Aristocratic revolt – bourgeoisie, popular and peasant – the Constituent Assembly and its achievements – Girondins and Jacobins – the Reign of Terror and the rise and fall of the Jacobin Republic – the Thermidorian reaction and the Dictatory –

- Interpreting the French Revolution – Creation of a new political culture.
3. Napoleon Bonaparte: the revolutionary legacy – the reorganization of France and the new elite – Napoleonic Empire and Europe – Fall of Bonaparte – conflicting estimation of Napoleon's character and achievements.
 4. The Vienna Congress: Metternich and the Conservative order in Europe – Liberalism – Nationalism and the revolutionary challenge to the conservative order – an overview; the Revolution of 1848 – pattern of insurrections in France and other central European countries – collapse of the Revolution.
 5. The emergence of the national states in Central Europe – Unification of Italy and Germany- Russian modernization – emancipation of the serfs and liberal reforms in Russia – France under the second emperor.
 6. Industrialisation of Europe: Difference in the industrialisation process between England and the continent – French, German and Russian industrialisation – rise of the working class, working class movement and the socialist thought.
 7. Europe in 1871: the Third Republic, Paris Commune and the new German Reich – Bismarckian diplomacy and the new balance of power
 8. European imperialism: The impetus behind colonial expansion – scramble for colonies in Asia and Africa – Eastern Question in the late 19th century and the Balkan nationalism – Wilhelm II and the new course in German foreign policy – Triple Alliance, Triple Entente and the emergence of two armed camps – the origins of the First World War.
 9. The impact of the War on old order – the collapse of the dynastic empire – Russian Revolution: Origins – the October revolutions and the success of the Bolsheviks.

References

1. David Thomson - *Europe Since Napoleon*
2. George Rude - *Revolutionary Europe*
3. Georges Lefebvre - *Coming of the French Revolution*
4. Stephen J. Lee - *Aspects of European History*
5. James Joll - *Europe since 1870*
6. Albert Soboul - *Understanding the French Revolution*
7. Petr Geyl - *Napoleon for and against*
8. Phyllis Deane - *The First Industrial Revolution*
9. Clive Trebilcock - *The industrialization of Continental Powers*
10. Pat Hudson - *The Industrial Revolution*
11. L.C.B. Seaman - *From Vienna to Versailles*
12. Denis Mack Smith - *Italy: A Modern History*
13. Gordon Craig - *Germany, 1871-1945*
14. Geoffrey Barraclough - *The Origins of Modern Germany*
15. Henry Kissinger - *A World Restored*
16. Alfred Cobban - *A History of France, Vols. I-III.*
17. E.H. Carr - *The History of Soviet Russia, Vols. I-III.*
18. Hugh Seton Watson - *The Decline of Imperial Russia, 1815-1914.*
19. W.L. Langer - *Diplomacy of Imperialism*
20. L. Kochan - *The Making of Imperial Russia.*
21. Ralph Finley - *Modern German History*
22. Christopher Hill - *Lenin and the Russian Revolution.*
23. Richard Pipes - *A Concise History of Imperial Russia*
24. A.J.P. Taylor - *The Course of German History*
25. ----- - *The Struggle for Mastery over Europe*

Paper VII: World since 1919

1. Peace settlements of 1919: its long-term consequences – the establishment of the Weimar Republic.
2. Europe in the inter-war period: Consolidation and development of the power of the Soviet state – Rise of Fascism in Italy – League of Nations – The Economic Depression – the rise of the Nazi power – Germany's aggressive foreign policy – the outbreak of the World War II and historians.
3. The world after 1945: Origins of the Cold War and the division of Europe – the emergence of the American and the Soviet spheres of influence – the system of military and economic alliances.
4. The decline of European imperialism: Decolonisation – national improvements of Asia and Africa – the emergence of the Third World – alternatives of the cold war and the Non-aligned movement.
5. Regional theatres of the cold war: Korea, Vietnam, Cuba and Middle-East – Tensions within the Soviet Bloc: Hungary, Czechoslovakia, Poland. Bipolar World and the regional conflicts.
6. The Communist Revolution and Emergence of China in world politics – Sino-Soviet and Sino-American relations.
7. From Bi-polarism to Uni-polarism: Politics of détente – end of the Cold War – German Reunification – Globalization and its impact – American Uni-polarism and its significance for international politics.
8. Rise of terrorism and the challenge to international security – 9/11 and its impact on world politics
9. India and her neighbours: Indo-China relations – Indo-Myanmar relations – Indo-Bangladesh relations – Indo-Pakistan relations.

Reference

1. E. H. Carr, *International Relations between the Two Wars*
2. Peter Calvocoressi, *The World Politics Since 1945*
3. McWilliams, Wayne and Piotrowski, H, *The World since 1945*.
4. W Keylor, *Twentieth Century World*
5. D.F. Fleming, *The Cold War and Its Origins*
6. J. W. Young and John Kate, *International Relations since 1945*
7. D. Rees, *A Short History of Modern Korea*
8. Carl L. Brown, *International Politics in the Middle East*
9. M.S. Rajan, *Studies on Non-alignment and the Non-aligned Movement*
10. Donald Seekings – *Historical Dictionary of Burma*
11. S. Liang Chi, *Burma's Foreign Relations: neutralism, theory and practice*
12. Kishore C. Dash, *Regionalism in South Asia*
13. J.K. Ray, ed. *Aspects of India's International Relations, 1700-2000: South Asia and the World*
14. Mohan Guruswamy and Zorawar Daulet Singh, *India-China Relations: The Border Issue and Beyond*
15. S.B. Jain, *India's Foreign Policy and Non-Alignment*
16. Suranjan Das, *Kashmir and Sindh: Nation Building, Ethnicity and Regional Politics in South Asia*
17. P. Sukumar Nair, *Indo-Bangladesh Relations*

Paper VIII (Any one from two options)

(A): History of East Asia since 1839

China

1. The nature of Chinese traditional society – social structure – the peasantry, the gentry class, government, bureaucracy and central control – China's pre-modern economy.
2. Colonial penetration and Chinese response: the tribute system, the canton system and their collapse – the opium wars and the treaty system – Rebellion in China and the White Lotus Society as a prototype – the Taiping rebellion – the Boxer rebellion.
3. Restoration, Reform, Revolution – the Restoration of Confucian government – the self-strengthening Movement – the Reform Movement of 1898 – Dynastic reform and the Republican Revolution of 1911 – the New Nationalism.
4. The rise of the Kuomintang – Warlordism – the May Fourth Movement – the Rise of the Communist Party – the Kuomintang-Communist conflict – the People's Republic of China and the establishment of the new order.
5. Economic development and industrialization – Growth and change of China's foreign trade – compradors and Chinese capital – early industrialization.

Japan

6. Pre-Restoration period – The Shogunate, the feudal society and Government – the Perry Mission and the opening up of Japan to the West – the fall of the Shogunate.
7. The Meiji Restoration – Its nature and character – different social classes and groups behind the Restoration – contrasting response of China and Japan to the impact of the West.
8. Abolition of feudalism and economic growth – Social and military reforms – land settlement pattern of economic growth – the role of state and private entrepreneurs.
9. Foreign policy after Restoration – The Sino-Japanese War – Anglo-Japanese alliance – the Russo-Japanese War – Japan in the Pacific – the rise of militarism in the 1930s and 1940s – Japan in the Second World War.

Reference

1. H. Vinacke, *The History of the Far East in Modern Times*
2. J.K. Fairbank, *East Asia: The Modern Transformation*
3. Immanuel Hsu, *Rise of Modern China*
4. Jean Chaeneoux, *China from Opium War to 1911 Revolution*
5. -----, *China from 1911 Revolution to Liberation*
6. Israel Epstein, *From Opium War to Liberation*
7. C.P. Fitzgerald, *Birth of Communist China*
8. Edgar Snow, *Red Star over China*
9. *Cambridge History of China*, vol. 10
10. George M. Bakeman, *Modernization of China and Japan*
11. -----, *The Making of Meiji Constitution*
12. Richard Story, *A History of Modern Japan*
13. Sansom George, *The Western World and Japan*
14. *The Cambridge History of Japan*, vols. 5-6
15. G.C. Allen, *A Short Economic History of Japan*

(B): Aspects of the History of Modern Southeast Asia

1. Historical writings on Southeast Asia in the early 20th century – Debates on the question of ‘Indianisation’ – Post-War historiography and the ‘autonomy’ of Southeast Asia.
2. (a) Growth of early European interests in Southeast Asia: 16th to 18th centuries – Colonial penetration and indigenous response: interaction and accommodation, collaboration and resistance. (b) Establishment of the colonial regimes in the 19th century: Stamford Raffles in Java, British forward movement in Malaya, foundation of Singapore, French colonial system in Indochina, British annexation of Burma, British movement in Borneo and the Brookes in Sarawak.
3. (a) Pre-colonial polity, society, economy and culture in Southeast Asia – a brief survey. (b) Colonial impact on society: growth of Western education; changing position of women and the gender question under colonial rule; social anomalies and eradication efforts; colonial science; Western medicine and public health. (c) Independent modernisation of Siam from Mongkut to Vajiravudh.
4. Economic impact of colonialism: (a) Dutch domination in Indonesia – from the Culture system to the Liberal system. (b) Colonial policy and land question in Indochina – communication and plantation economy. (c) British economic policy in Burma – agricultural expansion. (d) Development of plantation economy in Malay. (e) Singapore as a strategic defence centre and its growing significance in international economy
5. Nationalism in Indonesia: Sarekat Islam, PKI, PNI and other political parties – Japanese impact during the World War II – Birth of Indonesian Republic and the constitution of 1945 – Indonesian National Revolution, 1945-50.
6. Early nationalist protest movement against French rule in Indochina – Rise of Ho Chih Minh and birth of Communist party – Vietminh and the August Revolution (1945) – The First Indochina war and Geneva Agreements – the nature of American participation.
7. Nationalism and religion in Burma: the Pongyis and the Sayasan Rebellion – the Thakin movement – Second World War, the struggle for independence and the transfer of power.
8. Growth of anti-Spanish sentiments in the Philippines – Dr. Jose Rizal and the propaganda movement – the anti-Spanish revolution of 1898 – the U.S. intervention and the road to self-government – Transfer of power and birth of a republic (1946).
9. Growth of nationalism in British Malaya – National liberation movement – Malaya Union Plan.
10. Decolonisation and cold war politics – Regional cooperation initiatives: SEATO, ASA, ASEAN and NAM

References

1. Nicholas Tarling, ed. *The Cambridge History of Southeast Asia*
2. -----, *A Concise History of Southeast Asia*
3. D.G.E. Hall, *A History of South East Asia*
4. G.M.T. Kahin, *Government and Politics of Southeast Asia*
5. J.F. Cady, *Southeast Asia: Its Historical Development*
6. -----, *A History of Modern Burma*
7. Swapna Bhattacharya (Chakraborti), *India-Myanmar Relations: 1886-1948*
8. Frank N. Trager, *Burma from Kingdom to Republic*
9. Robert H. Taylor, *The State in Myanmar*
10. Michael W. Charney, *A History of Modern Burma*
11. C.D. Cowan, *Nineteenth Century Malay*
12. W.R. Roff, *The Origin of Malay Nationalism*
13. -----, *A History of Malaysia*

14. J.C. Van Leur, *Indonesian Trade and Society*
15. G.M.T. Kahin, ed. *Nationalism and Revolution in Indonesia*
16. Robert Van Niel, *The Emergence of Modern Indonesian Nationalism*
17. Anthony J.S. Reid, *Indonesian Nationalist Revolution*
18. W.M. Wertheinil, *Indonesian Society in Transition*
19. David K. Watt, *Thailand: A Short History*
20. -----, *Studies in Thai History*
21. David A. Wilson, *Politics in Thailand*
22. Craig Reynolds, *National Identity and Its Defenders: Thailand, 1939-89*
23. John D. Legge, *Indonesia*
24. NI. Wright, *Revolution in the Philippines*
25. M.K. Kaul, *The Philippines and Southeast Asia*
26. J.V. Abueva and R.P.De Guziian, eds. *Foundations and Dynamics of Filipino Government and Politics*
27. D.R. Sardesai, *A History of Vietnam*
28. Joseph Buttinger, *The Smaller Dragon: A Political History of Vietnam*
29. Helen B. Lamb, *Vietnam's Will to Live*

HISTORY (GENERAL)

PART - I (Full Marks : 300)

Paper I :

Full Marks : 100

Indian History

(Pre-historic times to Sixteenth Century A.D.)

- A. Literary and Archaeological sources of Ancient and Medieval Indian History - Archaeological methods - Archaeological knowledge and the historical understanding of the rise and decline of the Indus Valley Civilization.
- B. Political developments - I :
Indian Polity in later Vedic times - The Mahayanapadas - The rise and fall of the Maurya Empire - the Satavahana and Kushana rule - the Imperial Guptas - Regional powers and the struggle for power in North India - Political developments in South India.
- C. Political developments - II :
Impact of Islam and political change in India -
Brief overview of the Delhi Sultanate - the administration of the Delhi Sultanate - the centralized monarchy - political ideologies in the Delhi Sultanate - Independent Sultans of Bengal - the Vijaynagar empire.
- D. I. Economic life in ancient and early medieval India - Land systems in ancient India - Framework of agriculture; the state, taxation, irrigation and the agrarian economy - The urban social formations - Internal and overseas trade - Crafts and Guilds - the Indian Feudalism, issues and debates.
- II. The Delhi Sultanate and a changing framework of agriculture - Iqta system - emergence of new urban centres and a reorientation in commercial life.
- E. I. Society and Religion : Vedic religion and the quest for knowledge - the basic framework of Brahminical religion - Buddhism, Jainism and social protest. The apogee of Brahminism and the rise of sectarian cults - Saivism, Vaishnavism, the cult of mother goddess.
- II. Social life : Social structure - From Varna to Jati - Family life and the status of women.

- III. The nature of the impact of Islam on Indian society - sufism - Syncretic beliefs and the Bhakti movement.
- F. Art, Architecture, Science and Culture :
- I. Ancient Indian architecture and sculpture - stupa, chaitya, temples of different styles - Islam and the introduction of new forms - emergence of an Indo saracenic style.
- II. Literary products of classical India - Epics and Puranas - Administrative texts, Kautilya's Arthashastra - Literary developments in the Gupta age - Scientific knowledge with special reference to astronomy, mathematics and medicine - Post thirteenth century developments - history writing in India under the Sultanate - new developments in medicine.
- (A) 4 Questions from Section A, B & C.
- (B) 2 Questions from Section D (one each from Sub-Section I & II)
- (C) 2 Questions from Section E
- (D) 2 Questions from Section F (one each from Sub-Section I & II)

Paper II :**Full Marks - 100****Indian History (C. 1526 to C. 1914 A.D.)**

- A. *Disintegration of the Sultanate and foundation of Mughal Empire*
Significance of the victory of Babar over the Indian adversaries — Mughal Afghan contest — Sher Shah as a reformer.
- B. I. *Akbar and the consolidation of the Mughal Empire*
Political expansion; administrative reorganisation; relations with the Rajputs — Expansion of Mughal control over Bengal and Deccan — Land Revenue and Manasabdari System — Evolution of religious policy.
- II. *Politics and administration in Post-Akbar India*
Expanding frontiers of the Empire — consolidation of the Mughal ruling class; reorganisation in the Mansab system.
- III. *Economy, Society & Culture* : Commercial expansion : religious syncretism; art & architecture.
- C. *Aurangzeb and the zenith of the Empire*
Political Expansionism : Deccan — Rise of Shivaji, Mughal - Maratha contest and the eventual incorporation of the Marathas within the imperial
-

framework — Rajput Policy - State and religion : changes since the death of Akbar.

D. *Break up of the Mughal Empire*

Causes thereof — Growth of regional entities and the relation between the centre and the periphery — Trade, Commerce and the rise of the European trading companies — Eventual success of the English East India Company.

E. *Early stages of the rise of the E.I. Company*

Plassey, Buxar and the Diwani — Structural reorganization in the administration — Regulating and the Pitts India Acts — Company's relations with Indian states and its emergence as the dominant power; Marathas, Mysore and Sikhs — Subsidiary Alliance and the enunciation of a new principle of expansion — The course of British annexationism in early 19th century : subjugation of the Marathas.

F. *The Colonial Economy*

I. Basic features — Land revenue settlements : Bengal, North India, South and West — long term colonial impact on agriculture — changing forms of early colonial impact on trade and commerce : From monopoly to Free trade.

II. Drain of Wealth — Deindustrialization — India's international trade in the second half of the nineteenth century — limited development of modern industries upto 1914 — changes after 1914.

G. *Early Resistance to Colonial Rule :*

Different forms of resistance — rural resistance — resistance by landlords and peasants; Poligar uprising (Madras); Paik rebellion (Orissa) and peasant uprisings in Western Bengal — Peasant movement and religion : Wahabi and Farazi — Santal Rebellion (1855) — The Revolt of 1857 : The Social context; the political context (popular and aristocratic resentment about British Imperial Policies).

H. *Reformism and Westernisation*

British Orientalism : Bentinck, Macaulay, Western Education and Social Reform. The Indian Response : Rammohan and Social reform; The Young Bengal — The Brahma Movement — Vidyasagar and social and educational reform; Reformist initiatives in western and southern India, — Prarthana Samaj; Reform from within tradition — Arya Samaj; Aligarh Movement and modernisation of Islam in India; Westernisation and Indian social conservatism : The Age of Consent Agitation.

- Indian Politics : 1858-1885*
- I. Provincial associations : Bengal, Madras, Bombay — Background to the emergence of the Indian National Congress — The Foundation of the Congress — the nature of the early Congress.
- Indian Politics : 1885 - 1914*
- J. Congress under Moderate Leadership — Hindu Revivalism — Militant nationalism — Ideology and Programme of militant nationalists — Swadeshi Movement : Its varied dimensions — The birth of All India Muslim League and Seperate electorate — Revolutionary terrorism in Bengal and the Punjab.
- (A) 3 Questions from A, B & C (one from each Section)
- (B) 2 Questions from D & E (one from each Section)
- (C) 2 Questions from F, G & H (at least one from each group)
- (D) 2 Questions from I & J (at least one from each group)

MODERN EUROPE (1789 - 1939)

Full Marks - 100

Paper III :

- A. *Foundation of Modern Europe (1789 - 1814)*
1. Background - Renaissance and Reformation — Geographical Discoveries — Scientific Revolution — Advent of Capitalism.
 2. The French Revolution — Socio-Economic Background — Progress of the revolution — Popular Movements — Jacobins and Girondins.
 3. Rise of Napoleon — Internal Reconstruction — Napoleon and Europe — Napoleon and Revolution.
- B. *Political Developments in Europe from 1815 - 1870*
1. Triumph of conservatism — The Metternich System.
 2. Nationalism, Liberalism and the Revolutions of 1830 and 1848.
 3. Stages of Italian unification.
 4. Unification and consolidation of Germany.
 5. Russia : Attempts at Reforms by Alexander - II.
- C. *Society and Economy in Nineteenth Century Europe*
1. Industrial Advances in England and the continent.

2. Labour Movements.
 3. Utopian Socialism and Marxism.
 4. Art and Culture, Literatures and Science.
- D. *Modern Imperialism 1871 - 1914*
1. Europe in 1871 — New Balance of Power.
 2. Scramble for colonies in Asia and Africa.
 3. The Eastern Question in later Nineteenth Century.
 4. Triple Alliance, Triple Entente and the emergence of two armed camps.
- E. *First World War (1914 - 1919)*
1. Origins of the First World War — Issues and Stakes.
 2. Russian Revolution of 1917.
 3. Peace Settlement of 1919 — Its long term consequences — Birth of German Republic.
- F. *Europe in the Inter - War Period (1919 - 1939)*
1. Consolidation of economic and political power of the Soviet State.
 2. Rise of Fascism in Italy.
 3. Nazism and Germany — Nazi state — the aggressive foreign policy.
 4. Outbreak of the Second World War — Different Interpretations.
- (A) 4 Questions from Section A & B (2 from each Section)
- (B) 4 Questions from Section C & D (2 from each Section)
- (C) 1 Question from Section E
- (D) 1 Question from Section F

PART - II (Full Marks - 100)

Paper IV :

Full Marks - 100

India and the World 1914-1964 : Selected Themes

1. Impact of the First World War on Indian economy, society and polity; Emergence of Gandhi in Indian nationalist politics; Concept of 'Satyagraha'; Champaran, Kheda, Ahmedabad & Rowlatt Satyagrahas.
 2. Gandhian Mass Movements — Khilafat — Non Cooperation & Civil Disobedience Movements; Revolutionary Nationalism during the 1930s;
-

The Government of India Act of 1935; 1937 elections and formation of Congress provincial ministries; Quit India Movement of 1942.

3. Subhas Chandra Bose, the Indian National Army and Indian Freedom Movement.
4. Demand for the creation of Pakistan and its repercussions on Indian Politics and Society; Communal Politics in India.
5. Post-War upsurge and different strands of protest politics; partition & the Transfer of Power, Adoption of a republication constitution in 1950.
6. The Nehru era in independent India — Development of parliamentary democracy — Economic planning — Movements for social justice — India and Non-aligned Movement.
7. Emergence of bipolarism and its impact on post - 1945 world politics — The Rise of the Third World; Impact of the Cold War on the Third World.

Questions :

7 Questions from Sections 1 - 5.

4 Questions from Sections 6 and 7.

1 Set of objective questions covering the whole syllabus.

Recommended Books :

1. Sumit Sarkar : Modern India
2. সুমিত সরকার : আধুনিক ভারত
3. Bipan Chandra, Mridula Mukherjee, Aditya Mukherjee, K.N. Panikkar and Sucheta Mahajan : India's Struggle for Independence (Bengali Translation available)
4. অমলেশ ত্রিপাঠী : ভারতের স্বাধীনতা আন্দোলন ও জাতীয় কংগ্রেস
5. Judith Brown : Gandhi's Rise to Power
6. Leonard Gordon : Brothers Against the Raj
7. Mushirul Hasan (ed) : India's Partition
8. Paul Brass : The Politics of India Since Independence



WEST BENGAL STATE UNIVERSITY
Under Graduate Curriculum for the B. A. (General) degree
course in
HUMAN DEVELOPMENT
W.e.f. 2011-12 academic year

COURSE STRUCTURE
Full Marks: 400 (Theoretical: 270, Practical: 130)

Paper-I: Theory	Part-I	100
Paper-II: Theory	Part-II	100
Paper-III: Practical		100
Paper-IV:	Part-III	100
Unit-I: Theory		(70)
Unit-II: Practical		(30)

Part-I

Paper-I: Theory- 100 marks

Unit-I= 50 Marks

I. Introduction to Human Development:

A.D. 1. Human development and its significance. Definition of growth and development, Approaches to the study of human development – Longitudinal and Cross-Sectional, Methods of studying human development – Observation, Interview and Questionnaire.

P.B. Principles of growth and development- roles of heredity and environment in human development

P.B. 2. Conception, Maturation, ovulation, fertilization, course of prenatal development, factors influencing prenatal development.

P.B. 3. Birth of the baby- the characteristics of the neonate, care of the neonate-feeding, weaning, supplementary feeding, sleep routine, clothing, bathing, immunization schedule.

P.B. 4. Areas of development- Infancy, childhood, adolescence, (adulthood, old age.)
(Physical, motor, social, emotion, language.) A.D.

Unit-II= 50 Marks

I. Societal influences on Human Development:

A.D. 1. Marriage- definition, functions, types, changing trends, marital adjustment and its influencing factors.

A.D. 2. Family- definition, functions and types, changing trends and its influencing factors, influence of family on the development of child.

P.B. 3. Problems related to marriage and family- divorce, single parenthood, domestic violence, poverty and unemployment.

P.B. 4. Influence of pre-school (nursery), school and peer on the development of the child.

Part-II

Paper-II: Theory- 100 marks

Unit-I= 50 Marks

I. Psychological bases of Human Development:

1. Key theoretical concepts-
 - i) Psychoanalytic theory-Freud.
 - ii) Psychosocial theory-Erikson.
 - iii) Cognitive theory-Piaget. (P.B)
2. Socialization- Definition, agents, gender difference in socialization and cultural differences in socialization. (P.B)
3. Emotion – Definition, primary emotions (basic emotions). Behavioural expression of common emotions, controlling emotions. (P.B)
4. Intelligence -Definition, factors influencing intelligence, intelligence test.
5. Personality- Definition, factors influencing personality, personality test.

Unit-II= 50 Marks

I. Behavioural Problems and Children with Special Needs:

1. Child with special needs- definition, types (blind, deaf, communication disorder, mental retardation, gifted), identification, causes, rehabilitation. (P.B)
2. Behavioural problems- Definition. Causes of and remedies for behaviour problems in children: thumb sucking, bedwetting, fear, anxiety, shyness, temper tantrum, stealing, lying and truancy. (P.B)
3. Guidance and counselling- definition, process and types. (P.B)

Paper-III: Practical- 100 Marks

1. Report on the study of growth and development in infancy (0-2 yrs.). (Physical, motor, language, social, immunization, sleep and food routine)
2. Psychological testing of a child (3-12 yrs.)
3. Preparing a resource material for generating awareness on nutritional needs of pregnant/expectant mothers/ children. (P.B)
4. Visit to an institution working for child with special needs and preparing a report on that visit.
5. Conducting a survey in the community on the problems of women and elderly.

Part-III

Paper-IV

Paper IV A: Theory- 70 Marks

I. Environmental education and child welfare:

A.D 1. Environment – Definition, components, effects of environment on human behaviour and human behaviour on the environment. NGO's working for environmental causes.

P.B 2. Child Welfare- Definition, objectives and philosophies, National policies and legislation related to children, Welfare agencies and services: governmental and non-governmental. (~~FARE~~ ~~RECCOS~~ ~~CHILDREN~~ ~~CSWS~~ ~~INDIA~~ ~~WELFARE~~)

P.B 3. Women Welfare- Definition, objectives, National policies and legislation related to women, programmes for women welfare.

A.D 4. Concepts of Human Development Index.

Paper IV B: Practical- 30 Marks

✓ 1. Case study of a child belonging to any one of the following families:-

- i) Single parent family.
- ii) Dual earner family.
- iii) Families in extreme poverty.
- iv) Inter-caste/religion family.

P.B 2. Preparing a resource material for generating awareness among masses on child and women welfare.

**Syllabi for Three-Year B.A. (Honours & General) Courses
in
Journalism & Mass Communication**

(Professional Lab Oriented Communication and Media Course)

Honours

Part-I

Paper-I **100 Marks**

First Half: **Reporting** **50 Marks**
Module One 25 Marks
Module Two 25 Marks

Second Half: **Editing** **50 Marks**
Module Three 25 Marks
Module Four 25 Marks

Paper-II **100 Marks**

First Half: **History of Indian Journalism** **50 Marks**
Module One 25 Marks
Module Two 25 Marks

Second Half: **Practical** **50 Marks**

Part-II

Paper-III **100 Marks**

First Half: **Mass Communication** **50 Marks**
Module One 25 Marks
Module Two 25 Marks

Second Half: **Media Management and Laws** **50 Marks**
Module Three 25 Marks
Module Four 25 Marks

Paper-IV **100 Marks**

Practical

Part-III

Paper-V **100 Marks**

First Half: **National and International Affairs** **50 Marks**
Module One 25 Marks
Module Two 25 Marks

Second Half: **Visual Media** **50 Marks**
Module Three 25 Marks
Module Four 25 Marks

Paper-VI **100 Marks**

First Half: **Radio Journalism** **50 Marks**
Module One 25 Marks
Module Two 25 Marks

Second Half: **Television Journalism** **50 Marks**
Module Three 25 Marks
Module Four 25 Marks

Paper-VII **100 Marks**

First Half: **Advertising** **50 Marks**
Module One 25 Marks
Module Two 25 Marks

Second Half: **Public Relations** **50 Marks**
Module Three 25 Marks
Module Four 25 Marks

Paper-VIII **100 Marks**

Practical

Question Patterns and Break-up of Marks for each module will be in the following order:

- (a) Two Broad Questions consisting 10 Marks each;**
- (b) One Short Answer-type Question consisting 5 Marks;**

This Order will be applicable for every module of all papers.

Part I

Paper I

100 Marks

First Half: Reporting

50 Marks

Module: One

News: Definition; Elements of News; News Values; Objectivity of News; Reporters/Correspondents; Chief Reporter; News Beat; News Sources; Special Correspondent; Parliamentary Correspondent; Foreign Correspondent; District Correspondent; Feature; Photo Journalism.

Module: Two

Specialization in Reporting: Political Reporting; Crime and Legal affairs Reporting; Public affairs Reporting; Human Interest Stories; Business Reporting; Science Reporting; Sports Reporting; Film Reporting; Environment and Human Rights; Page-3 Reporting; Interpretative and Investigative Reporting; Online Reporting; Interviewing; Column writing; Writing a report on any given topic.

References:

- (1) Professional Journalists: John Hohenberg
- (2) Into The Newsroom: Leonard Ray
- (3) Professional Journalism: M.V. Kamath
- (4) Reporting Manual: Sourin Banerjee
- (5) Reporting: M.V. Charnley
- (6) Guide Line for News Reporters: Sol Robinson
- (7) Reporting Methods: S. Kundra
- (8) Outline of Reporting: M.K. Joseph
- (9) Handbook of Reporting and Editing: R.K. Ravindran.

Second Half: Editing

50 Marks

Module: Three

Principles of Editing; Editor; News Editor; News Coordinator; Sub-Editors; Chief Sub-Editor; Headline: different Types; Techniques of Writing Headlines; Lead; Intro; News Compilation; Re-writing.

Module: Four

Editing Agency Copies; Copy Testing; Page Planning; Picture Editing; Proof Reading; Page Make-up; Cartoons; Page Lay-out; Principles of Page lay-out; Graphics and Illustrations; Typography; Magazine Editing; Use of Computer and Softwares in Editing; Writing Editorial; Editing a News Story with Headline.

References:

- (1) Basic Journalism: Rangaswamy Parthasarathi

- (2) News Reporting and Editing: K.M. Srivastava
- (3) News Editing: Bruce Westley
- (4) Editing and Design: Harold Evans
- (5) Editing in the Electronic Era: M.L. Gibson
- (6) Editing Manual: Sourin Banerjee
- (7) Journalism Update: Sourin Banerjee
- (8) Professional Journalist: John Hohenberg

Paper II

100 Marks

First Half: History of Indian Journalism

50 Marks

Module: One

The Origin of Print Media in India; James Augustus Hickey; James Silk Buckingham; Serampore Baptist Missionaries; Raja Rammohan Roy; young Bengal Movement, Adam's Press Gagging Act; Derozio and Derozians; Charles Metcalfe; Sambad Prabhakar and Iswar Chandra Gupta; Tatwobodhini Patrika; Hindu Patriot and Harish Chandra Mukherjee; Somprakash.

Module: Two

Vernacular Press Act; Amrita Bazar Patrika; Surendranath Banerjee; Sandhya, Jugantar; The Statesman; The Times of India; Journalistic contribution of Mahatma Gandhi, Jawaharlal Nehru, Subhas Ch. Bose, Rabindranath Tagore; Ananda Bazar Patrika; Swadhinata; Development of News Agencies; History of Radio and Television in India.

References:

- (1) History of Indian Journalism: J. Natarajan
- (2) History of Indian Press: S. Natarajan
- (3) Romance of Indian Journalism: J.N. Basu
- (4) Journalism in India: Rangaswamy Parthasarathi
- (5) Bengal Renaissance and Other Essays: Susobhan Sarkar
- (6) Critique of Colonial India: Sumit Sarkar
- (7) The Press: Chalapati Rao
- (8) Report of the First Press Commission

Second Half: Practical

50 Marks

First Part (written):

25 Marks

- (1) Writing a Report in about 150 words from given points.
- (2) Writing a News Feature
- (3) Prioritizing the importance of News from a given set of Headlines, asserting reasons.
- (4) Writing Headlines from a news story.
- (5) Writing caption of a news picture.

Second Part (Computer practical):

20 Marks

- (1) Editing a given piece of News Report or Agency Copy using word-processing software (including suitable lead and headline).
- (2) Drawing a Dummy for a front page of a daily using a page-making software.
- (3) Rewriting and Summarizing a given piece with headlines using word processing software.

Third Part (viva voce):

5 Marks

Viva-Voce on Media related General Knowledge and Current Affairs.

**** [Compulsory Practical Examination (written examination) to be held at the Examination Centre.
Compulsory Viva-Voce to be conducted at the Examination Centre].**

Part II

Paper III

100 Marks

First Half: Mass Communication

50 Marks

Module: One

Communication: Definition and functions; Types of Communication: Intra-Inter-Group-Mass Communication; Means of Communication: Press, Radio, Television, Film, Internet, Cable Network; Media-Society Theories: Mass Society, Mass Culture and Mass Audience; Normative theories, Functionalism, Critical Political Economy, Marxism, Information Society; Frankfurt School of Communication; Mass Media in India.

Module: Two

Communication models: Aristotle's classical model; Laswell's model; Shannon-Weaver's Mathematical model; Wilbur Schramm's model; David Berlo's model; Newcomb's model; Westley McLean's model; George Gerbner's model; Media Dependency model; McCombs and Shaw's Agenda Setting model; Chomsky-Herman's Propaganda model; Development Communication and Diffusion of Innovation; Dominant Paradigm; Uses & Gratification; Globalization and Mass Media.

References:

- (1) McQuail's Mass Communication Theory (4th and 5th Edition): Denis McQuail
- (2) Communication for Development in the Third World: Srinivas Melkote and H. Leslie Steeves
- (3) India's Communication Revolution: Arvind Singhal and Everett Rogers
- (4) Mass Communication Effects: Joseph Klapper
- (5) Many Voices One World: Report of the McBride Commission
- (6) Mass Communication: Rowland Lorimer

- (7) Understanding Mass Communication: Melvin DeFleur
- (8) Development Communication: Uma Narula
- (9) Electronic Media and Communication Research Methods: G.K. Parthasarathi

Second Half: Media Management, Laws and Ethics **50 Marks**

Module: Three **25 Marks**

Definition and different types of Media Management; Ownership patterns of Newspapers in India; Corporatization and Monopolization: Changing nature of Newspaper Management; Cross Media Ownership; FDI in Media; Various Departments of Newspaper; Dual Economy of a Newspaper: Circulation and Advertisement Management of electronic Media; Public Control, Private Control; Autonomous model; Prasar Bharati; Cable TV Regulation Act; Organizational Structure of Doordarshan and All India Radio; Convergence of Media; DTH, TRP, ABC, NRS; Satellite Channels.

Module: Four **25 Marks**

Freedom of Information; Right to Information; Freedom of the Press with special reference to India; Press Commissions; Press Council; Press Laws: Defamation, Contempt of Court; Sedition, Official Secrets Act, Copyright Act, Press and Registrations of Books Act, Obscenity Act, Working Journalist Act, Parliamentary Proceedings Act; Codes of Ethics; Yellow Journalism.

References:

- (1) Newspaper Management in India: Gulab Kothari
- (2) Newspaper Organization and Management: Herbert Lee Williams
- (3) India's Communication Revolution: Arvind Singhal and Everett Rogers
- (4) Media Ownership: Gillian Doyle
- (5) Sambadpatra Sangathan O Parichalana: Pabitra Mukherjee
- (6) The Indian Media Business: Vanita Kohli
- (7) Media Ethics: K.M. Srivastava
- (8) Media Monoliths: Mark Tungat
- (9) Laws of Press in India: Justice Durgadas Basu
- (10) Report of the Second Press Commission in India
- (11) Press and Press Laws in India: H.P. Ghosh

Paper IV **100 Marks**

Practical

Written Segment: **40 Marks**

Book Review; Film Review; Music Review; Review of Television Programmes; Writing an Editorial; Writing a Post-Editorial; Writing an Anchor Story; Writing Interview with Headline; Lead or Intro writing; Editing agency creed; Proof Reading.

Project: **15+5 Marks**

Dissertation Project on Media Related Topics and Viva-Voce (Within four thousand words)

Computer:

30 Marks

- (1) Advanced Page-designing of a broadsheet using Page Make-up Software and Picture Editing Software; Photo Editing; Candidates are expected to know various elements of page design that includes slug, info-graphics, blurbs, shoulder, reverse etc.
- (2) Designing a Web Page of a Newspaper using Page Make-up Software.

Short answer type Questions on Current Issues

10 Marks

Part III

Paper V

100 Marks

First Half: National and International Affairs

50 Marks

Module: One

Indian Constitution: Preamble, Fundamental Rights and Duties; Power and Position of President, Prime Minister; Supreme Court; Parliament; Chief Minister; Governor; Election Commission; Objectives of India's Five Year Plans; Current Economic Policy; Speaker; Contemporary National Events and Issues.

Module: Two

Role of United Nations, UNESCO, Imbalances in Information Flow; McBride Commission; NWICO, NANAP; Regional Groupings; ASEAN, SAARC, European Union; International News Agencies; Foreign Policies of India and USA; Unipolar World; Sino-Indian Relations, Indo-Pak Relations; Indo-Sri Lanka Relations; Indo-Bangladesh Relations; Contemporary International Issues.

References:

- (1) The Making of India's Foreign Policy: J. Bandyopadhyay
- (2) International Relations: Joseph Frankell
- (3) International Relations in the Twentieth Century: D.C. Bhattacharya
- (4) Communication for Development in the Third World: Srinivas Melkote and H. Leslie Steeves
- (5) Many Voices One World: Report of the McBride Commission
- (6) Introduction to the Constitution of India: Justice Durgadas Basu
- (7) Indian Administration: S. Maheswari
- (8) Indian Economics: K. Sundaram

Second Half: Visual Media

50 Marks

Module: Three

Film as a Medium of Mass Communication; History of Indian Motion Pictures; Visual Literacy; Language of Film; Feature Film; Documentary Film; Script; Basic Visual Media Production; Location; Camera Work; Basic Shots and Terminology; Direction; Editing; Dubbing; Digital Film Making; Sound Effects and Music; Film Censorship.

Module: Four

Cross Cultural Cinema; Film and literature; Film and culture; New Wave Cinema; Major Film Makers: D. W. Griffith, Robert Flaherty, John Ford, Orson Welles, Sergei Eisenstein, Pudovkin, Vittorio De Sica, Federico Fellini, Charles Chaplin, Jean Luc Goddard, Franscois Truffaut, Akira Kurosawa, Satyajit Ray, Mrinal Sen, Ritwik Ghatak, Tapan Sinha, Shyam Benegal, Aparna Sen, Mira Nair; Recent Trends in Indian Cinema.

References:

- (1) Our Films Their Films: Satyajit Ray
- (2) How to Read a Film: James Monaco
- (3) The Inner Eye: Satyajit Ray
- (4) Bengali Cinema: Kiranmoy Raha
- (5) Film Cultures: Janet Harbord
- (6) A Short History of Movies: Gerald Mast
- (7) A History of Film: Virginia Wright Wexman
- (8) A Short History of Film: Wheeler Winston Dixon and Gwendolyn Audrey Foster

Paper VI**100 Marks****First Half: Radio Journalism****50 Marks****Module: One**

History of Radio in India; Radio News; News Editor; Producer, Radio Reporter; Radio Interview; Radio News Reels; Radio Feature; Applications of Audio Equipments and Software; Radio Talk; Audience Research.

Module: Two

SFX; Community Radio; Educational Radio; Radio Jockey; Recent Developments in FM Broadcast; National Programmes of All India Radio; BBC and other International Radio Stations; Radio and Newspaper: A Comparative study.

References:

- (1) Broadcast Journalism: An Introduction to News Writing: Mark W. Hall
- (2) Handbook of Broadcasting: Abbot and Rider
- (3) Newswriting for Broadcast: Ed Bliss
- (4) Broadcast News Producing: Brad Schultz
- (5) Radio and Television: K.M. Srivastava
- (6) This is All India Radio: U.L. Barua

Second Half: Television Journalism

50 Marks

Module: Three

History of Television in India; Scope of Television Journalism; TV Newsroom; News Editor; Producer; TV Correspondents; Techniques of writing TV News; TV News Production; Anchoring; Use of Clippings; TV Interview; Basic Principles of Camera Work; Live Coverage through Satellite; Effects of Television on Society.

Module: Four

Outside Coverage; Television Documentaries; News Magazines and Talk Shows; Ethical Problems; Field Research; Interviewing; Pre-Production- Need of Balanced Presentation and Selection of Topics; Cable TV; Satellite Channels and its effects on Society; Television and Video Editing; Use of software; Soap Operas; Other Entertainment Programmes.

References:

- (1) Writing and Producing for Television and Film: John Riber
- (2) Television Journalism: Ivor Yorke
- (3) Television: A Critical Review: Horace Newcomb
- (4) The Age of Television: Carl Bode

Paper VII

100 Marks

First Half: Advertising

50 Marks

Module: One

Advertising: Definition, Historical Development; Social and Economic Benefits of Advertising; Types of Advertising: Consumer, Corporate, Industrial, Retail, National, Trade; Public or Government Advertising; Product Advertising; Target Audience; Brand Positioning; USP; Advertising strategies, appeals, market and its segmentation; Sales Promotion, Creative Strategy; Purchase proposition; Creative Execution; Ad-Copy Writing; Slogan; Headline; Ad Lay-out; Use of Software in Print Advertisement; Television Advertisement; Storyboard; Radio Advertisement.

Module: Two

Outdoor Advertising; Advertising Research; Advertising Agencies; Media Strategy; Planning of Ad-budget for Newspapers, Magazines, Radio, Television; Ad contents; Surrogate Advertisements; Advertising on Internet; Advertising and Ethics; Advertising and Law.

References:

- (1) Advertising: Frank Jefkins
- (2) Advertising: James S. Norris
- (3) Brand Positioning: Subrato Sengupta
- (4) Effective Advertising: Marieke De Mooji
- (5) Creative Advertising: Theory and Practice: Gillian Dyor

- (6) Principles of Advertising: Monle Lee and Carla Johnson
- (7) Advertising Management: Alok Bajpaye
- (8) Advertising Today: The Indian Context: Dr. Sarojit Dutta

Second Half: Public Relations

50 Marks

Module: Three

Public Relations: Definition and History; Internal and External Publics; PR Publicity, Propaganda and Opinion; PR as a Management Function; PR and Marketing; Image Management; PR Principles: Planning, Implementation, Research and Evaluation; PRO: Qualifications and Functions.

Module: Four

Tools of Public Relations; Media Relations; Press Release; Press Conference; House Journal; Corporate Film; Crisis Management; Community Relations; Corporate Public Relations; Employee Relations; PR in Public Sector; Financial PR; Shareholder Relations; DAVP, PR by Government Departments; PR Counseling; PR Agencies; Marketing Communications; PR for Hospitals, Charitable Institutions, NGOs; Use of Internet as a major PR Tool; PR Research; PR Ethics; Emerging Trends in PR.

References:

- (1) Handbook of Public Relations and Communications: Phillip Lesly
- (2) Media Relations: Jane Johnston
- (3) Practical Public Relations: Sam Black
- (4) Public Relations in Practice: Anne Gregory (IPR publication)
- (5) Public Relations in your Business: Frank Jefkins
- (6) Public Relations in India: J.M. Kaul
- (7) Corporate Public Relations: K.R. Balan
- (8) Jana Sanjog: Samar Basu

Paper VIII

100 Marks

Practical as per Latest CSR, CU.

1st Half (Written Segment and Anchoring)

50 Marks

2nd Half (Video Documentary and Computer)

50 Marks

First Half:

First Part

40 Marks

- (a) Radio Presentation
- (b) Preparation of Radio News, Talks, and Different Programme
- (c) Techniques of Radio Script writing.
- (d) News Script Writing for Television

- (e) Script writing for different Television Programmes (TV Talk Show/ Panel Discussion)
- (f) Press Release
- (g) Press Rejoinder
- (h) Slogan writing
- (i) Making different Illustrations
- (j) Classified Advertisement
- (k) Display Advertisements
- (l) Writing for a House Journal
- (m) Cinema Script Writing (Documentary)

Second Part

10 Marks

Anchoring (5 Minutes)

Second Half: (Video Documentary and Computer)

50 Marks

(a) **Video Documentary**

25 Marks

(20 Marks for Documentary and 5 for Viva Voce)

(b) **Computers**

25 Marks

(i) Preparing a Print Advertisement using necessary software.

15 Marks

(ii) Preparing a Slide Presentation about Media Related events using presentation software.

10 Marks

- **Examination in 1st half and 2nd half of Paper VIII will be conducted separately on separate dates.**
- **Any candidate failing to appear any half of the Practical Paper or Viva Voce or non-exhibition of video documentary on the day of examination will be treated as absent for the whole paper.**

**General Course
Journalism & Mass Communication (JORG)**

Part-I

Paper-I **100 Marks**

Print Journalism

Module: One	25 Marks
Module: Two	25 Marks
Module: Three	25 Marks
Module: Four	25 Marks

Part-II

Paper-II: **100 Marks**
Media Management, Advertising and Public Relations

Module: One	25 Marks
Module: Two	25 Marks
Module: Three	25 Marks
Module: Four	25 Marks

Paper-III: **100 Marks**

First Half: Indian Constitution, Economy and Press laws **50 Marks**
Module: One 25 Marks
Module: Two 25 Marks

Second Half: Practical **50 Marks**

Part-III: Paper IV **100 Marks**

First Half: Advanced Media Studies **75 Marks**
Module: One 25 Marks
Module: Two 25 Marks
Module: Three 25 Marks

Second Half: Practical	25 marks
External assessment:	20 Marks
Viva-Voce	5 Marks

Question Pattern and break-up of Marks will be in the following order:
(a) One Broad question comprising 15 Marks;
(b) Two short answer-type question comprising 5 Marks each

This order will be followed in each module of every paper.

Part-I

Paper-I **100 Marks**

Print Journalism

Module: One **25 Marks**

- (1) Newspaper as recorder of news and events; Newspaper as an organ of public opinion; Newspaper as an instrument of social service and as a promoter of democracy; Impact of newspaper on society; Newspaper and socio-economic and cultural development.
- (2) News: Definition; Elements of news; News Sources; Different types of news.
- (3) The Editor: functions and responsibilities; Editorial freedom; The role of the editor in recent perspective.
- (4) The News Editor: Functions; duties and qualities.
- (5) Chief Sub-Editor; Sub-Editors; Their duties and qualities.

Module: Two **25 Marks**

- (1) The Reporter; Duties and Responsibilities of a reporter; Duties responsibilities & qualities of a chief reporter; Foreign correspondent; Special correspondent; Bureau Chief; Duties and responsibilities of a district correspondent; Crime and legal reporting; Science and financial reporting.
- (2) News writing; Different structures of news writing (inverted pyramid structure); Intro; Lead; Language of news writing; Objectivity; Writing techniques on society, fashion, music and arts, education, employment opportunities, health, environment etc.; financial reporting.
- (3) Feature: Definition, special kind of reporting, Different types, important branch of modern Journalism.
- (4) Editorial: Importance, Choice of subjects, Arrangement, Style of presentation.

Module: Three**25 Marks**

- (1) Editing; Principles of Editing; Copy Testing; Processing Copies; Computer Editing;
- (2) Making headlines of news stories; Importance; Rules to be followed; Different types of headlines; Computer applications;
- (3) Page Make-up; Front page and other pages; Principles to be followed; Typography; Main type groups; Recent changes and development;
- (4) Photo journalism; Definition; Importance; Duties, responsibilities and qualities of a news photographer; How to edit news photos; Caption writing; Photo printing process; Dark room processing;

Module: Four**25 Marks**

- (1) Column and columnist; Importance of column; Different types; Qualities of a good columnist;
- (2) Letters to the Editor; Importance; How to edit;
- (3) Proof reading; Symbols of proof reading; Duties and responsibilities of proof readers;
- (4) The News Agencies; Their services; functions; Importance in today's journalism; Styles of Agency reporting; How does it differ from reporting in other media; Different international News Agencies.

References:

- (1) Reporting: M.V. Charnley
- (2) Reporting Manual: Sourin Banerjee
- (3) Editing Manual: Sourin Banerjee
- (4) Professional Journalism: M.V. Kamath
- (5) News Reporting and Editing: K.M. Srivastava

Part-II

Paper-II:**100 Marks****Media Management, Advertising & Public Relations****Module: One****25 Marks**

- (1) Newspaper as a business enterprise and its public service role; Indian experience;
- (2) Ownership of Newspapers; Different types in India; Main features;
- (3) Sources of revenue of newspapers; Scope in India;

Module: Two**25 Marks**

- (1) Circulation of newspapers; Circulation factors: Geographical factor, Social Factor, Economic, Technological factor; Promoting circulation; Newspaper's policy;
- (2) Circulation department; Organization; Functions; Duties and responsibilities of the circulation manager; Audit Bureau of Circulation (ABC);
- (3) Advertisement department of a Newspaper; Administration of Ad-department; Advertisement Manager: Duties and responsibilities; Different types of advertisement in newspapers: classified and display; Newspaper as a medium of advertisement;

Module: Three**25 Marks**

- (1) Advertising: Definition; Different types; Classified and display; Advertisement medium; different types; relative advantages; Selection criteria; Ethics of Advertising; Market research; Brand positioning; Creative strategy; Market and its segmentation; Sales promotion;
- (2) Advertising agency: structure, functions, important functionaries; Client; Agency relationship;
- (3) Copy writing; Types of Copy; How to prepare; Principles of writing; Main features; Copy writer: qualities, duties and responsibilities; Copy for electronic media and print media; Ad-administration and Video production;

Module: Four**25 Marks**

- (1) Public Relations: Definition; Publics in PR; Importance of PR; PRO: Qualities and Duties; PR in Public Sector; PR for Private Sector; PR tools; Press Release; Press Conference; Press Rejoinder; Corporate PR;
- (2) House Journal: Planning; Data collection; Editing principles; Production and distribution; PR as a management function; PR institutions; PR and new technology

References:

- (1) Newspaper Organization and Management: H.L. Williams
- (2) Sanagbadpatra Sangathan O Parichalana: P.K. Mukherjee
- (3) Advertising Made Simple: Frank Jefkins
- (4) Public Relations in India: J.M. Kaul
- (5) Jana Sanjog: Samar Basu
- (6) Practical Public Relations: Sam Black

Paper-III**100 Marks****Indian Constitution, Economy and Press Laws****50 Marks****Module: One****25 Marks**

- (1) Indian Constitution; Main features; Fundamental Rights; President of India: Power and position; Prime Minister: power and position; Chief Minister: Power

- and position; Governor: Power and position; Parliament; Supreme Court; and High Court; Local governments; Indian Foreign Policy;
- (2) National Economic policy; New trends; Industrial policy; New trends; Finance Commission and its functions; Five Year Plans: Objectives; Economic policy and its impact on society;

Module: Two

25 Marks

- (1) Press Laws: Defamation, Contempt of Court; Parliamentary Privileges; Article 19(1)A and freedom of press; Copyright Act; Official Secrets Act; Working Journalists' Act;
- (2) Ethics of Journalism; Freedom and responsibility of the press; Press Council of India: Constitution, objectives and guidelines; Media Council of India.

Practical:

50 Marks

- (1) Writing News Reports; Headlines; Intro
- (2) Page Make-up and Design; Editing news copy (Computer part): 10 Marks
- (3) Writing Short Feature
- (4) Editorial Writing
- (5) Film and Book Review
- (6) Compulsory Viva-Voce (10 Marks) to be conducted at the examination centre on the day of examination.

References:

- (1) Introduction to the Constitution of India: D.D. Basu
- (2) Bharatiya Sangbidhan Parichay: D.D. Basu
- (3) Bharater Press Ain: Banshi Manna
- (4) Indian Economics: K. Sundaram
- (5) Press Laws: N.K. Bhattacharya

Part-III

Paper- IV

100 Marks

Advanced Media Studies

75 Marks

Module: One

25 Marks

- (1) Communication: Definition, Scope and Functions
- (2) Mass Communication; Definition, Scope and Functions; Theories and models;
- (3) Mass Media: Definition; Different types; Functions; Recent trends; Impact of New Technologies; Film and Video;
- (4) Specialization in Reporting; Science, Political, Administration, Crime, Fashion, Financial and Agriculture journalism; Sports journalism; Coverage of environment; Human Interest;
- (5) Interpretative and Investigative reporting; Importance and Scope; Basic qualities; planning and style;

Module: Two**25 Marks**

- (1) Press conference and interview; How to handle an important source of news; Need for preparation; How to conduct; Different types of interview;
- (2) Women and mass media; Women's page; Women's magazine; Scope in India;
- (3) Radio: Development of Radio broadcasting in India; Recent trends in Radio journalism; Radio and society; Elements of radio news; Differences in reporting and presentation between Radio and Television;

Module: Three**25 Marks**

- (1) Television as a mass medium; Development of TV in India; Recent trends; Cable TV and Satellite channels; TV as news medium and entertainment medium; Autonomy of Indian broadcasting; Impact of TV on Print media; Differences in news reporting and presentation between Radio & TV;
- (2) Making of front page of a daily newspaper;
- (3) Review; Style and presentation; techniques; Film review; Book review; Music review; Radio and Television review

References:

- (1) Reports of the first and second Press Commission
- (2) Radio and Television: K.M. Srivastava
- (3) Television Sambadikata: Sisir Bhattacharya
- (4) Professional Journalism: M.V. Kamath

Second Half: Practical**25 Marks****External assessment****20 Marks****Viva-Voce****5 Marks****External assessment:**

Writing AD copy by computer application; Display and classified; Front page layout in computer; Heading and intro writing; Preparation of audio visual copy;

Viva Voce:

Compulsory Viva-Voce to be conducted at the examination centre on the day of practical examination

WEST BENGAL STATE UNIVERSITY

Syllabus
For
THE THREE- YEAR B.Sc. HONOURS
COURSES OF STUDIES

MATHEMATICS



Berunanpukuria, P. O. Malikapur,
Barasat , North 24 Parganas,
Kolkata- 700126, W.B.,
INDIA

2008 ONWARDS

COURSE STRUCTURE & DISTRIBUTION OF MARKS

for three-year B.Sc. Honours Course in Mathematics

PART-I :

AT THE END OF FIRST YEAR
(TWO PAPERS OF 100 MARKS EACH)

PAPER-I

Group A	Classical Algebra I	25 Marks
Group B	Modern Algebra I	20 Marks
Group C	Linear Algebra I	15 Marks
Group D	Introduction to Linear Programming	10 Marks
Group E	Analytical Geometry of Two & Three dimensions I	30 Marks

PAPER-II

Group A	Real Analysis I	25 Marks
Group B	Application of Differential Calculus and Evaluation of Integral I	20 Marks
Group C	Differential Equation I	30 Marks
Group D	Vector Algebra & Analysis I	25 Marks

PART-II :

AT THE END OF SECOND YEAR
(TWO PAPERS OF 100 MARKS EACH)

PAPER-III

Group A	Classical Algebra II	15 Marks
Group B	Modern Algebra II	10 Marks
Group C	Linear Algebra II	20 Marks
Group D	Real Analysis II	20 Marks
Group E	Function of Several Variables	25 Marks
Group F	Application of Integral Calculus II	10 Marks

PAPER-IV

Group A	Analytical Geometry of Two & Three dimensions II	20 Marks
Group B	Differential Equation II	10 Marks
Group C	Linear Programming and Game Theory	25 Marks
Group D	Analytical Dynamics of a Particle	45 Marks

PART-III :
AT THE END OF THIRD YEAR
(FOUR PAPERS OF 100 MARKS EACH)

PAPER-V

Group A	Real Analysis II	70 Marks
Group B	Metric Space	15 Marks
Group C	Complex Analysis	15 Marks

PAPER-VI

Group A	Probability & Statistics	50 Marks
Group B	Numerical Analysis & Computer Programming	50 Marks

PAPER-VII

Group A	Vector Analysis II	10 Marks
Group B	Analytical Statics	35 Marks
Group C	Rigid Dynamics	30 Marks
Group D	Hydrostatics	25 Marks

PAPER-VIIIA (50 MARKS)

Group A	Algebra III (Linear, Modern and Boolean)	25 Marks
Group B	Differential Equation III	15 Marks
Group C	Tensor Algebra and Calculus	10 Marks

PAPER-VIIIB

Practical	50 Marks
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N.B. : Minimum number of classes required : 20 classes per week

DETAILED SYLLABUS : HONOURS
Syllabus for three-year B.Sc. Honours Course
*(Figures in the margin indicate the minimum number
of lectures required to cover the topic)*

PART-I

Paper-I

Group-A (25 Marks)
(Classical Algebra I)

1. Integers (It is not the aim to give an axiomatic development of the topic, rather assume that the students are familiar with the set Z of integers, the elementary properties of addition, multiplication and order.)
Statements of well ordering principle, first principle of mathematical induction, second principle of mathematical induction. Proofs of some simple mathematical results by induction. Divisibility of integers. The division algorithm ($a = gb + r$, $b \neq 0$, $0 \leq r < b$). The greatest common divisor (g.c.d.) of two integers a and b . (This number is denoted by the symbol (a, b)). Existence and uniqueness of (a, b) . Relatively prime integers. The equation $ax + by = c$ has integral solution iff (a, b) divides c . (a, b, c are integers).
Prime integers. Euclid's first theorem: If some prime p divides ab , then p divides either a or b .
Euclid's second theorem: There are infinitely many prime integers.
Unique factorisation theorem. Congruences, Linear Congruences.
Statement of Chinese Remainder Theorem and simple problems, Theorem of Fermat. Multiplicative function $\phi(n)$. [15]
2. Complex Numbers: De-Moivre's Theorem and its applications, Exponential, Sine, Cosine and Logarithm of a complex number. Definition of a^z ($a \neq 0$). Inverse circular and Hyperbolic functions. [8]
3. Polynomials with real co-efficients : Fundamental theorem of classical Algebra (statement only). The n th degree polynomial equation has exactly n roots. Nature of roots of an equation (surd or complex roots occur in pairs). Statements of Descartes' rule of signs and of Sturm's Theorem and their applications. Multiple roots. Relation between roots and coefficients. Symmetric functions of roots. Transformation of equations. [8]

Group-B (20 Marks)
(Modern Algebra I)

1. Basic concepts: Sets, Sub-sets, Equality of sets, and Operations on sets - Union, Intersection and Complement, Symmetric difference. Properties including De Morgan's laws. Cartesian products: Binary relations from a set to a set (domain, range, examples from $\mathbb{R} \times \mathbb{R}$). Equivalence relation : Fundamental Theorem on Equivalence relation (Partition). Relation of Partial Order. Congruence relation module n is an Equivalence Relation. Congruence Classes. Mapping: Injection, Surjection, Bijection, Inverse and Identity mapping. Composition of Mappings and its Associativity. Binary operation : Intuitive definition. Definition on the basis of mapping. Binary operation in a finite set by Cayley Tables. [10]
2. Introduction to Group Theory : Groupoid, Semi-group, Quasigroup, Monoid, Group. Definition with both-sided identity and Inverse. (Examples of finite and infinite groups taken from various branches, e.g. from number system, roots of unity, non-singular real matrices of a fixed order, symmetries of a square, triangle, etc.) Additive group of integers modulo an integer m , Multiplicative group of integers modulo a prime p . Klein's 4 Group. Properties deducible from the definition of group including solvability of $ax = b$ and $ya = c$. Any finite semi-group, in which both cancellation laws hold, is a group. Integral powers of an element and laws of indices in a group. Order of a group and order of an element of a group.
Subgroups : Necessary and sufficient condition for a sub-set of a group to be a sub-group. Intersection and Union of two sub-groups. Necessary and sufficient condition for the union of two sub-groups to be a sub group. [10]
3. Introduction to Rings and Fields :
Ring : Definition and examples. Ring of integers modulo n . Properties directly following from the definition. Multiplicative identity in a ring. Commutative ring. Divisors of zero. Commutative ring with identity and without zero divisor - Integral Domain.
Field : Definition and examples. Every field is an integral domain. Every finite integral domain is a field. Sub-ring and Sub-field. Necessary and sufficient condition of a sub-set of a ring (a field) to be a sub-ring (sub-field). Characteristic of a ring and of an integral domain. [10]

Group-C (15 Marks)
(Linear Algebra I)

1. Matrices of real and complex numbers : Definition of a matrix. Equality of matrices. Addition, multiplication, Scalar multiplication. Transpose of a matrix. Symmetric, Skew-symmetric and Hermitian matrix. Orthogonal matrix. [5]
2. Determinants : Definition of a determinant of a square matrix. Basic Properties. Minors and Cofactors. Expansion of determinant. Laplace's method. Product of determinants. Symmetric and Skew-symmetric determinant. Vandermonde's determinant. Solution of the system of equations by Cramer's Rule (Problems of determinants of order greater than 4 will not be asked). (No proof of theorems). [8]
3. (a) Adjoint of a square matrix. For a square matrix A of order n,
 $A \cdot \text{Adj } A = \text{Adj } A \cdot A = \det A \cdot I_n$
(b) Non-singular matrix iff corresponding determinant is non-zero. Non-singular matrix and Invertible Matrix.
(c) Elementary operations. Echelon matrix. Rank of a matrix - Determination of rank of a matrix - statement and applications of all relevant results and theorems (No proof required). [5]
4. Normal forms. Elementary matrix : Statement and application of the results on Elementary matrix. The normal form and equivalence of matrices. Congruence of matrices - Statement and application of relevant theorems.
Real Quadratic form involving three variables. Reduction to Normal Form (Statement and application of relevant theorems). [10]

Group-D (10 Marks)

(Introduction to Elements of Linear Programming)

1. Definition of L. P. P. Formation of L. P. P. from daily life involving inequations. Graphical solution of L.P.P.
Basic solutions and Basic Feasible Solutions (BFS) with reference to L.P.P. Matrix formulation of L.P.P. Degenerate and Non-degenerate B.F.S. [8]

Group-E (30 Marks)
(Analytical Geometry of Two & Three Dimensions-I)

Two Dimensions (15 Marks)

1. a) Transformation of Rectangular axes : Translation, Rotation and their combinations. Theory of Invariants. [2]
b) General Equation of second degree in two variables: Reduction into canonical form. Classification of conics, Lengths and position of the axes. [2]
2. Pair of straight lines : Condition that the general equation of second degree in two variables may represent two straight lines. Point of intersection of two intersecting straight lines. Angle between two lines given by $ax^2 + 2hxy + by^2 = 0$. Angle bisector. Equation of two lines joining the origin to the points in which a line meets a conic. [8]
3. Polar equation of straight lines and circles. Polar equation of a conic referred to a focus as pole. Equations of tangent, normal, chord of contact. [5]

Three Dimensions (15 Marks)

1. Rectangular Cartesian co-ordinates in space. Halves and Octants. Concept of a geometric vector (directed line segment). Projection of a vector on a co-ordinate axis. Inclination of a vector with an axis. Co-ordinates of a vector. Direction cosines of a vector. Distance between two points. Division of a directed line segment in a given ratio. [4]
2. Equation of Plane : General form, Intercept and Normal form. The sides of a plane. Signed distance of a point from a plane. Equation of a plane passing through the intersection of two planes.
Angle between two intersecting planes. Bisectors of angles between two intersecting planes. Parallelism and perpendicularity of two planes. [8]
3. Straight lines in space : Equation (Symmetric & Parametric form). Direction ratio and Direction cosines. Canonical equation of the line of intersection of two intersecting planes. Angle between two lines. Distance of a point from a line. Condition of coplanarity of two lines. Equations of skew-lines. Shortest distance between two skew lines. [10]

Paper-II
Group-A (25 Marks)
(Real Analysis I)

1. Real numbers : Field axioms for numbers and other salient properties taken as axioms. Arithmetic continuum, well-ordering principle for \mathbb{N} . Concept of ordered field. Concept of point set in one dimension. Bounded set. Least upper bound axiom or completeness axiom. Archimedean property and density property. Characterisation of \mathbb{R} as a complete, Archimedean, ordered field and \mathbb{Q} as Archimedean, ordered field, Symbols ∞ and $-\infty$. Symbols of intervals. [5]
2. Sequence of points in one dimension: Bounds, Limits, Convergence and non convergence, Operations on limits, Sandwich rule. Monotone sequences and their convergence. Nested interval theorem: Cauchy's general principle of convergence. Cauchy sequence. Limit of some important sequences with special reference to $\left\{ \left(1 + \frac{1}{n} \right)^n \right\}_n$. Cauchy's first and second limit theorems. [10]
3. Point set in one dimension: (a) Denumerable, at most denumerable and non denumerable sets. A sub-set of a denumerable set is either finite or denumerable. Union of (i) a finite set and a denumerable set (ii) two denumerable sets (iii) denumerable number of denumerable set. Denumerability of rational number. Non denumerability of points in a finite interval and of the set of all real numbers, (b) Neighbourhood of a point. Interior point. Accumulation point and isolated point of a linear point set. Bolzano-Weierstrass Theorem on accumulation point, Derived set, Open set and closed set. Union, Intersection, Complement of open and closed sets in \mathbb{R} . No non-empty proper sub-set of \mathbb{R} is both open and closed in \mathbb{R} . Closure of a set to be defined as the union of the set and its derived set. Interior of a set, Deduction of basic properties of interior of a set and closure of a set. [10]
4. Real valued functions defined on intervals: Bounded functions. Step functions. Monotone functions. Composition of functions. Limits of functions: Algebra of limits and Sandwich rule. Cauchy criterion for the existence of finite limit. Important limits like $(\sin x)/x$, $\{\log(1+x)\}/x$, $(a^x - 1)/x$ ($a > 0$) as $x \rightarrow 0$. [5]
5. Continuity of a function at a point and on an interval: Neighbourhood properties, continuity of x^n , $\sin x$, $\cos x$, $\log x$ to be established. Continuity of composite function. Piecewise continuous functions. Discontinuity of function - type of discontinuity, ordinary discontinuity

Group - B (20 Marks)**Application of Differential Calculus and evaluation of integral I**

1. Concept of a plane curve : Closed curve, simple curve.
 - a) Tangents and Normals: Subtangent and sub-normals. Angle of intersection of curves. Pedal equation of a curve, Pedal of a curve
 - b) Rectilinear asymptotes of a curve (Cartesian, Parametric and polar form).
 - c) Curvature—Radius of curvature. Centre of curvature, Chord of curvature. Evolute of a curve.
 - d) Concavity, convexity, singular points, nodes, cusps, points of inflexion—simple problems on species of cusps of a curve.
 - e) Envelopes of one parameter and two parameter family of curves. Envelope as singular point locus-Evolute.
 - v) Curve tracing-familiarity with well-known curves. [15]

2. Indefinite and suitable corresponding definite integrals for the functions. $1/(a + b \cos x)^n$, $(l \cos x + m \sin x)/(p \cos x + q \sin x)$, $1/(x^2 + a^2)^n$. $\cos^m x$. $\sin^n x$, $\cos^m x \sin nx$ etc. where l, m, p, q, n are integers. Simple problems on definite integrals as the limit of a sum. [5]

3. Working knowledge of Beta and Gamma function (convergence to be assumed) and their interrelation (no proof). Use of the result $\Gamma(n)\Gamma(1-n) = \pi / \sin n\pi$ where $0 < n < 1$. Computation of the integrals $\int_0^{\pi/2} \sin^n x dx$, $\int_0^{\pi/2} \cos^n x dx$, $\int_0^{\pi/2} \tan^n x dx$, $\int_0^{\pi/2} \sin^m x \cos^n x dx$ etc. when they exist, (using Beta function and Gamma function). [5]

Group-C (30 Marks)
(Differential Equation I)

1. Significance of ordinary differential equations. Geometrical and physical consideration. Formation of differential equation by elimination of arbitrary constant. Meaning of the solution of ordinary differential equation.
Concept of linear and non-linear differential equations. [2]
2. Equations of first order and first degree: Statement of Existence theorem. Separable, Homogeneous and Exact equations. Condition of exactness, Integrating factor, Rules of finding integrating factor. (Statement of relevant results only) [5]
3. First order linear equations: Integrating factor (Statement of relevant results only). Equations reducible to first order linear equations. [2]
4. Equations of first order but not of first degree. Clairaut's equation. Singular solution. [3]
5. Applications : Geometric applications, Orthogonal trajectories. [2]
6. Higher order linear equations with constant co-efficients: Complementary Function, Particular Integral. Method of undetermined co-efficients, Symbolic operator D. Method of variation of parameters. Exact Equation.
Euler's homogeneous equation and Reduction to an equation of constant co-efficients. [8]
7. Second order linear equations with variable co-efficients:
$$\frac{d^2y}{dx^2} + p(x)\frac{dy}{dx} + Q(x)y = F(x).$$

Reduction of order when one solution of the homogeneous part is known. Complete solution. Method of variation of parameters. Reduction to Normal form. Change of independent variable. Operational Factors. [10]

Group-D (25 Marks)
(Vector Algebra and Analysis-I)

1. Vector Algebra: Vector (directed line segment) Equality of two free vectors, Addition of Vectors, Multiplication by a Scalar.
Position vector, Point of division, Conditions of collinearity of three points and co-planarity of four points.
Rectangular components of a vector in two and three dimensions.
Product of two or more vectors. Scalar and vector products, Scalar triple products and Vector triple products. Product of four vectors.
Direct application of Vector Algebra in (i) Geometrical and Trigonometrical problems (ii) Work done by a force, Moment of a force about a point.
Vector equations of straight lines and planes. Volume of a tetrahedron.
Shortest distance between two skew lines. [15]
2. Vector differentiation with respect to a scalar variable, Vector functions of one scalar variable, Derivative of a vector. Second derivative of a vector. Derivatives of sums and products. Velocity and Acceleration as derivative. [5]
3. Concepts of scalar and vector fields Direction derivative, Gradient, Divergence and curl, Laplacian. [5]

PART-II

Paper-III

Group-A (15 Marks)
(Classical Algebra II)

1. Polynomial equations with real co-efficients: Reciprocal equations. Cardan's method of solving a cubic equation. Ferrari's method of solving a biquadratic equation. Binomial equation. Special roots. [7]
2. Inequalities $AM \geq GM \geq HM$ and their generalisations : the theorem of weighted means and m th. power theorem. Cauchy's inequality (statement only) and its direct applications. [8]

Group-B (10 Marks)
(Modern Algebra II)

1. Cosets and Lagrange's theorem on finite group. Cyclic group : Definition and examples. Sub-groups of a cyclic group, Generator. Necessary and sufficient condition for a finite group to be cyclic. Permutations : Cycle, Transposition. Every $\sigma \in S_n$ (Symbols have their usual meanings) can be expressed as the product of disjoint cycles. Even and odd permutations. Permutation Group, Symmetric group, Alternating group: Order of an alternating group. [10]

Group-C (20 Marks)
(Linear Algebra II)

1. Vector/Linear space over a field with special reference to spaces of n tuples of real numbers. Examples of vector space from different branches of Mathematics. Sub-spaces. Union and intersection of vector sub-spaces. Sum of two sub-spaces. Linear combinations. Linear dependence and independence of a finite set of vectors. Linear span. Generators of a vector space. Finite dimensional vector space. Existence of Basis, Replacement Theorem. Any two bases have the same number of basis vectors. Extension theorem - Extraction of basis from generators. Formation of basis from linearly independent sub-set. Special emphasis on \mathbb{R}^n . Examples from \mathbb{R}^n ($n \leq 4$). [10]
2. Row Space and Column Space of a Matrix. Definition of row space and column space of a matrix, Row rank, Column rank. Rank of a matrix. Rank $(AB) \leq \text{Min}(\text{Rank } A, \text{Rank } B)$. [6]
3. Linear homogeneous system of equations : Solution space as a sub-space. For a homogeneous system $AX = 0$ in n unknowns, Rank $X(A) + \text{Rank } A = n$. The homogeneous system $AX = 0$ containing n equations in n unknowns has a non-trivial solution iff Rank $A < n$. System of linear non-homogeneous equations : Necessary and sufficient condition for the consistency of the system. Solution of the system of equations (Matrix method, Cramer's Rule). [5]
4. Characteristic equation of a square matrix. Eigen value and Eigen vector. Cayley-Hamilton Theorem. Simple properties of Eigen value and Eigen vector. Diagonalisation of matrices. [6]
5. Inner Product Space : Definition and examples. Norm. Euclidean vector spaces (EVS), Triangle Inequality and Cauchy-Schwarz Inequality in

EVS. Orthogonality of vectors. Orthonormal basis, Gram-Schmidt process of orthonormalisation. [8]

Group-D (20 Marks)
(Real Analysis II)

1. Sub-sequence : All the sub-sequences of a convergent sequence are convergent and converge to the same limit as that of original sequence. Every bounded sequence has a convergent sub-sequence. Subsequential limits. Upper limit and Lower limit as the L.U.B. and G.L.B. respectively of a set containing all the subsequential limits-other equivalent definitions. Inequalities and equalities with upper and lower limits. A sequence is convergent iff its upper and lower limits be equal. [10]
2. Infinite series of real numbers : Convergence, divergence Cauchy's criterion of convergence. Abel-Pringsheim's Test. Series of non-negative real numbers: Tests of convergence-Cauchy's condensation test. Upper limit and lower limit criteria for (i) Comparison test, (ii) Ratio test, (iii) Root test, (iv) Rummer's test. Statements of Raabe's test, Bertrand's test, Logarithmic test and Gauss test.
Series of arbitrary terms : Absolutely convergent and conditionally convergent series. Alternating series : Leibnitz test, Root test and Ratio test. Non-absolute convergence-Abel's and Dirichlet's test (statements and applications).
Rearrangement of series through examples. Riemann's rearrangement theorem (statement) and simple examples. Rearrangement of absolutely convergent series. [10]
3. Real valued functions defined on an interval : Uniform continuity. Properties of continuous functions on closed intervals : Boundedness, attainment of bounds, Bolzano's theorem. Intermediate-value property and allied results.
Continuous function carries closed and bounded interval into closed and bounded interval. Functions continuous on a closed and bounded interval I is uniformly continuous on I . A necessary and sufficient condition under which a continuous function on a bounded open interval I will be uniformly continuous on I . Lipschitz condition and uniform continuity. Existence of inverse function of a strictly monotone function and its continuity with special reference to inverse circular functions. [15]
4. Concept of differentiability and differential : chain rule, sign of derivative. For a differentiable function Lipschitz condition is equivalent to boundedness of the derivative. Successive derivative : Leibnitz theorem. Theorems on derivatives : Darboux theorem, Rolle's theorem,

Mean value theorem of Lagrange and Cauchy, Taylor's theorem with Schlomilch-Rouche's form of remainder, Lagrange's and Cauchy's form of remainder. Young's form of Taylor's theorem. Maclaurin's series. Expansion of e^x , a^x ($a > 0$), $\log(1+x)$, $(1+x)^m$, $\sin x$, $\cos x$ etc. with their ranges of validity. [10]

5. Indeterminate forms: Statement of L. Hospital's rule and its consequences. [2]
6. Point of local extremum (maximum, minimum and saddle point) of a function in an interval. Sufficient condition for the existence of a local maximum/ minimum of a function at a point. Application of the principle of maximum/minimum in geometrical and physical problems. [5]

Group-E (25 Marks)
(Functions of Several Variables)

1. Point set in two and three dimensions - Concept only of neighbourhood of a point, interior point, accumulation point, open set, closed set, Bolzano-Weierstrass theorem (statement only) in \mathbb{R}^2 . [2]
2. Concept (only) of \mathbb{R}^n and examples of functions on \mathbb{R}^n . [1]
3. a) Functions of two and three variables - Limit and continuity, Partial derivatives. Sufficient condition for continuity. Relevant results regarding repeated limits and double limits.
b) Functions $\mathbb{R}^2 \rightarrow \mathbb{R}^1$ - Differentiability and its sufficient condition, differential as a map, Chain rule. Euler's theorem and its converse. Commutativity of the order of partial derivatives - Theorem of Young and Schwarz. [12]
4. Jacobian for functions of two and three variables - Simple properties including functional dependence. Concept of Implicit Function : Statement and simple application of implicit function theorem for two variables. Differentiation of implicit function. Jacobian of implicit function. Partial derivative as ratio of two Jacobians in case of function of two variables. [10]

Group-F (10 Marks)
(Application of Integral Calculus II)

1. Area : Area enclosed by a curve, area enclosed between a curve and a secant, area between two curves and area between a curve and its asymptote (if there be any). [2]
2. Problems on volume and surface area of solids of revolution. Statement of Pappus theorem and its direct application to well-known curves. [2]
3. Determination of C. G. and moments & products of inertia-simple problems only. [3]

Paper-IV
Group-A (20 Marks)
(Analytical Geometry of Two & Three dimensions-II)

1. Circle, Parabola, Ellipse and Hyperbola : Equations of pair of tangents, from an external point, chord of contact, poles and polars, conjugate points and conjugate lines. [4]
2. Sphere (General Equation, Circle, Sphere through the intersection of two spheres, Radical Plane, Tangent, Normal).
Cone (Right circular cone, General homogeneous second degree equation. Section of a cone by a plane as a conic and as a pair of lines, Condition for three perpendicular generators, Reciprocal cone, Enveloping cone). Cylinder (Generators parallel to either of the axes, general form of equation. Right-circular cylinder, Enveloping cylinder).
Surface of Revolution (about axes of reference only). Ruled surface. [15]
3. Transformation of rectangular axes by translation, rotation and their combinations. [2]
4. General equation of second degree in three variables: Reduction to canonical forms. Classification of Quadrics. [2]
5. Ellipsoid, Hyperboloid, Paraboloid : Canonical equations and the study of their shape. [5]
6. Tangent planes, Normals, Enveloping cone. [5]
7. Generating lines of hyperboloid of one sheet and hyperbolic paraboloid. [8]
8. Knowledge of Cylindrical, Polar and Spherical polar co-ordinates, their relations (No deduction required). [2]

Group-B (10 Marks)
(Differential Equation II)

1. Simple eigenvalue problems. [2]
2. Simultaneous linear differential equations. Total differential equation: Condition of integrability. [3]
3. Partial differential equation (PDE) : Introduction, Formation of P.D.E, Solution of PDE by Lagrange's method of solution and by Charpit's method. [5]

Group-C (25 Marks)
(Linear Programming and Game Theory)

1. Hyperplane, Convex set, Cone, Extreme points, convex hull and convex polyhedron, Supporting and Separating hyperplane.
The collection of all feasible solutions of an L.P.P. constitutes a convex set. The extreme points of the convex set of feasible solutions correspond to its B.F.S. and conversely. The objective function has its optimal value at an extreme point of the convex polyhedron generated by the set of feasible solutions, (the convex polyhedron may also be unbounded). In the absence of degeneracy, if the L.P.P. admits of an optimal solution, then at least one B.F.S. must be optimal. Reduction of a F.S. to a B.F.S. [6]
2. Slack and surplus variables. Standard form of L.P.P. Theory of simplex method. Feasibility and optimality conditions. [6]
3. The algorithm. Two phase method, Degeneracy in L.P.P. and its resolution. [8]
4. Duality Theory. The dual of the dual is the primal. Relation between the objective values of dual and the primal problems. Relation between their optimal values. Complementary slackness, Duality and simplex method and their applications. [6]
5. Transportation and Assignment problems. Mathematical justification for optimality criterion. Hungarian method. Travelling Salesman problem.[8]
6. Concept of Game problem. Rectangular games. Pure strategy and Mixed strategy. Saddle point and its existence. Optimal strategy and value of the game. Necessary and sufficient condition for a given strategy to be optimal in a game. Concept of Dominance. Fundamental Theorem of Rectangular games. Algebraic method. Graphical method and Dominance method of solving Rectangular games. Inter-relation

Group-D (45 Marks)
(Analytical Dynamics of a Particle)
(Acquaintance with elementary concepts of Statics is assumed)

1. Fundamental Ideas and Principles of Dynamics. Laws of motion. Work, Power and Energy. Principles of conservation of energy and of momentum - Impulse and Impulsive forces. [5]
2. Motion in a straight line under variable acceleration. Motion under inverse square law, Composition of two S. H. M's of nearly equal frequencies. Motion of a particle tied to one end of an elastic string. Rectilinear motion in a resisting medium. Damped forced oscillation. Motion under gravity where the resistance varies as some integral power of velocity, Terminal velocity. [10]
3. Impact of elastic bodies. Newton's experimental law of elastic impact. Direct impact. Loss of K.E. in a direct impact Oblique impact of two elastic spheres, Loss of K. E. in oblique impact. Angle of deflection. [3]
4. Expressions for velocity and acceleration of a particle moving on a plane in Cartesian and polar co-ordinates. Motion of particle moving in a plane with reference to a set of rotating axes. Motion of a particle in plane. [6]
5. Central forces and central orbits. Characteristics of central orbits. Stability of nearly circular orbits. [6]
6. Tangential and Normal accelerations. Circular motion. Motion of a train or cyclist on a banked tract. Simple cases of constrained motion of a particle. [4]
7. Motion of a particle in a plane under different laws of resistance. Motion of a projectile in a resisting medium in which the resistance varies as the velocity. Trajectories in a resisting medium where resistance varies as some integral power of the velocity. [5]
8. Motion on a smooth curve under resistance. [2]
9. Motion under inverse square law in a plane. Escape velocity, Planetary motion and Kepler's laws. Time of describing an arc of the orbit. Motion of artificial satellite Slightly disturbed orbits. [6]
10. Conservative field of force and principle of conservation of energy. Motion of a rough curve (such as circle, parabola, ellipse, cycloid etc.)

- under gravity. [6]
11. Equation of motion of a particle of varying mass. Simple problems of motion of varying mass such as those of falling raindrops and projected rockets. [6]

ANNEXURE : LIST OF BOOKS FOR REFERENCE

Paper-I, Group A & Paper-III, Group A

1. The Theory of Equations (Vol. I) - Burnside and Panton.
2. Higher Algebra - Barnard and Child.
3. Higher Algebra - Kurosh (Mir)

Paper-I, Group B & Paper-III, Group B

1. Modern Algebra - Surjeet Singh & Zameruddin.
2. First Course in Abstract Algebra – Fraleigh
3. Topics in Algebra – Herstein
4. Text book of algebra - Leadership Project Committee (University of Bombay)
5. Elements of Abstract Algebra - Sharma, Gokhroo, Saini (Jaipur Publishing House, S. M. S. Highway, Jaipur-3).
6. Abstract Algebra - N. P. Chaudhuri (Tata Mc.Graw Hill).

Paper-I, Group C & Paper-III, Group C

1. Linear Algebra - Hadley
2. Text Book of Matrix - B. S. Vaatsa

Paper-I, Group D & Paper IV, Group A

1. Co-ordinate Geometry - S. L. Loney
2. Co-ordinate Geometry of Three Dimensions - Robert J. T. Bell
3. Elementary Treatise on Conic sections —. C. Smith
4. Solid Analytic Geometry - C. Smith.

Paper-II, Group A & Paper-III, Group D, Group E

1. Basic Real & Abstract Analysis - Randolph J. P. (Academic Press)
2. A First Course in Real Analysis - M. H. Protter & G. B. Morrey (Springer Verlag, NBHM)
3. A Course of Analysis - Phillips.
4. Problems in Mathematical Analysis - B. P. Demidovich (Mir)
5. Problems in Mathematical Analysis - Berman (Mir)
6. Differential & Integral Calculus (Vols. I & II) - Courant & John.

7. Calculus of One Variable-Maron (CBS Publication)
8. Introduction to Real Analysis - Bartle & Sherbert (John Wiley & sons)
9. Mathematical Analysis - Parzynski.
10. Introduction to Real Variable theory - Saxena & Shah (Prentice Hall Publication)
11. Real Analysis - Ravi Prakash & Siri Wasan (Tata McGraw Hill)
12. Mathematical Analysis - Shantinakaran (S. Chand & Co.)
13. Theory & Applications of Infinite Series - Dr. K. Knopp
14. Advanced Calculus - David Widder (Prentice Hall)

Paper-II, Group B & Paper-III, Group F

1. Differential Calculus - Shantinarayan.
2. Intergral Calculus – Shantinarayan
3. An elementary treatise on the Differential Calculus - J. Edwards (Radha Publishing House)

Paper-II, Group D

1. Vector Analysis - Louis Brand.
2. Vector Analysis - Barry Spain
3. Vector & Tensor Analysis - Spiegel (Schaum)
4. Elementary Vektor Analysis - C. E. Weatherburn (Vol. I & II)

Paper-I, Group C & Paper-IV Group C

1. Linear Programming : Method and application - S. I. Gass
2. Linear Programming - G. Hadley
3. An Introduction to Linear Programming & Theory of Games - S. Vajda.

Paper-II, Group C & Paper IV, Group B

1. Differential Equations - Lester R. Ford (McGraw Hill)
2. Differential Equations - S. L. Ross (John Wiley)
3. Differential Equations - H. T. H. Piaggio
4. A Text book of Ordinary Differential Equations - Kiseleyev, Makarenko & Krasnov (Mir)
5. Differential Equations - H. B. Phillips (John Wiley & Sons)
6. Differential Equations with Application & Programs - S. Balachanda Rao, H. R. Anuradha (University Press)
7. Text Book of Ordinary Differential Equations (2nd Ed.) - S. G. Deo, V. Lakshmikantham & V. Raghavendra (Tata McGraw Hill).
8. An Elementary Course in Partial Differential Equation-T. Amarnath

(Narosa)

9. An Introductory Course on Ordinary Differential Equation-D.A. Murray.

Paper IV, Group D:

1. An Elementary Treatise on the Dynamics of a Particle & of Rigid bodies
- S. L. Loney (Macmillan)

**PART-III
Paper-V
Group-A (70 Marks)
(Real Analysis-II)**

1. *Linear Point Set:* Covering by open intervals. Sub-covering. Cantor intersection theorem. Lindelof-covering theorem (statement only). Compact sets. Heine-Borel Theorem and its converse. [5]
2. *Functions defined on point sets in one dimension:* Limit and continuity. Continuity on compact set. Uniform continuity on compact set. Inverse function. Continuous image of compact set is compact. [5]
3. a) Sequence of functions defined on a set ($\subset \mathbb{R}$): Pointwise and uniform convergence. Cauchy criterion of uniform convergence. Dini's theorem on uniform convergence. Weierstrass' M-test.
Limit function: Boundedness. Repeated limits. Continuity. Integrability and differentiability of the limit function of a sequence of functions in case of uniform convergence.
b) *Series of functions defined on a set:* Pointwise and uniform convergence. Cauchy criterion of uniform convergence. Dini's theorem on uniform convergence. Tests of uniform convergence -Weierstrass' M-test. Statement of Abel's and Dirichlet's test and their applications. Passage to the limit term by term. Sum function : boundedness, continuity, integrability, differentiability of a series of functions in case of uniform convergence.
c) *Power Series (P.S.):* Fundamental theorem of Power Series. Cauchy-Hadamard theorem. Determination of radius of convergence. Uniform and absolute convergence of P.S. Properties of sum function. Abel's limit theorems. Uniqueness of power series having same sum function.
Exponential, logarithmic and trigonometric functions defined by Power Series and deduction of their salient properties. [20]
4. a) *Function of two variables:* $f: \mathbb{R}^2 \rightarrow \mathbb{R}^1$. Mean value theorem and Taylor's theorem.
b) Extremum of functions of two and three variables: Lagrange's Method of undetermined multipliers. [3]
5. *Riemann Integration for bounded functions:* Partition and

refinement of partition of an interval. Upper Darboux sum $U(P, f)$ & Lower Darboux sum $L(P, f)$ and associated results. Upper Riemann (Darboux) integral and Lower Riemann (Darboux) integral. Darboux's theorem. Necessary and sufficient condition of R-integrability.

Classes of Riemann Integrable functions: Monotone functions, continuous functions, piecewise continuous functions with (i) finite number of points of discontinuities, (ii) infinite number of points of discontinuities having finite number of accumulation points.

Riemann Sum : Alternative definition of integrability. Equivalence of two definitions (statement only).

Integrability of sum, product, quotient, modulus of R-integrable functions.

Sufficient condition for integrability of composition of R-integrable functions.

Properties of Riemann integrable functions arising from the above results.

Function defined by definite integral $\int_a^x f(t)dt$ and its properties.

Primitive or Indefinite Integral. Properties of definite integral. Definition of $\log x$ ($x > 0$) as an integral and deduction of simple properties including its range. Definition of e and its simple properties. Fundamental theorem of Integral Calculus. First Mean Value Theorem of Integral Calculus. Statements and applications of Second Mean Value Theorem of Integral Calculus (both Bonnet's form and Weierstrass form) Theorem on method of substitution for continuous functions. [10]

6. *Improper Integral:* Range of integration, finite or infinite. Necessary and sufficient condition for convergence of Improper Integral in both cases.

Tests of convergence: Comparison and μ -Test. Absolute and non-absolute convergence - Corresponding Tests. Beta and Gamma functions - their convergence and inter-relations. Statement of Abel's and Dirichlet's Tests for convergence of the integral of a product.

Uniform convergence of Improper Integral by M-Test.

$$\left[\Gamma(n)\Gamma(1-n) = \frac{\pi}{\sin nx}, 0 < n < 1, \text{ to be assumed} \right] \quad [8]$$

7. *Definite Integral as a function of a parameter:* Differentiation and Integration with respect to the parameter under integral sign –

- Statements (only) of some relevant theorems and simple problems. [3]
8. i) *Concept on function of Bounded Variation (BV)*: Monotonic function is of BV. If f be of BV on $[a, b]$, then f is bounded on $[a, b]$. Examples of functions of BV which are not continuous and continuous functions not of BV. Statement of a necessary and sufficient condition for a function f to be of BV on $[a, b]$ is that f can be written as the difference of two monotonic increasing functions on $[a, b]$ [3]
- ii) *Rectification of Plane Curves*: Definition of Rectifiable Curve. A plane curve $v = (f, g)$ is rectifiable if and only if f and g be both of bounded variation (Statement only). Simple examples on determination of length of curves.
 Determinations of intrinsic equation of a curve. [5]
9. *Fourier Series*: Trigonometric Series. Fourier co-efficients. A periodic function of bounded variation can be expressed as a Fourier series (Statement only). Statement of Dirichlet's conditions of convergence. Half-range series, sine and cosine series. [5]
10. i) *Double Integral*: Concept of Upper sum, Lower sum, Upper Integral, Lower Integral and Double Integral (no rigorous treatment is needed). Statement of Existence Theorem for continuous functions. Change of order of integration. Triple integral. Transformation of double and triple Integrals (Problems only).
- ii) *Determination* of volume and surface area by Multiple Integrals (Problems only). [5]

Group-B (15 Marks)
(Metric Space)

Definition and examples of Metric Space. Neighbourhoods. Limit points. Interior points. Open and closed sets. Closure and Interior. Boundary points. Sub-space of a Metric Space. Cauchy Sequences. Completeness. Cantor Intersection Theorem. Construction of real number as the completion of the incomplete metric spaces of rationals. Real number as a complete ordered field (No proof of theorem). [10]

Group-C (15 Marks)
Complex Analysis

Complex numbers as ordered pairs. Geometric representation of complex numbers. Stereographic projection.

Complex functions: Continuity and differentiability of complex functions. Analytic functions. Cauchy-Riemann Equations. Statement of Milne's Method, Harmonic functions. [10]

Paper-VI
Group-A (50 Marks)
(Probability and Statistics)

Mathematical Theory of Probability:

Random experiments. Simple and compound events. Event space. Classical and frequency definitions of probability and their drawbacks. Axioms of Probability. Statistical regularity. Multiplication rule of probabilities. Bayes' theorem. Independent events. Independent random experiments. Independent trials. Bernoulli trials and binomial law. Poisson trials. Random variables. Probability distribution. Distribution function. Discrete and continuous distributions. Binomial, Poisson, Gamma, Uniform and Normal distribution. Poisson Process (only definition). Transformation of random variables. Two dimensional probability distributions. Discrete and continuous distributions in two dimensions. Uniform distribution and two dimensional normal distribution, conditional distributions. Transformation of random variables in two dimensions. Mathematical expectation. Mean, variance, moments, central moments. Measures of location, dispersion, skewness and kurtosis. Median, mode, quartiles. Moment-generating function. Characteristic function. Two-dimensional expectation. Covariance, Correlation co-efficient, Joint characteristic function. Multiplication rule for expectations. Conditional expectation. Regression curves, least square regression lines and parabolas. Chi-square and t -distributions and their important properties (Statements only) Tchebycheff's inequality. Convergence in probability. Statements of : Bernoulli's limit theorem, Law of large numbers, Poisson's approximation to binomial distribution and normal approximation to binomial distribution. Concepts of asymptotically normal distribution. Statement of central limit theorem in the case of equal components and of limit theorem for characteristic functions (Stress should be more on the distribution function)

theory than on combinatorial problems. Difficult combinatorial problems should be avoided). [40]

Mathematical Statistics:

Random sample. Concept of sampling and various types of sampling. Sample and population. Collection, tabulation and graphical representation. Grouping of data, Sample characteristic and their computation. Sampling distribution of a statistic. Estimates of a population characteristic or parameter. Unbiased and consistent estimates. Sample characteristics as estimates of the corresponding population characteristics. Sampling distributions of the sample mean and variance. Exact sampling distributions for the normal populations. Bivariate samples. Scatter diagram. Sample correlation co-efficient. Least square regression lines and parabolas. Estimation of parameters. Method of maximum likelihood. Applications to binomial, Poisson and normal population. Confidence intervals. Interval estimation for parameters of normal population. Statistical hypothesis. Simple and composite hypothesis. Best critical region of a test. Neyman-Pearson theorem (Statement only) and its application to normal population. Likelihood ratio testing and its application to normal population. Simple applications of hypothesis testing (for practical). [35]

Group-B (50 Marks)
(Numerical Analysis and Computer Programming)

Numerical Analysis:

What is Numerical Analysis?

Errors in Numerical computation: Gross error, Round off error, Truncation error. Approximate numbers. Significant figures. Absolute, relative and percentage error.

Operators : $\Delta, \nabla, E, \mu, \delta$ (Definitions and simple relations among them)

Interpolation : Problems of interpolation, Weierstrass' approximation theorem (only statement). Polynomial interpolation. Equispaced arguments. Difference table. Deduction of Newton's forward and backward interpolation formulae. Statements of Stirling's and Bessel's interpolation formulae. Error terms. General interpolation formulae : Deduction of Lagrange's interpolation formula. Divided difference. Newton's General Interpolation formula (only statement). Inverse interpolation.

Interpolation formulae using the values of both $f(x)$ and its derivative $f'(x)$: Idea of Hermite interpolation formula (only the basic concepts).

Numerical Differentiation based on Newton's forward & backward and Lagrange's formulae.

Numerical Integration : Integration of Newton's interpolation formula.

Newton - Cote's formula. Basic Trapezoidal and Simpson's 1/3 rd. formulae. Their composite forms. Weddle's rule (only statement). Statement of the error terms associated with these formulae. Degree of precision (only definition).

Numerical solution of non-linear equations : Location of a real root by tabular method. Bisection method. Secant/Regula-Falsi and Newton-Raphson methods, their geometrical significance. Fixed point iteration method.

Numerical solution of a system of linear equations: Gauss elimination method. Iterative method - Gauss-Seidel method. Matrix inversion by Gauss elimination method (only problems - up to 3x3 order).

Eigenvalue Problems : Power method for numerically extreme eigenvalues.

Numerical solution of Ordinary Differential Equation : Basic ideas, nature of the problem. Picard, Euler and Runge-Kutta (4th order) methods (emphasis on the problems only). [30]

Fundamentals of Computer Science and Computer Programming:

Computer fundamentals : Historical evolution, computer generations, functional description, operating systems, hardware & software.

Positional number systems : binary, octal, decimal, hexadecimal systems. Binary arithmetic.

Storing of data in a computer : BIT, BYTE, Word. Coding of data - ASCII, EBCDIC, etc.

Algorithm and Flow Chart : Important features. Ideas about the complexities of algorithm. Application in simple problems.

Programming languages : General concepts, Machine language, Assembly Language, High Level Languages. Compiler and Interpreter. Object and Source Program. Ideas about some major HLL.

Students are required to opt for any one of the following two programming languages :

(1) Programming with FORTRAN 77/90

or (2) Introduction to ANSI C :

Programming with FORTRAN 77/90 :

Introduction, Keywords, Constants and Variables-integer, real, complex, logical, character, double precision, subscripted. Fortran expressions. I/O statements-formatted and unformatted. Program execution control-logical if, if-then-else, etc. Arrays-Dimension statement. Repetitive computations-Do, Nested Do, etc. Sub-programs : Function sub program and Subroutine sub program.

Application to simple problems : Evaluation of functional

values, solution of quadratic equations, approximate sum of convergent infinite series, sorting of real numbers, numerical integration, numerical solution of non-linear equations, numerical solution of ordinary differential equations, etc.

Introduction to ANSI C:

Character set in ANSI C. Key words: if, while, do, for, int, char, float etc.

Data type : character, integer, floating point, etc. Variables, Operators :=, =, !=, <, >, etc. (arithmetic, assignment, relational, logical, increment, etc.). Expressions : e.g. (a == b) != (b == c), Statements : e.g. if (a < b) small = a; else small = b. Standard input/output. Use of while, if else, for, do... while, switch, continue, etc. Arrays, strings, Function definition. Running simple C Programs. Header File. [30]

Books for Reference

1. The elements of probability theory and some of its applications : H. Cramer
2. An introduction to probability theory and its applications (Vol 1) : W. Feller
3. Mathematical methods of statistics : H. Cramer
4. Theory of probability : B. V. Gnedenko
5. Mathematical probability : J. V. Uspensky
6. Structured FORTRAN 77 for engineers and scientists : D. M. Etter (The Benjamin/Cummings Publishing Co. Inc.)
7. Programming with FORTRAN 77-A structured approach : R. S. Dhaliwal, S. K. Agarwal, S. K. Gupta (Wiley Eastern Limited/New Age International Ltd.)
8. Programming and computing with FORTRAN 77/90 : P. S. Grover (Allied Publishers)
9. Programming with FORTRAN including structured FORTRAN : Seymour Lipschutz and Arthur Poe (Schaum's Outline Series)
10. FORTRAN 77 and numerical methods : C. Xavier (Wiley Eastern limited)
11. Numerical methods: E. Balagurusamy (Tata McGraw-Hill Publishing Co.)
12. Let us C : Yashvant Kanetkar (BPB Publications)
13. Programming in C : V. Krishnamoorthy and K. R. Radhakrishnan (Tata McGraw Hill).
14. C by example : Noel Kalicharan (Cambridge University Press)

15. Programming in ANSI C: E. Balagurusamy (Tata McGraw Hill).
16. Introduction to numerical analysis : F. B. Hilderbrand (TMH Edition)
17. Numerical Analysis : J. Scarborough
18. Introduction to numerical analysis : Carl Erik Froberg (Addison Wesley Publishing)
19. Numerical methods for science and engineering : R. G. Stanton (Prentice Hall)

Paper-VII

Group-A (10 Marks) (Vector Analysis II)

Line integrals as integrals of vectors, circulation, irrotational vector, work done, conservative force, potential orientation. Statements and verification of Green's theorem, Stokes' theorem and Divergence theorem. [8]

Group-B (55 Marks) (Analytical Statics)

1. Friction : Laws of Friction, Angle of friction, Cone of friction. To find the positions of equilibrium of a particle lying on a (i) rough plane curve, (ii) rough surface under the action of any given forces. [4]
2. Centre of Gravity : General formula for the determination of C.G. Determination of position of C. G. of any arc, area of solid of known shape by method of integration. [3]
3. Astatic Equilibrium, Astatic Centre. Positions of equilibrium of a particle lying on a smooth plane curve under action of given force. Action at a joint in a frame work. [4]
4. Virtual work : Principle of virtual work for a single particle. Deduction of the conditions of equilibrium of a particle under coplanar forces from the principle of virtual work. The principle of virtual work for a rigid body. Forces which do not appear in the equation of virtual work. Forces which appear in the equation of virtual work. The principle of virtual work for any system of coplanar forces acting on a rigid body. Converse of the principle of virtual work. [8]
5. Stable and Unstable equilibrium. Co-ordinates of a body and of a system of bodies. Field of forces. Conservative field. Potential energy of a system. The energy test of stability. Condition of stability of equilibrium of a perfectly rough heavy body lying on fixed body. Rocking stones. [6]
6. Forces in three dimensions. Moment of a force about a line. Axis

of a couple. Resultant of any two couples acting on a body. Resultant of any number of couples acting on a rigid body. Reduction of a system of forces acting on a rigid body. Resultant force is an invariant of the system but the resultant couple is not an invariant.

Conditions of equilibrium of a system of forces acting on a body. Deductions of the conditions of equilibrium of a system of forces acting on a rigid body from the principle of virtual work. Poincot's central axis. A given system of forces can have only one central axis. Wrench, Pitch, Intensity and Screw. Condition that a given system of forces may have a single resultant. Invariants of a given system of forces. Equation of the central axis of a given system of forces. [12]

Group-C (30 Marks)
(Rigid Dynamics)

Momental ellipsoid. Equipomental system. Principal axis. D'Alembert's principle. D'Alembert's equations of motion. Principles of moments. Principles of conservations of linear and angular momentum. Independence of the motion of centre of inertia and the motion relative to the centre of inertia. Principle of energy. Principle of conservation of energy.

Equation of motion of a rigid body about a fixed axis. Expression for kinetic energy and moment of momentum of a rigid body moving about a fixed axis. Compound pendulum. Interchangeability of the points of a suspension and centre of oscillation. Minimum time of oscillation. Reaction of axis of rotation.

Equations of motion of a rigid body moving in two dimensions. Expression for kinetic energy and angular momentum about the origin of rigid body moving in two dimensions. Two dimensional motion of a solid of revolution down a rough inclined plane. Necessary and sufficient condition for pure rolling. Two dimensional motion of a solid of revolution moving on a rough horizontal plane.

Equations of motion under impulsive forces. Equation of motion about a fixed axis under impulsive forces. Centre of percussion. To show that (i) if there is a definite straight line such that the sum of the moments of the external impulses acting on a system of particles about it vanishes, then the total angular momentum of the system about that line remains unaltered, (ii) the change of K. E. of a system of particles moving in any manner under the application of impulsive forces is equal to the work done by the impulsive forces. Impulsive forces applied to a rigid body moving in two dimensions.

Group-D (25 Marks)
(Hydrostatics)

1. Definition of Fluid, Perfect Fluid, Pressure. To prove that the pressure at a point in a fluid in equilibrium is the same in every direction. Transmissibility of liquid pressure. Pressure of heavy fluids. To prove
 - i) In a fluid at rest under gravity the pressure is the same at all points in the same horizontal plane.
 - ii) In a homogeneous fluid at rest under gravity the difference between the pressures at two points is proportional to the difference of their depths.
 - iii) In a fluid at rest under gravity horizontal planes are surfaces of equal density.
 - iv) When two fluids of different densities at rest under gravity do not mix, their surface of separation is a horizontal plane.Pressure in heavy homogeneous liquid. Thrust of heavy homogeneous liquid on plane surfaces.
2. Definition of centre of pressure. Formula for the depth of the centre of pressure of a plane area. Position of the centre of pressure. Centre of pressure of a triangular area whose angular points are at different depths. Centre of pressure of a circular area. Position of the centre of pressure referred to co-ordinate axes through the centroid of the area. Centre of pressure of an elliptical area when its major axis is vertical or along the line of greatest slope. Effect of additional depth on centre of pressure.
3. Equilibrium of fluids in given fields of force : Definition of field of force, line of force. Pressure derivative in terms of force. Surface of equipressure. To find the necessary and sufficient conditions of equilibrium of a fluid under the action of a force whose components are X , Y , Z along the co-ordinate axes. To prove (i) that surfaces of equal pressure are the surfaces intersecting orthogonally the lines of force , (ii) when the force system is conservative, the surfaces of equal pressure are equipotential surfaces and are also surfaces of equal density. To find the differential equations of the surfaces of equal pressure and density.
4. Rotating fluids. To determine the pressure at any point and the surfaces of equal pressure when a mass of homogeneous liquid

- contained in a vessel, revolves uniformly about a vertical axis.
5. The stability of the equilibrium of floating bodies. Definition, stability of equilibrium of a floating body, metacentre, plane of floatation, surface of buoyancy. General propositions about small rotational displacements. To derive the condition for stability.
 6. Pressure of gases. The atmosphere. Relation between pressure, density and temperature. Pressure in an isothermal atmosphere. Atmosphere in convective equilibrium. [30]

Books for Reference

1. Vector Analysis - Spiegel (Schaum)
2. Vector Calculus - C. E. Weatherburn
3. Analytical Statics - S. L. Loney
4. Dynamics of a Particle and of Rigid bodies - S. L. Loney.
5. Hydrostatics - A. S. Ramsay

Paper-VIII A Group-A (25 Marks) (Algebra II)

Section - 1: Linear Algebra (10 Marks)

1. Linear Transformation (L.T.) on Vector Spaces : Definition of L. T., Null space, range space of an L. T., Rank and Nullity, Sylvester's Law of Nullity. [Rank (T) + Nullity (T) = dim (V)]. Determination of rank (T), Nullity (T) of linear transformation $T : R^n \rightarrow R^m$. Inverse of Linear Transformation. Non-singular Linear Transformation. Change of basis by Linear Transformation. Vector spaces of Linear Transformations.
2. Linear Transformation and Matrices : Matrix of a linear transformation relative to ordered bases of finite-dimensional vector spaces. Correspondence between Linear Transformations and Matrices. Linear Transformation is non-singular if its representative matrix be non-singular. Rank of L.T. = Rank of the corresponding matrix. [5]

Section-2 : Modern Algebra (8 Marks)

3. Normal sub-groups of a Group : Definition and examples. Intersection, union of normal sub-groups. Product of a normal sub-group and a sub

- group. Quotient Group of a Group by a normal sub-group. [5]
4. Homomorphism and Isomorphism of Groups. Kernel of a Homomorphism. First Isomorphism Theorem. Properties deducible from definition of morphism. An infinite cyclic group is isomorphic to $(\mathbb{Z}, +)$ and a finite cyclic group of order n is isomorphic to the group of residue classes modulo n . [5]

Section - 3 : Boolean Algebra (7 Marks)

5. Boolean Algebra : Huntington Postulates for Boolean Algebra. Algebra of sets and Switching Algebra as examples of Boolean Algebra. Statement of principle of duality. Disjunctive normal and Conjunctive normal forms of Boolean Expressions. Design of simple switching circuits. [10]

Group-B (15 Marks)
(Differential Equations III)

1. Laplace Transform and its application in ordinary differential equations: Laplace Transform and Inverse Laplace Transform. Statement of Existence theorem. Elementary properties of Laplace Transform and its Inverse. Laplace Transform of derivatives. Laplace transform of integrals. Convolution theorem (Statement only). Application to the solution of ordinary differential equations of second order with constant coefficients.
2. Series solution at an ordinary point : Power Series solution of ordinary differential equations, Simple problems only.

Books for Reference

1. Advanced Calculus - David Widder (Prentice Hall)
2. Elementary Treatise on Laplace Transform - B. Sen (World Press).
3. Operational Methods in Applied Mathematics - H. S. Carslaw. J. C. Jaeger.

Group-C (10 Marks) (Tensor Calculus)

A tensor as a generalized concept of a vector in an Euclidean space E^3 . To generalize the idea in an n -dimensional space. Definition of E^n . Transformation of co-ordinates in E^n ($n = 2, 3$ as example). Summation convention.

Contravariant and covariant vectors. Invariants. Contravariant, covariant and mixed tensors. The Kronecker delta. Algebra of tensors Symmetric and skew-symmetric tensors. Addition and scalar multiplication. Contraction. Outer and Inner products of tensors. Quotient law. Reciprocal Tensor. Riemannian space. Line element and metric tensor. Reciprocal metric tensor. Raising and lowering of indices with the help of metric tensor. Associated tensor. Magnitude of a vector. Inclination of two vectors. Orthogonal vectors. Christoffel symbols and their laws of transformations, Covariant differentiation of vectors and tensors.

Books for Reference

1. Tensor Calculus - Barry Spain
2. Vector Analysis and Tensor Calculus (Schaum Series) – Spiegel

Paper-VIII B Practical (50 Marks)

*Numerical Analysis**

Newton's forward & backward interpolation. Stirling & Bessel interpolation. Lagrange's and Newton's Divided Difference interpolation. Inverse Interpolation.

Numerical differentiation based on Newton's forward and backward formulae.

Numerical integration : Trapezoidal and Weddle's rule.

Numerical solution of non-linear equations : Tabulation, Bisection, Secant/Regula Falsi and Fixed-point iteration methods.

Numerical solution of a system of linear equations : Gauss elimination method, Gauss Seidal iteration method. Matrix inversion by Gauss method.

Power method for finding the extreme eigenvalues. (3×3 or 4×4 order).

*Statistics **

Sample characteristics - mean, variance, skewness, kurtosis, excess, mode, median, semi-interquartile range. Bivariate samples - correlation coefficient, regression lines, parabolic curve fitting, goodness of fit.

Confidence intervals for mean and standard deviation of a normal population. Approximate confidence limits for the parameter of a binomial populations.

Tests of hypothesis - tests on mean and standard deviation of a normal population, comparison of means and standard deviations of two normal populations. Approximate tests on the parameter of a binomial population, on comparison of two binomial populations. Poisson distribution.

**Above problems are to be done on a non-programmable scientific calculator.*

The following problems are to be done on computers using either FORTRAN or C compiler:

1. Numerical integration by Simpson's 1/3 rule.
2. Numerical solution of non-linear equation by Newton - Raphson method.
3. Numerical solution of ordinary differential equation by Runge-Kutta (4th order) method.

Detailed Syllabus

B.SC. MATHEMATICS GENERAL

PART – I

PAPER – I

GROUP – A : 25 MARKS

(CLASSICAL ALGEBRA)

1. Complex Numbers : De Moivre's Theorem and its applications
Exponential, Sine, Cosine and Logarithm of a complex number.
Definition of a^z ($a \neq 0$). Inverse circular and Hyperbolic functions.

2. Polynomials: Fundamental Theorem of Classical Algebra (Statement only). Polynomials with real co-efficients: The nth degree polynomial equation has exactly n roots. Nature of roots of an equation (surd or complex roots occur in pairs). Statement of Descartes's rule of signs and its applications.

Statements of:

- i) If the polynomial $f(x)$ has opposite signs for two real values of x , e.g. a and b , the equation $f(x) = 0$ has an odd number of real roots between a and b . If $f(a)$ and $f(b)$ are of same sign, either no real root or an even number of roots lies between a and b .

 - ii) Rolle's Theorem and its direct applications. Relation between roots and co-efficients, symmetric functions of roots, Transformations of equations. Cardan's method of solution of a cubic.
3. Determinants up to the third order: Properties, Cofactor and Minor, product of two determinants. Adjoint, Symmetric and Skew-symmetric

determinants. Solutions of linear equations with not more than three variables by Cramer's Rule.

4. Matrices of Real Numbers : Equality of matrices. Addition of Matrices. Multiplication of a matrix by scalar. Multiplication of matrices — Associative properties. Transpose of matrix – Its properties. Inverse of a non-singular square matrix. Symmetric and Skew - Symmetric matrices. Scalar matrix. Orthogonal matrix. Elementary operations on matrices.

Rank of a matrix : Determination of rank either by considering minors or by sweep-out process. Consistency and solution of a system of linear equations with not more than 3 variables by matrix method.

GROUP – B : 15 MARKS
(ANALYTICAL GEOMETRY OF TWO DIMENSIONS)

1. Transformations of Rectangular axes : Translation, Rotation and their combinations. Invariants.
2. General equation of second degree in x and y : Reduction to canonical forms. Classification of conic.
3. Pair of straight lines : Condition that the general equation of 2nd degree in x and y may represent two straight lines. Point of intersection of two intersecting straight lines. Angle between two lines given by $ax^2 + 2hxy + by^2 = 0$. Equation of bisectors. Equation of two lines joining the origin to the points in which a line meets a conic.

4. Equations of pair of tangents from an external point, chord of contact, poles and polars in case of General conic : Particular cases for Parabola, Ellipse, Circle, Hyperbola.
5. Polar equation of straight lines and circles. Polar equation of a conic referred to a focus as pole. Equation of chord joining two points. Equations of tangent and normal.

GROUP – C : 15 MARKS
(VECTOR ALGEBRA)

Addition of Vectors, Multiplication of a Vector by a Scalar. Collinear and Coplanar Vectors. Scalar and Vector products of two and three vectors. Simple applications to problems of Geometry. Vector equation of plane and straight line. Volume of Tetrahedron. Applications to problems of Mechanics (Work done and Moment).

GROUP-D : 25 MARKS
(DIFFERENTIAL CALCULUS)

1. Rational numbers, Geometrical representations, Irrational number, Real number represented as point on a line - Linear Continuum. Acquaintance with basic properties of real number (No deduction or proof is included).
2. Real-valued functions defined on an interval, limit of a function (Cauchy's definition). Algebra of limits. Continuity of a function at a point and in an interval. Acquaintance (on proof) with the important properties of continuous functions on closed intervals. Statement of existence of inverse function of a strictly monotone function and its continuity.

3. Derivative - its geometrical and physical interpretation. Sign of derivative-Monotonic increasing and decreasing functions. Relation between continuity and derivability. Differential - application in finding approximation.
4. Successive erivative - Leibnitz's theorem and its application.
5. Functions of two and three vaviables: their geometrical representations. Limit and Continuity (definitions only) for function of two variables. Partial derivatives. Knowledge and use of chain Rule. Exact differentials (emphasis on solving problems only). Functions of two variables - Successive partial Derivatives: Statement of Schwarz's Theorem on Commutative property of mixed derivatives. Euler's Theorem on homogeneous function of two and three variables.
6. Applications of Differential Calculus : Tangents and Normals, Pedal equation and Pedal of a curve. Curvature of plane curves.

GROUP – E : 10 MARKS
(INTEGRAL CALCULUS)

1. Integration of the form :-

$$\int \frac{dx}{a + b \cos x} \int \frac{l \sin x + m \cos x}{n \sin x + p \cos x} dx$$
 and
 Integration of Rarional functions.
2. Evaluation of definite Integrals.

3. Integration as the limit of a sum (with equally spaced as well as unequal intervals).
4. Reduction formulae of $\int \sin^m x \cos^n x dx$, $\int \frac{\sin^m x}{\cos^n x} dx$,
 $\int \tan^n x dx$ and associated problems (m and n are non-negative integers)

GROUP-F : 10 MARKS
(ORDINARY DIFFERENTIAL EQUATIONS)

1. Order, degree and solution of an ordinary differential equation (ODE) in presence of arbitrary constants, Formation of ODE.
First order equations :
 - i) Variables separable.
 - ii) Homogeneous equations and equations reducible to homogeneous forms.
 - iii) Exact equations and those reducible to such equation.
 - iv) Euler's and Bernoulli's equations (Linear).
 - v) Clairaut's Equations : General and Singular solutions

PART-II

PAPER-II

GROUP – A : 25 MARKS (MODERN ALGEBRA)

1. Basic concept : Sets, Sub-sets, Equality of sets, Operations on sets : Union, intersection and complement. Verification of the laws of Algebra of sets and De Morgan's Laws. Cartesian product of two sets.

Mappings, One-one and Onto mapping, Composition of Mappings - concept only. Identity and Inverse mappings. Binary Operations in a set. Identity element. Inverse element.
2. Introduction of Group Theory : Definition and examples taken from various branches (example from number system, roots of Unity, 2×2 real matrices, non singular real matrices of a fixed order). Elementary properties using definition of Group. Definition and examples of sub-group - Statement of necessary and sufficient condition and its applications.
3. Definitions and examples of (i) Ring, (ii) Field, (iii) Sub-ring, (iv) Sub-field.
4. Concept of Vector space over a Field : Examples, Concepts of Linear combinations, Linear dependence and independence of a finite number of vectors, Sub- space, Concepts of generators and basis of a finite-dimensional vector space. Problems on formation of basis of a vector space (No proof required).
5. Real Quadratic Form involving not more than three variables (problems only).

6. Characteristic equation of square matrix of order not more than three
determination of Eigen Values and Eigen Vectors (problems only).
Statement and Illustration of Cayley-Hamilton Theorem.

GROUP- B : 20 MARKS

(ANALYTICAL GEOMETRY OF THREE DIMENSIONS)

1. Rectangular Cartesian co-ordinates : Distance between two points.
Division of a line segment in a given ratio. Direction cosines and
direction ratios of a straight line. Projection of a line segment on
another line. Angle between two straight lines.
2. Equation of Plane : General form, Intercept and normal form. Angle
between two planes. Signed distance of a point from a plane. Bisectors
of angles between two intersecting planes.
3. Equations of Straight line : General and symmetric form. Distance of a
point from a line. Coplanarity of two straight lines. Shortest distance
between two skew lines.
4. Sphere and its tangent plane.
5. Right circular cone.

GROUP – C : 25 MARKS

(DIFFERENTIAL CALCULUS)

1. Sequence of real numbers : Definition of bounds of a sequence and
monotone sequence. Limit of a sequence. Statements of limit
theorems. Concept of convergence and divergence of monotone
sequences-applications of the theorems, in particular, definition of ϵ .

Statement of Cauchy's general principle of convergence and its application.

2. Infinite series of constant terms; Convergence and Divergence (definitions). Cauchy's principle as applied to infinite series (application only). Series of positive terms : Statements of comparison test. D'Alembert's Ratio test. Cauchy's nth root test and Raabe's test Applications. Alternating series. Statement of Leibnitz test and its applications.
3. Real-Valued functions defined on an interval: Statement of Rolle's Theorem and its geometrical interpretation. Mean value theorems of Lagrange and Cauchy. Statements of Taylor's and Maclaurin's Theorems with Lagrange's and Cauchy's form of remainders. Taylor's and Maclaurin's Infinite series of functions like e^x , $\sin x$, $\cos x$, $(1+x)^n$, $\log(1+x)$ with restrictions wherever necessary.
4. Indeterminate Forms: L'Hospital's Rule : Statement and Problems only.
5. Application of the principle of Maxima and Minima for a function of single variable in geometrical, physical and to other problems.
6. Maxima and minima of functions of not more than three variables Lagrange's Method of undetermined multiplier - Problems only.
7. Applications of Differential calculus : Rectilinear Asymptotes (Cartesian only). Envelope of family of straight lines and of curves (problems only). Definitions and examples of singular points (Viz. Node. Cusp, Isolated point).

GROUP-D : 20 MARKS
(INTEGRAL CALCULUS)

1. Definition of Improper Integrals : Statements of i) u-test (ii) Comparison test (Limit from excluded) - Simple problems only. Use of Beta-and Gamma functions (convergence and important relations being assumed).
2. Working knowledge of Double integral.
3. Applications : Rectification, Quadrature, volume and surface areas of solids formed by revolution of plane curve and areas problems only.

GROUP-E : 10 MARKS
(ORDINARY DIFFERENTIAL EQUATIONS)

1. Second order linear equations : Second order linear differential equation with constant co-efficients. Euler's Homogeneous equations.
- 1.2. Simple applications : Orthogonal Trajectories.
M.T.M.G. PAPER -3 and PAPER - 4 as in the present syllabus will remain unchanged.
(Vide Notification No. CSR /167 / 2002

PART-II

PAPER-III

(Groups A and B are compulsory and any one of Groups C, D & E)

**GROUP – A : 20 MARKS
(NUMERICAL METHODS)**

1. Approximate numbers, Significant figures, Rounding off numbers. Error Absolute, Relative and percentage
2. Operators D, N and E (Definitions and some relations among them).
3. Interpolation: The problem of Interpolation Equispaced arguments Difference Tables, Deduction of Newton's Forward Interpolation Formula, remainder term (expression only). Newton's Backward interpolation Formula (Statement only) with remainder term. Unequally-spaced arguments Lagrange's Interpolation Formula (Statement only). Numerical problems on Interpolation with both equi-and unequally spaced arguments.
4. Numerical Integration : Trapezoidal and Simpson's 1/3rd formula (statement only) Problems on Numerical Integration.
5. Solution of Numerical Equation : To find a real root of an algebraic or transcendental equation. Location of root (tabular method), Bisection method, Newton-Raphson method with geometrical significance, Numerical Problems.
(Note : Emphasis should be given on problems)

GROUP-B : 40 MARKS
(LINEAR PROGRAMMING)

Motivation of Linear Programming problem. Statement of L.P.P. Formulation of L.P.P. Slack and Surplus variables. L.P.P. in matrix form. Convex set, Hyperplane, Extreme points, convex Polyhedron, Basic solutions and Basic Feasible Solutions (B.F.S.). Degenerate and Non-degenerate B.F.S.

The set of all feasible solutions of an L.P.P. is a convex set. The objective function of an L.P.P. assumes its optimal value at an extreme point of the convex set of feasible solutions, A.B.F.S. to an L.P.P. corresponds to an extreme point of the convex set of feasible solutions.

Fundamental Theorem of L.P.P. (Statement only) Reduction of a feasible solution to a B.F.S. Standard form of an L.P.P. Solution by graphical method (for two variables), by simplex method and method of penalty. Concept of Duality. Duality Theory. The dual of the dual is the primal. Relation between the objective values of dual and the primal problems. Dual problems with at most one unrestricted variable, one constraint of equality. Transportation and Assignment problem and their optimal solutions.

GROUP – C : 40 MARKS
(ANALYTICAL DYNAMICS)

1. Velocity and Acceleration of a particle. Expressions for velocity and acceleration in rectangular Cartesian and polar co-ordinates for a particle moving in a plane. Tangential and normal components of velocity and acceleration of a particle moving along a plane curve.
2. Concept of Force : Statement and explanation of Newton's laws of motion.. Work, power and energy. Principles of conservation of energy

and momentum. Motion under impulsive forces. Equations of motion of a particle (i) moving in a straight line, (ii) moving in a plane.

3. Study of motion of a particles in a straight line under (i) constant forces, (ii) Variable forces (S.H. M. Inverse square law, Dampned oscillation, Forced and Damped oscillation, Motion in an elastic string). Equation of Energy Conservative forces.
4. Motion in two dimensions : Projectiles in vacuo and a medium with resistance varying linearly as velocity. Motion under forces varying as distance from a fixed point.
5. Central orbit. Kepler's laws of motion. Motion under inverse square law.

GROUP-D : 40 MARKS
(PROBABILITY & STATITICS)
(EMPHASIS ON APPLICATIONS ONLY)

A. Elements of probability Theory : Random experiment, Outcome, Event, Mutually Exclusive Events, Equally likely and Exhaustive. Classical definition of probability, Theorems of Total Probability, Conditional probability and Statistical Independence. Baye's Theorem. Problems, Shortcoming of the classical definition. Axiomatic approach problems, Random Variable and its Expectation, Theorems on mathematical expectation. Joint distribution of two random variables.

Theoretical Probability Distribution

Discrete and Continuous (p.m.f., p.d.f.) Binomial, Poisson and Normal distributions and their properties.

B. Elements of Statistical Methods. Variables, Attributes. Primary data and secondary data, Population and sample. Census and Sample Survey. Tabulation Chart and Diagram, Graph, Bar diagram, Pie diagram etc.

Frequency Distribution Un-grouped and grouped cumulative frequency distribution. Histogram, Frequency curve, Measures of Central tendencies. Averages : AM,; GM, HM, Mean, Median and Mode (their advantages and disadvantages). Measures of Dispersions - Range, Quartile Deviation, Mean Deviation, Variance / S.D., Moments, Skewness and Kurtosis.

C. Sampling Theory : Meaning and objects of sampling. Some ideas about the methods of selecting samples, Statistic and parameter, Sampling Proportion. Four fundamental distributions, derived from the normal: (i) standard Normal Distribution, (ii) Chi-square distribution (iii) Student's distribution (iv) Snedecor's F-distribution. Estimation and Test of Significance. Statistical Inference. Theory of estimation Point estimation and Interval estimation. Confidence Interval / Confidence Limit. Statistical Hypothesis - Null Hypothesis and Alternative Hypothesis. Level of significance. Critical Region. Type I and II error. Problems.

D. Bivariate Frequency Distribution. Scatter Diagram, Co-relation co-efficient Definition and properties. Regression lines.

E. Time Series : Definition, Why to analyse Time series data? Components. Measurement of Trend (i) Moving Average method, (i) Curve Fittings (linear and quadratic curve). (Ideas of other curves, e.g. exponential curve etc.). Ideas about the measurement of other components.

F. Index number: Meaning of Index number. Construction of Price Index Number. Consumer Price Index Number. Calculation of Purchasing Power of Rupee.

GROUP – E : 40 MARKS
(ELEMENTS OF DIFFERENCE EQUATION AND CALCULUS OF VARIATION)

1. Difference equations-- Difference operator Δ . Algebra of Difference Operator. Shift Operator. Anti-difference of $\gamma(t)$. Algebra of anti-difference. Linear difference, equation with constant co-efficients. Solution of homogeneous and non-homogeneous equations.

2. Concept of functional. Difference between functional and function. Continuity of functional. Aim of calculus of variation. The variation of a functional. Statement of the necessary condition for an extremum. Euler's Equation (no proof). Extreme value of the functional

$$V[y(x)] = \int_{x_1}^{x_0} F(x)y(x), y'(x)dx$$

The problem of Brachistochrone. The problem of Geodesics. The Isoerimetric problem. Extremals of functional

$$L[y(x)] = \int_{x_0}^{x_1} \sqrt{1+y'^2} dx, t[y(x)] = \int_{x_0}^{x_1} \frac{\sqrt{1+y'^2}}{2} dx$$

Simple problems on application of Euler's equation can be decuded to 2nd order ODE with constant coefficients.

PART-III

PAPER – IV

(Any two groups from Group-A, B and C)

GROUP- A : 50 MARKS

(Elements of Computer Science and Programming)

A. Boolean algebra

Basic Postulates and Definition. Two-element Boolean algebra. Boolean Function. Truth table. Standard forms of Boolean function DNF and CNF. Minterms and maxterms. Principle of Duality.

Some laws and theorem of Boolean algebra. Simplification of Boolean expressions Algebraic method and Karnaugh Map method. Application of Boolean algebra Switching Circuits, circuit having some specified properties. Logical Gates - AND, NOT, OR, NAND, NOR etc.

B. Computer Science and Programming : Historical Development, Computer Generation, Computer Anatomy Different Components of a computer system. Operating System, hardware and Software.

Positional Number System. Binary to Decimal and Decimal to Binary. Other systems. Binary Arithmetic. Octal, Hexadecimal, etc. Storing of data in a Computer - BIT, BYTE, WORD etc. Coding of a data- ASCII, etc.

Programming Language : Machine language, Assembly language and High level language, Compiler and interpreter. Object Programme and source Programme. Ideas about some HLL-- e.g. BASIC, FORTRAN, C, C++, COBOL, PASCAL, etc.

Algorithms and Flow Charts-- their utilities and important features, Ideas about the complexities of an algorithm. Application in simple problems. FORTRAN 77/90: Introduction, Data Type-- Keywords, Constants and Variables – Integer, Real, Complex, Logical, character, subscripted variables, Fortran Expressions.

I/O statements - formatted and unformatted. Programme execution control— Logical if, if-then-else etc.. Arrays, dimension statement. Repetitive Computation - DO. Nested Do etc.

Sub programmes. --- i) Function Sub Programme

ii) Subroutine Sub programme

Elements of BASIC Programming Language : Reading Printing, Branch & Loop, Array, Functions.

Application to Simple problems. An exposure to M.S. Office, E-mail, Internet (Through Demonstration Only).

GROUP- B : 50 MARKS
(A COURSE OF CALCULUS)

1. Concept of Point-wise and Uniform convergence of sequence of functions and series of functions with special reference to power Series. Statement of Weierstrass M-Tests for Uniform convergence of sequence of functions and of series of functions. Simple applications. Statement of important properties like boundedness, continuity, differentiability and integrability of the limit function of uniformly convergent sequence of functions and of the sum function of uniformly convergent series of functions. Determination of Radius of convergence of power series. Statement of properties of continuity of sum function of power series, Term by term integration and Term by

term differentiation of power Series. Statements of Abel's Theorems on power Series. Convergence of power series. Expansions of elementary functions such as e^x , $\sin x$, $\log(1+x)$, $(1+x)^n$. Simple problems.

2. Fourier Series on $(-\pi, \pi)$: Periodic function, Determination of Fourier co-efficients. Statement of Dirichlet's conditions of convergence and statement of the theorem on convergence of Fourier Sine and Cosine series.
3. Third and Fourth order ordinary differential equation with constant co-efficients. Euler's Homogeneous Equation.
4. Second order differential equation : (a) Method of variation of parameters, (b) Method of undetermined co-efficients (c) Simple eigenvalue problem.
5. Simultaneous linear differential equation with constant co efficient.
6. Laplace transform and its application to Ordinary differential equation. Laplace Transform and Inverse Laplace Transform. Statement of Existence theorem. Elementary properties of Laplace Transform and its Inverse. Application to the solution of ordinary differential equation of second order with constant co- efficient.
7. Partial Differential Equation (PDE): Introduction, of PDE, Formation of Solution of PDE, Lagrange's method of solution.

GROUP – C (50 MARKS)
(DISCRETE MATHEMATICS)

1. Integers : Principle of Mathematical Induction. Division algorithm. Representation of integer in an arbitrary base. Prime Integers. Some properties of prime integers. Fundamental theorem of Arithmetic. Euclid's Theorem. Linear Diophantine equations. (Statement of Principle of Mathematical Induction, Strong form of Mathematical induction. Applications in different problems. Proofs of division algorithm. Representation of an integer uniquely in an arbitrary base, change of an integer from one base to another base. Computer operations with integers - divisor of an integer, g.c.d. of two positive integers, prime integer, proof of fundamental theorem. Proof of Euclid's Theorem. To show how to find all prime numbers less than or equal to a given positive integer. Problems related to prime number, Linear Diophantine equation - when such an equation has solution, some applications).

2. Congruences : Congruence relation on integers, Basic properties of this relation. Linear congruences, Chinese Remainder Theorem. System of Linear congruences. (Definition of Congruence - to show it is an equivalence relation, to prove the following : $a \equiv b \pmod{m}$ implies (i) $(a+b) \equiv (b+c) \pmod{m}$ (ii) $ac \equiv bc \pmod{m}$ (iii) $a^n \equiv b^n \pmod{m}$. for any polynomial $f(x)$ with integral coefficients $f(a) \equiv f(b) \pmod{m}$ etc. Linear Congruence, to show how to solve these congruences, Chinese remainder theorem-- Statement and proof and some applications. System of linear congruences, when solution exists - some applications).

3. Application of Congruences : Divisibility tests. Computer file Storage and Hashing functions. Round-Robin tournaments. Check-digit and an ISBN, in Universal product Code, in major credit cards. Error detecting capability, (using congruence, develop divisibility tests for integers based on their expansions with respect to different bases. If d divides $(b - 1)$ then $n = (a_k a_{k-1} \dots a_1)_b$ is divisible by d if and only if the sum of the digits is divisible by d etc. Show that congruence can be used to schedule Round -Robin tournaments. A university wishes to store a file for each of its students in its computer. Systematic methods of arranging files have been developed based on Hashing functions $h(k) \equiv k \pmod{m}$. Discuss different properties of this congruence and also problems based on this congruence. Check digits for different identification numbers - International standard book number, universal product code etc. .Theorem regarding error detecting capability).

4. Congruence Classes : Congruence classes, addition and multiplication of congruence classes. Fermat's little theorem. Euler's theorem. Wilson's theorem. Some simple applications (definition of congruence Classes, Properties of congruence Classes, addition and multiplication, existence of inverse. Fermat's little theorem. Euler's theorem. Wilson's theorem - Statement, proof and some applications)

5. Recurrence Relations and Generating functions : Recurrence Relations. The method of Iteration. Linear difference equations with constant coefficients. Counting with generating functions.

6. Boolean algebra : Boolean Algebra, Boolean functions, Logic gates, Minimization of circuits.

All the UG & PG syllabus are the approved syllabus for the University from academic session 2011-2012.

**By Order
Vice Chancellor**

SYLLABUS

**West Bengal State University
Course structure for three year B.Sc. (Hons.) in
MICROBIOLOGY under 1+1+1 System**

Part I (Full marks 200)
(Exam at the end of 1st year)

Paper-I (100 marks)

Group-A :	Biomolecules	50 marks
Group-B :	Biophysical chemistry	50 marks

Paper-II (100 marks)

Group-A:	General Microbiology	50 marks
Group-B:	Practical	50 marks

Part II (Full marks 200)
(Exam at the end of 2nd year)

Paper-III (100 marks)

Group-A:	Cellular and molecular biology	50 marks
Group-B:	Metabolism and Bioenergetics	50 marks

Paper-IV (100 marks)

Group-A:	Environment and Food Microbiology	50 marks
Group-B:	Practical	50 marks

Part III (Full marks 400)
(Exam at the end of 3rd year)

Paper-V (100 marks)

Group-A:	Microbial Genetics	50 marks
Group-B:	Industrial Microbiology and Recombinant DNA Technology	50 marks

Paper-VI (100 marks)

Group-A:	Medical Microbiology and Virology	50 Marks
Group-B:	Immunology	50 Marks

Paper-VII (100 marks)

Practical

Paper-VIII (100 marks)

Practical

**GUIDELINES TO THE STUDENTS FOR B.Sc (HONS) EXAMINATION
IN MICROBIOLOGY ,2011 (NEW SYALLABUS)**

Part –I, Part-II, Part III

(For each group)

1. A Compulsory short answer type question of 10 marks comprising of 5 questions each carrying 2marks
2. Broad answer type questions to carry 10 marks and will be subdivided into sections carrying from 2 to a maximum of 5 marks. Students will have to answer 4 from a choice of 8 questions and the question will be spread across the syllabus

Syllabus for B.Sc (Hons)

Part-I Course in Microbiology effective from 2011-2012

P A R T -I (Full Marks -200)

Paper-I (100 marks)

Group-A : Biomolecules (50 Marks)

1. a) Bonding Features :(10)

Hybridization (s,p,n =1,2,3)of C, N, O; formation of sigma and pi bonds, bond distance, bond angles, shapes of molecules, strain due to valence shell electron pair repulsion, bond-stretching, angular distortion, steric effect, inductive and field effects; bond energy, bond polarity, resonance, resonance energy, steric inhibition , hyperconjugation.

b) Stereochemistry: (15)

General concept on: Symmetry Elements and Symmetry Operations -Axis of symmetry, plane of symmetry and centre of symmetry ; Projection formula (Fischer, Newmann & Haworth);

Concept of chirality; Chiral Centre, Helicity, Asymmetry & Dissymmetry, Isomerism: Optical Isomerism, Geometric Isomerism; Concept of Configuration and Configuration: DL, RS, Nomenclature of Carbohydrates, Amino Acids and other Organic Molecules. Conformation of Ethane, n-Butane, n-Propane, n-Butane gauche Interaction; Stereochemistry of cyclohexane: idea of axial and equatorial bonds (related to chair form conformation); Chair form of carbohydrates, Configurational Isomers:- anomers, epimer; Mutarotation & its Mechanism, Stereochemistry of Amino Acids, Anomeric effect.

2. Carbohydrates:(10)

Definition , classification and structural concept of Monosaccharides : Hexoses, Pentoses

(Ribose, Ribulose, Xylose). Dissaccharides : (Sucrose, Lactose ,Maltose), Amino Sugar (Glucosamine ,Muramic Acids), Inversion of cane sugar, Chemical reactions of monosaccharides (glucose, fructose) with HNO_3 , Br_2 -water, HIO_4 , phenylhydrazine; principle of chemical estimation of glucose ; anomeric effect ; Polysaccharides:chemical structure of starch (alpha-amylose, amylopectin), glycogen and cellulose .

3. Amino acids, Peptides and Proteins: (20)

a) Amino Acids and Peptides:(10)

Definition, classification, structure; physico-chemical properties of amino acids. , zwitterionic nature, pK values; Isoelectric point. Electrophoresis, Titration of amino acids Reaction with Ninhydrin, FDNB, Dansyl chloride, van Slykes reaction. Reactions of carboxyl and amino groups. . Peptides, peptide bond, biologically important peptides (glutathione). Ramachandran plot, Enzymatic digestion of peptide (trypsin, chymotrypsin, papain, aminopeptidase, carboxypeptidase)

b) Proteins:(15)

Structure of segment of polypeptide chain (primary, secondary, super-secondary, tertiary ,quaternary) Forces that stabilize structure of proteins; H-bonds, Hydrophobic interactions, electrostatic attraction, van der Waals interaction, Dipole dipole interactions, Solubility of proteins, Salting in and Salting out, Denaturation and renaturation ; Types of proteins : Fibrous and globular protein with some examples. Brief discussion of protein separation technique (Ion exchange, Gel filtration chromatography)

4. Lipids:(10)

Definition, nomenclature, classification-(simple, complex, derived lipids) structure and example- phospholipids, glycolipids, sphingolipids. Hydrolysis of fats and oils, saponification. Saponification number, Iodine number, Acetyl number, Volatile fatty acid number- definitions and related problems, Fatty acids: Saturated, Unsaturated : nomenclature and structure -delta and omega-system—Oleic, Linoleic, Linolenic and Arachidonic Acid; Essential fatty acids. General chemical reaction of fatty acids-esterification, hydrogenation

5. Nucleic acid:(15)

Purine and Pyrimidine- definition and structure, Nucleoside, Nucleotide: definition and structure DNA and RNA: Double helical structure, A-DNA, B-DNA and Z-DNA, (structure and differences), intercalating agents. Chemical property: Hydrolysis (acid, alkali)

enzymatic hydrolysis of nucleic acids, general structure and functions of different types of RNA (t-RNA, m-RNA, r-RNA). Viscosity, Buoyant density, Hyper chromic and Hypochromic effect, cot curve, denaturation and renaturation of DNA.

Suggested text books :

1. Finar, I.L
2. Organic chemistry- Part I and Part II –I.L.Finar
2. Biochemistry-A.Lehninger
3. Biochemistry-J.Voet and R.Voet
4. Biochemistry-L.Stryer

Group B: Biophysical chemistry (50 Marks)

1. Physico -Chemical properties of water :(5)

Non-covalent interactions, Ionic product of water:, pH definition. Acids, Bases and Buffers in biological system ; Arrhenius and Bronsted -Lowry, Lewis theories of acid and bases. Titrable and true acidity, Polyprotic acids, Ampholytes, Dissociation of polyprotic acids, Surface tension, viscosity : application to biomolecules.

2. Thermodynamics and its application to biological systems: (15)

Zeroth law, 1st and 2nd law of thermodynamics, application in biological systems. Enthalpy and Entropy, Concept of free energy, standard free energy change. Equilibrium constant. Transport across membrane- passive diffusion, facilitated diffusion and active transport; gradient of chemical potential as a driving force in transport, equilibria and transport across membranes; diffusion and osmosis, sedimentation by centrifugation (Density gradient and isopycnic), osmotic pressure, Donnan equilibrium, diffusion potential, membrane potential.

3. Spectrometry (10)

Concept of Electromagnetic radiation, UV, Visible, IR, Molecular orbital theory : Bonding and antibonding ; simple association of atomic orbital to form pi and sigma molecular orbital .HOMO AND LUMO; UV spectra : Electronic transition (σ - σ^* , n- σ^* , n- π^* and n- π^*), concept of chromophore , Wit's chromophore theory, auxochrome, red shift, blue shift,

Lambert Beer law- derivation and deviation, Molar absorptivity,;Line diagram and working principle of spectrophotometer ,solvent effect, hyperchromic effect (typical example), Fluorescence,and Spectrofluometry., IR spectra : modes of molecular vibration, application of Hook's law ,force constant ,characteristic and diagnostic stretching frequency ,of O-H, N-H ,C-D, C=C, C=N, C=C, C=O functions ;factors of effecting stretching frequencies (H -bonding mass effect , electronic factors, bond multiplicity)[diagnostic bonding frequencies excluded]

4. Microscopy : (5)

General principles of optics in relation to microscopy; different components of light wave (UV ,IR ,Visible); principles and applications of compound microscope; Light microscope; Dark field microscope; Bright field microscope; Phase contrast microscope; Fluorescent Microscope; Electron Microscope (Principle only); Resolving power ;Numerical aperture; Chromatic aberration and spherical aberration.

5.Fundamentals of radioactivity :(10)

Law of radioactivity, Decay constant, half life, average life, properties of α , β , γ radiations, unit of radioactivity, radioactive carbon dating, Application of radioactivity isotopes (C^{14} , H^3 , P^{32}) in biological systems, preliminary concept in radioimmunoassay, principle of liquid scintillation counter and GM counter. Radiation absorption- Biological effectiveness- Linear energy transfer- radiation protection.

T E X T B O O K:

1.Tinoco, Sauer and Wang, Physical chemistry, principles and application in Biological sciences, Prentice Hall, 4th edition (2001).

ADDITIONAL REFERENCE TEXTS:

1. Atkins physical chemistry for the life sciences, W H Freeman (2005).
2. Cantor and Schimmel, Biophysical chemistry, (part1) Freeman Press.
3. Eisenberg and Crothers, Physical chemistry with application to the life sciences, Benjamin/ Cummings publication Co (1979).
- 4 P. Atkins and J Paula, physical chemistry for the life sciences (2006).
2. K.E van Holde, WC Johnson and P.S.Ho. Principles of physical biochemistry (1998).

Paper-II (100 marks)

Group A : General Microbiology (50 marks)

1. Notable contributions in the development of Microbiology :(3)

- i) Spontaneous generation (abiogenesis)
- ii) Biogenesis.
- iii) Germ theory of Disease.
- iv) Koch's postulates
- v) Scope of Microbiology.

2. Position of microorganisms in biological world (7):

Whittaker's Five Kingdom and Carl Woese three domain concept of living organisms (General characteristics of those groups); General features of Eubacteria and Archaeobacteria (major difference within eubacteria).

3. Stains and staining techniques :(10)

Definitions of auxochrome; chromophores; Acidic and Basic dyes; classification of stains; simple and differential staining: theories of staining, mordant and its function, Gram staining, acid fast staining, endospore staining, negative staining, capsule staining, flagella staining, mechanism of Gram staining.

4. Bacterial morphology and sub-cellular structures:(20)

Morphology of bacteria, slime layer, Mycelial morphology: Actinomycetes, capsule, cell wall and ribosome, cytoplasmic membrane (Fluid mosaic model of Singer-Nicholson), cytoplasmic inclusion bodies - (inorganic -organic); Exospores and cysts: types and structure; Endospore, Flagella,, Pilus, Fimbriae (structure, composition and function) plasmids and episomes, bacterial nucleoid.

5. Eukaryotic microbes (10):

General characteristics, vegetative and reproductive structure with example of the following groups of microorganism :

Algae : Cyanophyta, Chlorophyta, Bacillariophyta, Phaeophyta, Rhodophyta.

Fungi : Phycomycetes, Ascomycetes, Basidiomycetes, Deuteromycetes

Protozoa : *Giardia*, *Plasmodium* and *Entamoeba*.

6. Microbial Nutrition: (10)

Nutritional types (definition and example) - photoautotrophs, photoorganotrophs, chemolithotrophs (ammonia, sulphur, hydrogen, Carbon monoxide and iron oxidizing Bacteria); chemoorganotrophs, Effect of oxygen on growth- classification on the basis of oxygen requirement and tolerance.

7. Bacterial Growth :(10)

Growth phases- Generation time, kinetics of growth, Batch culture, Continuous culture, synchronous culture (definition and brief description) physical factors influencing growth - temperature- pH, osmotic pressure, salt concentration. Growth measurement technique.

8. Control of growth of microbes :(15)

Sterilisation, disinfection, antiseptic, sanitizer, germicide, antimicrobial agent (definition) application and examples; physical method of disinfection and sterilisation, dry heat, moist heat, filtration, radiation (mode of action, applications); chemical control -dye solutions, alcohol, acid, alkali, halogen, heavy metal, phenol and phenol derivatives ,formaldehyde, ethylene oxide, detergents (mode of action, applications). Assessment of chemical disinfectant, phenol coefficient -definition and method of determination. Chemotherapeutic agents -sulphonamides, antibiotics, (definition types), mechanism of action and antimicrobial spectrum of penicillin, streptomycin, tetracycline chloramphenicol nalidixic acid and metronidazole; drug resistance -phenomenon and mechanism.

Suggested Textbooks:

1. Stanier, RY., *et al*, General Microbiology, 5th ed Macmillan press.
2. Pelczar M., *et al* Microbiology, 5th ed,. 2000, Tata Mcgraw Hill.
3. Atlas RM, Principles of Microbiology, 2th ed, 1997 Tata Mcgraw Hill.
4. SalleAJ, Fundamental principles of Bacteriology, 7th ed, 1999 Tata Mcgraw Hill.
5. Prescott LM, Microbiology, 6th ed, 2005 Tata Mcgraw Hill.
6. Madigan MT, Martins JM & Parker, J , Brocks Biology of Microorganism – Prentice Hall International Inc.
7. H.G. Schlegel , General Microbiology – Cambridge Press
8. A.K.Banerjee & N.Banerjee , Fundamentals of Microbiology & Immunology, Central

Group B : Practical (50 marks)

:

1. Qualitative tests of Reducing and non reducing monosaccharides and disaccharides, polysaccharides, amino acids (identification of specific amino acids not required) proteins (Biuret method), cholesterol :(8)
2. Quantitative estimation of reducing sugar by 3,5 dinitrosalicylate method, DNA and RNA by UV spectroscopy and protein by Biuret method. :(8)
3. Estimation of amino acid by formol titration. (4)
4. Operation of light microscope; use of oil- immersion objective (4)
5. (a) Preparation of culture media :(10)
Complex media (Nutrient Broth, NA slant, NA stab, Lactose broth); chemically defined, synthetic media (Czapekdox broth / agar). YPD /select media which will be used for the experiments specified.
(b) Cultivation of microorganisms: on agar – slant /agar plate streak culture: Bacteria (*Bacillus subtilis* ,*Staphylococcus aureus* , *Escherichia coli*); Yeast (*Saccharomyces cerevisiae*) Moulds (*Penicillium notatum*, *Aspergillus niger*).& Pure culture: by streak plate / pour plate methods (18)
(c) Staining techniques for examination of microorganisms (20)
 - i) Bacteria -preparation of heat fixed smear and (a) simple staining and negative staining (*E. coli*, *Bacillus subtilis*, *Staphylococcus aureus*) (b) Gram staining- Gram positive (*B. Subtilis* ,*S. aureus* ,*M. lutea*) Gram negative (*E. coli*, *K. aerogenes*) (c) Endospore staining (*B. Subtilis*)[Dorner and Foulton method]
 - ii) Fungi-Lactophenol -cotton blue staining of Yeast (*Saccharomyces cerevisiae*): Molds (*Penicillium notatum*, *Aspergillus niger*).

[Figures given in the parenthesis above are the
Numbers of allotted classes for each topic]

West Bengal State University

PART II

Paper III Group A: Cellular and Molecular Biology (50 Marks)

Eukaryotic cell biology :(30)

Eukaryotic cell Membrane, Difference in membrane constituents between Eukaryotes and prokaryotes : target of antimicrobial drugs : Elementary idea of intracellular organelles, Comparison between Eukaryotic and prokaryotic flagella and cilia

Cell Biology of yeast : Yeast as model, Budding and fission, mating types and its determination (only elementary idea) mating type Mitosis and Meiosis, cell cycle switching, cdc mutants, Anti fungal drug, nistatin

DNA replication (15): semiconservative and semidiscontinuous mode of DNA replication , structure of replication fork , enzymes of DNA replication (definition and function only), Rolling circle and θ mode of replication , Inhibitors of replication (antibiotic), nalidixic acid.

Transcription in prokaryotes (15) :

Mechanism of transcription , mechanisms , initiation , elongation, termination, promoter structure, subunits of bacterial RNA polymerase, functions and domains responsible for activity, mechanism of termination rho dependent and independent, lac and tryp operon, arabinose operon, brief idea of capping, polyadenylation and splicing. rifampicin , streptolydigin(antibiotic)

Mechanism of translation in prokaryotes : (15)

Description of ribosomal cycle including phenomena of initiation , elongation , termination ; description of factors involved in these process ; genetic code ; wobble hypothesis, role of amino acyl t-RNA synthetases, inhibitors of translation(antibiotic only) streptomycin, chloramphenicol, tetracyclin and puromycin.

Text Book:

Stryer .L. et.al. Biochemistry ,5th edition ,WH, Freeman ,2006

Voet. D, and Voet JM , Biochemistry , Willey , 1995 ;

Reference books : Alberts , B, et. al. Molecular Biology of the cell , Garland , 4th edition

Lodish , et. Molecular cell biology , WH Freeman; 2003

Group : B : Metabolism and Bioenergetics(50)

Enzyme : (25)

General properties , Trivial and IUB nomenclature and classification ; cofactors , definition and function with special reference to the representative point to the substances -a) co-enzyme (NAD⁺, NADP⁺, co-enzyme A , TPP, pyridoxal, phosphate , b) prosthetic , groups (FAD⁺, succinic dehydrogenase); c) Metal ions (Zn²⁺, Mg²⁺, Fe²⁺, Fe³⁺, Mn²⁺,) required for enzyme action, isoenzyme .

Enzyme Kinetics : Michaelis-Menton equation , enzyme inhibition Competitive , Regulatory enzymes (Allosteric Site CTP on aspartate trans carbamylase as example) feedback inhibition , reversible competitive , non competitive , substrate level inhibition irreversible inhibition , suicide inhibitors. Feedback inhibition (Cite Threonine to Isoleucine as example) Ribozyme (catalytic RNA) and Abzyme (use of Antibody as enzyme) -definition only.

Carbohydrate metabolism :(25)

Aerobic respiration -Glycolysis (EMP-pathway) with energy production: entry of galactose and fructose in EMP-path ; TCA cycle with energy production ; pentose phosphate pathway Electron Transport chain (in brief) and ATP generation sites : ATP and ADP cycle (Oxidation -reduction potential and electromotive force). Photophosphorylation , oxidative phosphorylation (chemiosmotic theory); Anaerobic respiration Utilizing NO₂ sulfur SO₄ , CO₂ as electron acceptors; Stickland reaction Entner-Doudoroff pathway Fermentation-Glucose metabolism in anaerobic condition general concept only . Bacterial photosynthesis (cyanobacteria and green sulphur bacteria)

Amino acid metabolism (10):

Transamination , deamination transmethylation and decarboxylation. Glucogenic and ketogenic amino acids , Outline of Urea cycle ; Microbial metabolism glycine, phenylalanine

Lipid metabolism :(5)

Detailed account for oxidation of even and odd carbon numbered , saturated and unsaturated fatty acids, metabolism of triglycerides and phospholipids, brief idea of ketone bodies.

PAPER -IV

Group A, Environmental and food Microbiology : (50)

Air Microbiology ;(5)

Different type of Microorganisms in the air (name and disease) ,aerosole ,sampling techniques ,air borne pathogens ,techniques of room sterilization .

Microbiology of water :(10)

Microbiological analysis of water (total count ,indicative organism),BOD, COD, -determination and implication ,Coliform test-detection of feacal and nonfeacal coliform); IMVIC test ,determination of MPN microbiological treatment of sewage and industrial waste water ,Anearobic treatment (safety tank).

Soil microbiology :(25)

Physical and chemical charecteristics of various soil types -different microbial groups in soil ,method of study,Rhizosphere ,Pyllosphere ,brief account of microbial interactions (symbiosis,neutralism,commensialism,synergism competition,ammesialism,parasitism,and predation):Biological nitrogen fixation-symbiotic;and asymbiotic Root -nodule formation in legumes; Compost and humans biofertilizers,biogeochemical cycles Carbon ,Nitrogen Phosphorus, and sulphur cycles, role of microorganism in the process of methane production.

Food Microbiology (15):

Milk as a growth of medium of bacteria ,Normal microflora in milk ,undesirable microbes in milk and normal microflora of meat ,poultry of egg ,fruits and vegetable ,canned food and stored grains, phosphatase tests of pasteurized milk .

Preservation of food : preliminary idea of physical, chemical, biological preservatives, radiation, High temperature (Boiling, pasteurization,Appetization ,)low temperature (Freezing): Dehydration.Osmotic pressure .

Microbiologically fermented food : curd .cheese Idli, yogurt, Acidophilic,Milk microorganisms as food -SCP : food borne diseases -name and agent.

Text book : Salle AJ. Soil Microbiology ,7th edition ,Tata Mcgraw Hill publishing Co.

Reference : Subba Rao , NS.Soil Microbiology 4th edition ,Oxford and IBH Publishing Co.

Dube R C and Maheswari,DK Text book of Microbiology ,S. Chand and Co.

Group B Practical (50) Marks :

1) Isolation of pure culture from natural sources (36)

(a) Bacteria from soil-by serial dilution and pour plate / spread plate method .(b) isolation of amylase and phosphatase producing bacteria (qualitative only)

(c) Yeast from rotten banana or apple-by the method same as (a),

(d) molds from infected citrus fruits-by streak-plate method.

(e) Microbes from air-by agar-plate exposure method.

2) Microbiological examination of water: (Drinking water, supply water, pond water)

a) presumptive test.

b) confirmatory test.

c) completed test for coliform.

IMVIC reactions.

3) Microbiological examination of milk : By Methylene-blue dye reduction test :

4) Microbiological assay of antibiotics :i) Antibiotic sensitivity test by paper disc and by cup-plate method.

ii) Determination of minimal inhibitory concentration(MIC) by serial dilution method for assaying commonly used antibiotics (using appropriate test bacterial).

5) Micrometry (5)

Microscopic measurements of Yeast

6) Enumeration of Microbes : Yeast by haemocytometer (5)

7) Bacterial growth curve by nephelometric method (*E.coli*) (4)

PART III
Paper v
Group A: (50 marks)
Genetics and Biometry

1. Principles of elementary genetics: (15)

Mendelian genetics-

Genotype, Phenotype, Multiple Allele, Monohybrid, Dihybrid cross, Linkage Codominance, Phenotypic change due to environment, autosomal & sex linked inheritance .

Experimental evidence for DNA as genetic material (Experiments of Griffith, Avery and MacLeod; Hershey and Chase); Experimental evidence for RNA as genetic material (TMV),

Structure of prokaryotic gene; genomic organization in prokaryotes (nucleoid, DNA supercoiling, topoisomerases), Plasmids (types, copy number, compatibility, plasmid curing). Episomes. Structure of eukaryotic genes, chromosome and genome organisation, repetitive DNA. Extrachromosomal inheritance (mitochondria and plastids).

2. Genetic exchange and recombination : (15)

Transformation, Conjugation:F+, F-,Hfr and F Prime and F double prime bacteria, conjugation procedure and mapping.Development of competence using B.subtilis as model organisms, procedure of natural transformation, artificial transformation, chromosome mapping, genetic mapping of transformants.

Transduction-generalized (P1) and specialized (lambda-phage) and mapping.

Homologous recombination (Holiday structure: RecBCD system); gene conversion ; site specific recombination (lambda).

Transposable elements : Bacterial Transposons.(Types of transposons, TN family, mechanism of transposition and application.

3. Mutation and Repair (10)

Spontaneous (Spontaneous mutation Luria-Delbruck's Fluctuation Test) an induced mutations, Mutagenic agents-Physical, Chemical and Biological (Phage-mu). Genetic Techniques to detect mutations in bacteria and fungi (isolation and characterization of nutritional auxotrophic mutation); Different forms of mutations and how they arise (tautomeric shift, base analog, alkylating agent, apurinic lesions, UV radiation and thymine dimers, replicational error); Ames test.

Repair : Reversal of UV damage in prokaryotes : photoreactivation, base excision and nucleotide excision repair , post replicational repair, mismatch repair, SOS repair, error prone repair.

4. Biometry (10)

Types of biological data, population and samples. Descriptions of samples and populations : frequency distributions descriptive statistics (measures of central tendency and measures of dispersion, boxplot) , Distribution theory: Normal distribution and sampling distribution.

Statistical Inference: statistical estimation, standard error of the mean.Confidence interval and hypothesis testing of the population mean, t-test, brief discussions on the comparison of two independent population means. Chi square test and its applications.

Books:

1 Molecular Biology of the Gene(5th edition) : By James D watson etal

- 2 Concept of Genetics (6th Edition) : By Klug Cummings
3. Genetics : Principles of Analysis (4th edition) : By Hartl & Jones
4. Genetics : Analysis and Principles : By Robert J Brooker
5. Statistics: Goon gupta Dasgupta

Group B : Industrial Microbiology and Recombinant DNA Technology (50 marks)

Industrial microbiology

Microbial culture selection by screening method with reference to the Antibiotic and Enzyme production. Strain improvement, equipment and instrumentation (fermenters-General description of different types-stirred Tank, Bubble column, Air Lift, Packed-bed Bioreactor)

Fermentation-static, submerged, agitated, solid phase , batch, fed-batch, continuous. Use of immobilized cells and enzymes (Cal-alginate beads , polyacrylamide, micro-film)-definition and general characteristics, industrial production of Ethyl Alcohol, Acetic Acid, Pencillin, Vitamin B12, Lysine, amylase(inoculum building, scale up). Fermentation - separation assay and purification of products-general discussion) Concept of Primary and Secondary metabolites in Microorganisms.

General method of preservation of industrially important culture strains : (2)

Recombinant DNA Technology:

Isolation and purification of nucleic acid. Purification and separation of proteins by chromatography(gel filtration, ion exchange, affinity). Separation of Amono acids and lipids by TLC.

Cloning of gene, restriction and modification enzymes. Cloning vectors (PBR2, puc18/19, YAC, vector, Ti plasmid as transforming vector) Shuttle vector and cosmid vector.

Strategies of blunt and staggered end cloning.

Basic differences between cloning and expression vector. Some techniques used in RDT (RFLP, RAPD, Finger printing, DNA sequencing(Sanger, Maxam-Gilbert)

Construction of Genomic and c DNA library

Enzymes used in RDT (DNA polymerase, DNA Ligase, alkaline phosphatase, polynucleotide kinase, terminal transferase)

Production of human insulin by RDT.

Paper VI

Group : A : Virology and Medical Microbiology (50 marks)

Virology : (22)

General characteristics of viruses:Difference between bacteria and viruses, Components of viruses, symmetry and host range and specificity.

Classification of viruses based on the capsid symmetry and nucleic acid content(Baltimore Classification), Types of viruses

a. Bacteriophage(T4 lambda, Lytic and lysogenic life cycle of bacteriophage lambda, one step growth curve, plaque assay).

b. Plant virus (General features of TMV)

c. Animal virus (HIV and its role in AIDS)

d. Oncogenic virus SV 40

Virus like agents: Virioids; prions; phage mechanism(s) that determines lytic and lysogenic life cycle, Antiviral agents, interferon, Azt, acyclovir

Medical Microbiology

Normal Microbial Flora of human body

Thoracic, abdominal, Urogenital & Skin.

Mechanism of Bacterial Pathogenicity: (20)

Entry colonisation, growth, mechanism of damage of host cell.

Production of endo- and exotoxins - definition and general properties.

(a) Neurotoxin: botulinum toxin, tetanus toxin:

(b) Enterotoxin: cholera toxin, salmonella toxin.

(c) Diphtheria toxin.

(d) Toxoid

Common Microbial Diseases : (15)

Names of pathogens, symptoms, preventive measures and vector control where applicable.

i) Bacterial - Tuberculosis, Leprosy, Tetanus, cholera, Anthrax, Typhoid

ii) Viral - Influenza, polio

iii) Fungal - candidiasis.

iv) Protozoan - Malaria, Amoebiasis, leishmaniasis.

Group B: Immunology (50 marks)

Overview of the Immune system. (2)

1. Cells and organs - Immune system. Haematopoietic stem cells, (stromal cells)?, haematopoietic growth factors, Lymphoid organs (Primary and secondary) and cells, Mononuclear cells, Granulocytic cells, Mast cells, Dendritic cells - characteristics and functions. (10)

2. Types of Immunity : Humoral and Cell-mediated immunity - mechanism of immune response - antigen processing and presentation, types and structures of Major histocompatibility complex molecules (MHC) and their role in antigen presentation, clonal selection of lymphocytes, definition of cytokine, generation and humoral and cell mediated response by cellular interactions (general concept only). (14)

3. Antigens : chemical nature, antigenicity, immunogenicity, hapten, epitopes, mitogens (definition, properties, examples); Adjuvant (definition, examples, functions). (6)

4. Immunoglobulins : Isotypes - definition, basic and fine structures, general characteristics and functions. Monoclonal and polyclonal antibody (definition and characteristics). (8)

5. Antigen-Antibody interactions : Precipitation reactions - Radial immunodiffusion, double immunodiffusion, immunoelectrophoresis; Agglutination reactions - Hemagglutination, passive agglutination, bacterial agglutination, agglutination inhibition. (5)

6. Complement : The complement components, function, complement activation - Classical, (ii) Alternate and (iii) lectin pathways (characteristics & functions). (6)

7. Hypersensitivity: definition, types, examples (2)

8. Vaccines : Active and passive immunization (definition, characteristics, examples and functions). Attenuated and inactivated viral or bacterial vaccines (definitions characteristics, functions, examples). Autoimmune disease.

Paper VII(100 marks)

1. Separation of Amino Acids and monosaccharides by paper chromatography and by TLC.
2. Standard curve of:
 - a) reducing sugars
 - b) paranitrophenol
 - c) protein (Bradford and Lowry)
 - d) Ammonia (Nessler method)
- 3 (a) Determination of K_m , V_{max} and pH optima of α - amylase. Alkaline phosphatase and urease.
 - (b) Progress curve of alpha -amylase. Alkaline phosphatase and urease.
 - (c) Inhibitory study of alkaline phosphatase (by inorganic phosphate)

Industrial Visit (10)

Paper VIII (100 marks)

Practical

1. Antigen-Antibody reaction-
 - a.) Agglutination (blood typing)
 - b.) Ouchterlony's agar diffusion method.
 - c.) Single radial immunodiffusion (Mancini's method).
 - d.) Immunoelectrophoresis
2. Isolation of plasmid-DNA from E. coli by using a standard method: Gel-electrophoresis (Agarose-gel), quantification and purity of DNA.
3. Transformation of E. coli by plasmid DNA (CaCl₂ method)
4. Conjugation experiments
5. Plaque assay of bacteriophage.



West Bengal State University

**Revised Curriculum for Philosophy
Three Years B.A. Honours and General Course
Recommended in the BOS (UG) Meeting on 11.04.2012
w.e.f. 2012-13**

It is notified for information that the Vice-Chancellor has been pleased to approve the revised Curriculum of three Years B.A. Honours and General Course in Philosophy, under 1+1+1 system of examination under this University .This revised Curriculum for Philosophy will effect from 2012-13 academic session.

Dated the 17th April, 2012

**Dr. Sabita Samanta
Chairperson
U.G Board of Studies**

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PART-I

Honours Papers

Candidates are required to answer

- i) Ten objective-type questions covering the entire syllabus of this paper, within two sentences each, carrying two marks each.
- ii) Four short-answer type questions covering the entire syllabus of this paper, within one fifty words each, carrying five marks each.
- iii) Four broad-answer type questions covering the entire syllabus of this paper, within six hundred words each, carrying fifteen marks each.

Full Marks=100

2x10= 20

5x4=20

15x4=60

PAPER-I

History of Indian Philosophy

The Basic Philosophical Concepts of the Vedas and Upanisads:

The concept of the *Rta*, *Rina*, the concept of *Ātman*, *Brahman* in the *Upanisads*, *Jīva*, *Śreya*, *Preya*, *Mokṣa* (in brief).

Cārvāka System:

Epistemology- Perception as the only source of knowledge, Refutation of Inference
.Metaphysics—Causality -*yadicchavāda* / *svabhavavāda* / *akasmikatāvāda*,
Jagat and *Bhutacaitanyavāda*.

Jaina System :

Anekāntavāda and *Syādvāda*.

Bauddha System:

Four noble truths, *Pratityasamutpādvāda*, *Kṣanabhangavāda* or Momentariness, *Nairātmavāda*,
Basic tenets of four *Bauddha* schools- *Vaiśāṅghika* and *Sautrāntika* (in brief), *Yogācāra* and
Madhyamika (in details).

Nyāya System:

Four *Pramāna-s*: *Pratyakṣa*- definition, classification into *savikalpaka nirvikalpaka* and
pratyabhijñā and *laukika* and *alaukika*.

Ānumāna: definition, *pakṣa*, *sādhya*, *hetu*, *vyāpti*, *vyāptigrahopaya*, *svārtha-pararthānumāna*.

Outlines of *Upamāna* and *Śabda*. Nature of self and liberation, Arguments for the existence of God.

Vaiśeṣika System :

The Basic Outlines of *Dravya, Gunā, Karma* and detailed analysis of *Sāmānya, Viśeṣā, Samavāya* and *Abhāva, Paramānūvāda* (in brief).

Sāmkyā System:

Satkāryavāda as opposed to *Asatkāryavāda, Prakṛiti* and its constituents, Arguments for its existence, Theory of Evolution, *Purusā*, Arguments for its existence, Plurality of *Purusā*.

Yoga System_:

Citta, Cittavṛtti, Cittabhūmi, Asāṅgāyoga and Concept of God.

Mīmāṃsā System:

Pramāṇā-s with special reference to *Arthāpatti* and *Anupalabdhi* (*Prābhakara* and *Bhatta's* view).

Advaita Vedānta Philosophy of Sankara :

Brahmanā, Jīva, Māyā, The Relation of *Brahmanā* with *Jīva* and *Jagat* , Three grades of *Sattā*.

Visistadvaitavada of Ramanuja :

Brahmanā, Relation of *Brahmanā* with *Jīva* and *Jagat*, Criticism of Sankara's doctrine of *Māyā*.

TEXT BOOKS

Hiriyana, Outlines of Indian Philosophy.

Dipak Kumar Bagchi, Bharatiya Darsan.

Suggested Readings:

C.D. Sharma, A Critical Survey of Indian Philosophy.

D.M. Dutta, Six Ways of Knowing.

D.M.Dutta and Chatterjee, An Introduction to Indian Philosophy.

Debabrata Sen, Bharatiya Darsan.

Debiprasad Chattopadhyaya, Lokayata Darsan.

Dinesh Chandra Bhattacharya Shastri, Sadadarsana:Yoga

J.N. Mohanty, Classical Indian Philosophy.

Kanak Prabha Bandyopadhyaya, Sankhya Patanjali Darsana

Karuna Bhattacharya, Nyaya Vaisesika Darsan.

Panchanan Shastri, Carvaka Darsan.

Prodyot Kumar Mondal, Bharatiya Darsan.

Roma Choudhury, Vedanta Darsan.

S.C. Chatterjee, Nyaya Theory of Knowledge.

S.N. Dasgupta, History of Indian Philosophy.

S.Radhakrishnan, Indian Philosophy. (Vol I and II)

Sadananda Bhaduri, Nyaya-Vaisesika Metaphysics.

Samarendra Bhattacharya, Bharatiya Darsan.

Sukhamoy Bhattacharya, Purvamimamsa Darsan.

Sukomal Choudhury, Goutam Buddha Dharma Darsan.

T. R.V. Murti, Central Philosophy of Buddhism.

Aditya Kumar Mohanty, Concepts and issues in Indian Philosophy(Utkal Studies in Philosophy)

S.K.Moitra, Fundamental questions of Indian Metaphysics and Logic

Anil Kumar Roychouri, Doctrine of Maya

PAPER -II

Psychology and Social Political philosophy

Group A

Psychology

Definition and Methods of Psychology:

Subjective, Objective and experimental.

Sensation and Perception:

Definition, nature, classification and attributes of sensation, Nature of perception and its relation with sensation, Gestalt theory of perception, Illusion and Hallucination.

Memory:

Information-Processing Theory (Atkinson and Shiffrin's theory), Forgetting: Its types and causes.

Learning:

Theories of Learning – Gestalt Theory or Insight Theory, Classical Conditioning Theory (Pavlov's Theory), Operant Conditioning Theory (Skinner's Theory).

Intelligence:

Nature of Intelligence, Unifocal Theory, Multifocal Theory, Measurement of Intelligence, Binet-Simon test, and Weschler.

Consciousness:

Levels of consciousness, Conscious, Sub-conscious and unconscious, Proof for unconscious and Freud's Theory of dreams.

GROUP – B

Social and Political Philosophy

Definition:

Social Philosophy and Political Philosophy and their interrelation.

Some Basic Concepts:

Society, Community, Association, Institution, Caste and Class.

Social Change:

The Marxist View and the Gandhian View.

Social Ideals:

Plato's Theory of Justice and Rawl's Theory of Justice.

Concept of Political Philosophy:

Scientific theory and Philosophical theory.

Political Ideals:

Democracy and its different forms, Socialism and its varieties, Sarvodaya , Gandhiji's concept of Non-violence and Trusteeship.

Family:

New Vision and Challenges – Marxist and Feminist approaches.

Recomended Books:

Morgan, King and others, Introduction to Psychology

Paresnath Bhattacharya, Monovidya

Pritibhusan Chattopadhyaya, Monovidya

Nihar Ranjan Sarkar, Monovijnan o Jiban (Jnankosh Prakasani,Dhaka)

MacIver and Page, Society

Pritibhusan Chattopadhyaya, Samaj Darsana Dipika

Frederick Engels, Origin of the Family, Private Property and the State

Frederick Engels, Parivar, Byaktigata Malikana O Rashtreer Utpatti (Bengali Translation)

Shefali Moitra, Naitikata O Naribad

August Babel, Women in the Past, Present and Future

August Babel, Nari: Atit, Bartaman Bhabishyat (Bengali Translation By Kanak Mukhopadhyaya)

Satyabrata Chakroborty, Bharater Rashtra Bhaban.

Further Readings:

Ira Sengupta, Manovidya

Amal Kr Mukhopadyaya, (translated by Arun Kr. Roy Choudhury) Pascatya Rastra cintar Dhara- Plato theke Marx.

Madhabendra Mitra & Pushpa Misra, Manasamikhsha

V I Lenin, The State: An Essay

Parimal Bhusan Kar, Samaj Tatva

Sudarshan Ray Chaudhury, Rashtra

Frederick Engels, Principles of Communism

Frederick Engels, Communism-er Mul Niti

Gurudas Bandhyopadhyay, Sarvodaya Andoloner Itihaas

Humayun Azad, Dvitiyo Lingo

Susan Moller Okin, Justice, Gender and the Family

PART -II

Candidates are required to answer five short-answer type questions covering the entire syllabus of this paper within one fifty words each, carrying five marks each. And they have to answer five broad questions covering the entire syllabus of this paper within six hundred words each, carrying fifteen marks each.

Full Marks=100

5x5=25

15x5=75

Paper III History of Western Philosophy

Plato and Aristotle:

Theory of knowledge (episteme) and Opinion (doxa) and its refutation by Aristotle, Plato's theory of idea.

Descartes:

Method of Doubt, *Cogito* Principle, Different types of Ideas, Criterion of Truth, God and the External world.

Spinoza:

Substance, attributes and modes, existence of God, Pantheism, Theory of Knowledge.

Leibnitz:

Monad, Truths of Reason, Truth of Fact, Pre-established Harmony, Innate Idea.

Locke:

Ideas and their classification, Refutation of Innate Ideas, Substance, Locke's realism and theory of knowledge, Degrees of knowledge, Primary and Secondary qualities.

Berkeley:

Rejection of Abstract Ideas, Rejection of the distinction between Primary and Secondary qualities, *Esse est percipi*; Place of God.

Hume:

Impression and Ideas; Association of Ideas; Judgement Concerning relations of Ideas and matters of fact, Causality, Scepticism.

Kant:

Conception of critical Philosophy, Copernican Revolution, distinction between apriori and aposteriori, distinction between analytic-synthetic judgement, possibility of synthetic-apriori judgement, space and time as apriori intuitions

Text Books:

F. Copleston, A History of Philosophy, vols. IV. V. VI. VII.

Suggested Readings :

P. Edwards, Encyclopedia of Philosophy.
 B. Russell, History of Western Philosophy.
 R. Falckenberg, History of Modern Philosophy.
 F. Thilly, A History of Philosophy.
 W. K. Wright, History of Modern Philosophy.
 Bernard Williams, Descartes.
 S. Hampshire, Spinoza.
 J. Locke, An Essay Concerning Human Understanding.
 Locke, Berkeley and Hume, C. R. Morris
 G. Pitcher, Berkeley.
 N. Reacher, Leibniz: An Introduction to his Philosophy.
 T. E. Jessop and A. R. Luce (ed.), The Works of George Berkeley.
 D. M. Dutta, Chief Currents of Contemporary Philosophy.
 David Hume, An Enquiry Concerning Human Understanding.
 D. Hume, A Treatise of Human Nature.
 Immanuel Kant, N. K. Smith (tr. and ed), Critique of Pure Reason.
 H. J. Paton, Kant's Metaphysics of Experience.
 Rasvihari Das, A Handbook of Kant's Critique of Pure Reason.
 D. J. O. Conner, A Critical History of Western Philosophy.
 R. Scruton, A History of Philosophy from Descartes to Wittgenstein.
 N. B. Chakraborty, Paschatya Darsaner Itihas (Locke, Berkeley, Hume).
 Chandrodaya Bhattacharya (Part- I & II), Paschatya Darsaner Itihas.
 Ramaprasad Das, Hume-er enquiry.
 Rasvihari Das, Kant-er Darsan.

PAPER-IV**Western Logic**

Question 1 is compulsory. Candidates have to answer 5 objective type questions (each carrying two marks) covering the entire syllabus of this paper. Candidates are required to answer any six questions taking two from group A, B, and C.

Full Marks: 100

For Group A,B &C: 15x6

For Group D :2x5

Group – A

Propositional Logic

Truth functions and truth functional connectives:

Symbols for Negation, Conjunction, Disjunction, Conditional Statements and Material Implication and Material Equivalence.

Argument Forms and Arguments.

Validity Testing by Truth Table Method and Truth-value assignment method.

Statement Forms and Statement.

Tautologous, Contradictory and Contingent Statement forms by Truth Table Method and Truth Tree Method.

Consistency by Truth Tree Method.

Method of Deduction:

Construction of Formal Proof of Validity by using Nineteen rules.

Proof of invalidity by assignment of Truth Values.

Proof by I.P. and C.P.

Logical Truths using I.P. and C.P.

Group – B

Logic of Quantification and Multiple-General Quantification

Boolean interpretation of Categorical propositions:

Review of the traditional laws of logic concerning immediate inference and syllogism. Venn Diagram technique for testing syllogisms.

Quantification Theory :

Need for Quantification Theory , Singular Propositions , Quantification. Translating traditional subject - Predicate Proposition into the logical notation of Propositional Function and Quantifier. Quantification rules and Proving Validity, Proving invalidity for arguments involving Quantifiers and Multiple General Propositions.

Group – C

Induction and Probability

Introduction to Induction:

Causal Connections: Cause and effect, Meaning of Cause: Mill's Method of Experimental Enquiry: Method of Agreement; Method of Difference; Joint Method of Agreement and Difference; Method of

Residues; Method of Concomitant Variation; Criticism of Mill's Method and Vindication of Mill's Method.

Probability:

Alternative Conceptions of Probability; the Probability Calculus; Joint Occurrences and Alternative Occurrences.

Science and Hypothesis:

Explanations- Scientific and Unscientific, Evaluating scientific explanations, the Detective as Scientist, the problem, preliminary hypothesis, collecting additional facts, formulating the hypothesis, deducing further consequences, testing the consequences, the application, the pattern of scientific investigation, crucial experiments and *ad hoc* hypothesis.

Text

I. M. Copi, Introduction to Logic.

I. M. Copi, Symbolic Logic

Jeffery, Formal Logic

Mill, A *System* of Logic

Suggested Readings

Ramaprasad Das, *Sanketik Yukti Vijnana*

Ramaprasad Das and Subir Ranjan Bhattacharya, *Samsad Yuktivijnana Abhidhan*

Samir Chakroborty, *Yukti Vijnaner Bhumika*

Sukla Chakroborty, *Tarka Vijnana*

PART -III

Paper – V

Indian Epistemology and Logic

It is a text-oriented paper and the recommended text is *Tarkasamgraha* with *Dipika* by Annambhatta (Selected portions)

Candidates are required to answer five short-answer type questions covering the entire syllabus of this paper within one fifty words each, carrying five marks each. And they have to answer five broad questions covering the entire syllabus of this paper within six hundred words each, carrying fifteen marks each.

Full Marks=100

5x5=25

15x5=75

Buddhi or Jnana :

Definition and classification .

Smriti :

Definition and classification of smriti into yathartha and ayathartha .

Anubhava:

Definition and its classification into yathartha and ayathartha .

Definition:

Yathartha anubhava or prama and ayathartha anubhava or aprama, Classification of ayathartha anubhava.

Definition:

Karana and kārana and kārya , kinds of kārana, concept of anyathasiddhi and its varieties.

Pratyaksa:

Definition and its two fold division: Nirvikalpaka and Savikalpaka pratyaksa, proof for the existence of Nirvikalpaka, Sannikarsa and its varieties - Laukika and Alaukika sannikarsa, problem of transmission of sound, solution of the problem of anupalabdhi as a distinct pramana .

Anumana:

Definition of anumiti , paramarsa , paksata, vyapti and vyaptigraha, svarthānumiti and parārāthanumiti, Analysis of Pancavayava Nyaya add classification of Linga or hetu, classification of paksa , sapaksa and vipaksa, marks of saddhetu, hetvabhasa : Definition and classification Two types of definition . Five kinds of hetvabhasa : Svavyabhicara and and its three kinds defined and illustrated, Viruddha - definition and illustration, Satpratipaksa - defined and illustrated, three kinds of Asiddhi - asrayasiddhi , svarupasiddhi and vyapatasiddhi . (Upadhi and its four kinds excluded).

Upamana:

Definition and illustration.

Sabda:

As a Pramana defined and analyzed, Sakti - as Isvara sanketa and as pada - padartha sambandha, How sakti can be known? Analysis of laksana - its three varieties. Gounivrtti , and Vyanjanavrtti, Conditions of sabdabodha, Two kinds of vakya - Vaidika and Laukika.

Suggested Readings

Anamika Roy Chaudhory - *Tarkasamgraha* with *Dipika*.

Dipak Kumar Bagchi - *Tarkasamgraha* O *Dipika*.

Kanailal Podder - *Tarkasamgraha* with *Dipika*.

Narayan Chandra Goswami - *Tarkasamgraha* with *Dipika*.

Gopinath Bhattacharya - *Tarkasamgraha* with *Dipika*.

PAPER-VI**Ethics and Philosophy of Religion**

Candidates will have to answer question 1 and any six carrying 15 marks each (within 600 words) from the rest taking two from group A, B, and C. Question 1 will consist of six short questions covering the entire syllabus of this paper, each carrying 5 marks out of which candidates have to answer any two questions (within 150 words).

Group - A**Indian Ethics****Introduction:**

Special features of Indian Ethics as opposed to western Ethics, Concept of Sthitaprajna, and Karma yoga - (From Srimad Bhagavat Gita 2nd and 3rd Adhyaya)

Purusartha-

Concept of the four purusartha-s and their interrelations.

Dharma:

Meaning of Dharma (Mimamsa and Nyaya view only), Sadharandharma and Visesa dharma (with special reference to Varna-asrama dharma and Svadharma).

Duties:

Pancasila, Brahmavihara , Anubrata , Mahabrata and ahimsa (Baudha and Jaina view only).

Group - B**Western Ethics****Nature of ethics and Ethical Problems:**

Morality and Moral Problems, Moral-actions, Object of Moral judgment.

Theories of Morality:

Naturalism, Emotivism (Ayers' view only) , Prescriptivism . (Brief conception only)

Standards of Morality:

Hedonism: Ethical, Psychological. Utilitarianism: Act Utilitarianism and Rule utilitarianism, Deontological theory: Distinction between Act and Rule, Deontological theories: Kant's Moral theory.

Group - C**Philosophy of Religion****Origin of Religion:**

Different theories (A) Anthropological and (B) Psychological, Nature and scope of Philosophy of Religion, Magic and Religion, Sacred and Profane.

Proof for the existence of God:

Ontological, Cosmological, Teleological and Moral arguments.

Grounds for disbelief in God:

Sociological theory and Freudian theory.

Comparative Religion:

Meaning and Scope (in brief).

Some Religions:

Hinduism, Islam and Christianity.(in brief)

Suggested Readings

S. K. Moitra - The Ethics of the Hindus

S. C. Chatterjee - Fundamentals of Hinduism

W. Frankena - Ethics

W. Lillie - An Introduction to Ethics

John H. Hick - Philosophy of Religion

P. K. Mahapatra (ed.) Studies on the Purusarthas

Surama Dasgupta - Development of Moral Philosophies in India

J. N. Sinha - History of Indian Philosophy (vol. I)

Samarendra Bhattacharya- Nitividya

Somnath Chakraborty- Nitividya
 Rabindranath Das - Dharmadarsan
 Madhusudan Saraswati - Bhagavatgita (Bengali)
 Atul Chandra Sen - Bhagavatgita (Bengali)
 Amita Chatterjee (ed.) - Bharatiya Dharmaniti (Selected Portions)
 Dikshit Gupta - Nitishastra
 Dilip Kumar Mohanta - Dharmadarsaner Katipaya Samasya.
 Pritibhusan Chatterjee- Studies in Comparative Religion
 Shekh Abdul Wahab- Binsha Satabdir Nitidarsan
 Fred Feldman – Introductory Ethics
 Beauchamb – Philosophical Ethics
 Mial Edwards- Philosophy of Religion
 Rahul Sankrityayana, Darsan-Dikdarsana
 Nikhilesh Bandopadhyaya, Dharmadarsana

PAPER-VII

Western Metaphysics and Epistemology

Question 1 is compulsory. The candidates are required to answer 5(five) short-answer type questions within 150(one hundred fifty) words covering the entire syllabus of this paper and 5(five) broad questions carrying fifteen marks each (within 600 words) taking at least two from each group.

Full Marks=100

5x5=25

15x5=75

Group- A

Analytical Philosophy

Recommended Text: John Hospers, An Introduction to Philosophical Analysis

Meaning and Definition: Word-meaning, Definitions, Vagueness, and Sentence-meaning.

Knowledge: Concept, Truth, The Nature of Knowledge, and the Sources of Knowledge.

Our Knowledge of the Physical World: Realism, Idealism, and Phenomenalism.

Group – B

Problems of Philosophy

Recommended Text: Bertrand Russell – The Problems of Philosophy

Appearance and Reality

Knowledge by Acquaintance and Knowledge by Description

**On Induction
The World of Universals
The Value of Philosophy**

Suggested Readings

The Problem of Knowledge: A. J. Ayer
 Language, Truth and Logic: A. J. Ayer
 Readings in Philosophical Analysis: J. Hospers
 The Central Questions of Philosophy: A. J. Ayer
 Theory of Knowledge: A. J. Woozley
 Darsanik Bishleshaner Ruprekha: Samarikanta Samanta .
 Darsanik Bishleshaner Bhumika: Samarendra Bhattacharyya
 Darsanik Jignasa (Bagarthatattva): Rama Prasad Das.
 Darsanik Jignasa (Jnanatattva -2): Rama Prasad Das.
 Darsanik Jignasa (Jnanatattva - 3) : Rama Prasad Das .
 Paratattva O Bhanta Jagater Jnana: Rama Prasad Das.
 Darsanik Bishleshaner Ruprekha: Rama Prasad Das and Shibapada Chakraborty.
 Darsanik Bishleshaner Bhumika: Dikshit Gupta.
 Sushil Chakraborti, Darshan Samashya
 Debika Saha, Darshan Samashya
 Samarendra Bhattacharyya, , Darshan Samashya

PAPER-VIII

Philosophical Classics

This Paper will consist of two groups, Group A and Group B each consisting of 50 marks. Group A consists of some classical texts out of which students will have to choose any one. Group B is allotted for Essay Paper .

Group A

(Anyone from the following groups)

1. Sadananda Yogindra : Vedantasāra

2. Ryle -The Concept of Mind

Chapters Descartes' Myth
 Knowing How And Knowing That
 The Will
 Disposition and Occurrences
 Self Knowledge.

3. Logic

Group- I

Set Theory – Chapters 9, 10 and 11.

Introduction, Membership, Inclusion, the Empty Set, Operations on Sets, Intersection, Union and Difference, Domain Of Individuals, Translating sentences of everyday language into Set Notation, Venn diagram, Definition of Relations, Properties of Binary Relations, Definition of Functions and Operations on Functions.

Group-II

Truth-Tree for Quantification
Entailment –By P.K.Sen.

Suggested Reading:

R. Jeffery- Formal Logic - Its Scope And Limits (first ed)
P. Suppes – Introduction to Logic
P.K.Sen (ed.) Jadavpur Studies Vol. II

4. Practical Vedanta - Vivekananda

Topics : Man, Universal Religion, Practical Vedanta

Suggested Reading:

Vivekananda- Practical Vedanta

5. The Manifesto of the Communist Party – Karl Marx And Frederick Engels.

Suggested Readings:

Marx and Engels, Communist Manifesto, with notes By D. Riyazanov, edited by V.G.Kiernan. (Bengali Translation is also available) Translated by Ganendranath Bandyopadhyay, Pearl Publishers
Maurice Cornforth, Dialectical Materialism, National Book Agency
Shovanlal Duttgupta ,Marxiya Rastrachainta, West Bengal State Book Board.
Sudarshan Roy Chowdhury ,Communist Istaharer Bhumika
Sudhansu Dasgupta, Communist Manifesto Prasange, NBA
Surabhi Bandyopadhyay, Samajbijnaner Sabda Parichaya , West Bengal State Book Board .
Tarapada Lahiri , Marxiya Darsan O Samajbijnaner Bhumika , Lokayata Sahitya Chakra.

6. Dharma: Rabindranath Tagore

Manusyatva , Pracina Bharater Ekah , Prarthana , Dukhah, Utsaber Din , Tatah Kim

Suggested Reading:

Rabindranath Thakur- Dharma, Viswabharati Granthanvibhaga, Kolkata .

7. Practical and Environmental Ethics

Killing:

Suicide, Euthanasia, Animal Killing

Feminist Ethics: Radical and Liberal,

Human Rights And Discrimination.**War and Violence -Terrorism.****Concept of Environmental Ethics:**

Anthropocentrism and Non- Anthropocentrism, Deep Ecology and Concepts of Management Ethics

Suggested Readings:

Peter Singer – Practical Ethics

Peter Singer (ed.) Applied Ethics

Rinita Majumder -A Short Introduction to Feminist Ethics .

D.J.O. Byrne – Human Rights: An Introduction

Peter Singer: Applied Ethics For Environmental Ethics

G. Geetha- Gender.

Dikshit Gupta-Nitividya O Phalita Nitividya

Shefali Moitra- Naitikata O Narivada

Samarendra Bhattacharya- Vyavaharika Nitivijnana (new edition)

Group: B

Group B is an essay paper. Candidates will have to write **two** essays from two broad areas in Philosophy
 a) **History of Indian Philosophy** and b) **History of Western Philosophy** within of 1500 to 2000 words.
 Each essay carries 25 marks.

Old SYLLABUS-(1+1+1 SYSTEM)

PHILOSOPHY –GENERAL

PART-1

PAPER -1

GROUP-A

Systems of Indian Philosophy:

i. Cārvāka Epistemology:

Perception as the only source of knowledge,

Rejection of Inference and Testimony as sources of knowledge.

ii. Cārvāka Metaphysics: Causality- Svabhāvavāda, Yadr̥chāvāda, Akasmikatāvāda, Jagat, Bhūtacaitanyavāda.

iii. Nyāya Epistemology: Classifications of Pramana: Pratyaksa, Anumana.

Pratyaksa: Laksana, classifications: Determinate (Savikalpaka) and Indeterminate (Nirvikalpaka),
Laukika, a-laukika; Classification of a-laukika [in brief].

Sannikarsa: Laukika & a-laukika.

Anumana: Laksana, Vyapti, Paramarsa, Svarthanumiti & Pararthanumiti.

iv. Vaiśeṣika Metaphysics: Seven categories: Dravya, Guṇa, Karma, (in brief) Detailed Explanations of
Sāmānya, Viśeṣa, Samavāya, and Abhāva . Paramanuvad.

v. Advaita Metaphysics: Nature of Brahman, Māyā, Jagat, Relation between Brahman and Jīva .

GROUP-B

Western Philosophy

1. Theories of the origin of knowledge: Rationalism, Empiricism and Kant's Critical Theory.

2. Realism and Idealism as theories of Reality:

i). Realism: Naive Realism, Locke's Representationalism.

ii). Idealism: Subjective Idealism :Berkeley - refutation of the distinction between Primary and Secondary qualities, Subjective Idealism.

3. Substance: Empiricist and Rationalist view of Substance.

4. Causality: Entailment theory, Regularity Theory.

5. Mind-body Problem: Interactionism, Parallelism, and Epiphenomenalism.

PART-II

PAPER-II

GROUP-A

Psychology

1. Nature and Subject matter of Psychology.

2. Methods of Psychology.

3. Sensation: What is Sensation? Attributes of Sensation.

4. Perception: What is Perception? The relation between Perception and Sensation. The Gestalt theory of Perception.

5. Memory: Factors of Memory; Laws of Association; Forgetfulness.

6. Consciousness: Conscious, Sub-Conscious, Unconscious-its evidence; Freud's Theory of Dream.

7. Learning: The Trial and Error Theory; The Gestalt Theory; Pavlov's Conditioned- Response Theory.

8. Personality: Factors of Personality; Heredity and Environment.

9. Measurement of Intelligence; Binet-Simon Test.

GROUP-B

Ethics(Indian and Western)

- 1.Purusartha: General view
- 2.Karma: (Sakama&Niskama)
- 3.Carvaka Ethics .
- 4.Buddhist Ethics: The Four Noble Truths and the Eight-fold Path, *Pancasila*.
- 5.Jaina Ethics: *Anuvrata, Mahavrata*.
- 6.Moral and Non-moral actions: Concept and object of Moral Judgment.
- 7.Teleological Ethics- Utilitarianism [Bentham & Mill].
- 8.Deontological Ethics –Kant

PART-II

PAPER-III

GROUP-A

Indian Logic

Nature of Inference, Paksha, Sadhya, Hetu,Paramarsa,Vyapti, Vyaptigraha, Svarthanumiti, Pararthanumiti, Kevalanvayi, Kevelavyatireki, Anvaya-Vyatireki, Hetvabhasa.

GROUP-B

Western Logic

Proposition, Categorical Proposition, Quality, Quantity of categorical Propositions, argument, truth, validity.

Distribution of terms, Traditional Square of Oppositions:, conversion, obversion and contraposition. Categorical Proposition: Existential Import of propositions, Boolean Interpretation of Categorical propositions.

Categorical syllogism: Figure, Mood, Rules for Validity, Testing the validity of arguments by Venn diagram.

Symbolic Logic: The value of special symbols for conjunction, Negation, disjunction, implication, equivalence, tautology, contradiction and contingency.

Truth Table: Truth-table Method for testing arguments.

Inductive Logic: Mill's methods of experimental inquiry.

PART-III

PAPER-IV

GROUP-A

Part-I (Bhagavad Gita)

Chapter : 2,3&4.

Part-II (Practical Ethics)

i. Nature of Practical Ethics.

ii. Human Rights.

- iii. Killing- Suicide and Euthanasia
- iv. Environmental Ethics
- v. Punishment
- vi. Feminism

GROUP-B

Part-I(Social & Political Philosophy)

Primary concepts: Society, Community, Association, Institution, Social group . Religious and Moral codes, Custom and Law.

Culture and Civilization.

Social Class and Caste.

Political Ideals:

Democracy: Different forms.

Socialism: Utopian&Scientific.

Part-II(Philosophy of Religion)

Scope and nature of Religion

Origin of Religion; Different theories--Animism, Totemism, Manaism.

Magic and Religion.

Problem of evil

Proofs for the existence of God: Ontological, Cosmological, Teleological, Moral.

Herbert Spencer's Ghost Theory.

Positivism and Agnosticism.

West Bengal State University
B. Sc. (PHYSICS HONOURS) SYLLABUS

(draft)

This course is divided into three parts, each of one year duration. One University level examination will be held at the end of the each year. Each paper can be subdivided in two half papers hereafter called units. Each unit carries 50 marks. Part I consists of three theoretical units (IA, IB and IIA) and one practical unit (Paper IIB). Part II consists of three theoretical units (IIIA, IIIB and IVA) and one practical unit (IVB). Part III consists of five theoretical units (VA, VB, VIA, VIB and VIIA) and three practical units (VIIB, VIIIA and VIIIB). Final result will be determined on the basis of the three examinations out of a grand total of 800 marks.

THEORETICAL UNITS

Each theoretical unit is divided into one or more groups and each group is subdivided into a number of topics. A broad guideline of the material to be covered in each topic has been given together with the expected number of class room lecture periods (each of 45 min. duration) which is given within parentheses at the end of each topic. This is intended as a guideline to individual teachers for the depth and extension of the material to be covered.

A number of tutorial periods has been included for each unit. During these tutorial periods, group discussions will be conducted by the teacher on the topic taught earlier to remove any difficulty that the students may face. Part of such tutorial periods will also be used for solving problems on the topics of that particular group. No additional subject other than those covered in the syllabus should be introduced in the tutorial classes.

PHYSICS HONOURS
THEORETICAL
PART - I
PAPER I

[The setting of questions from different groups is as follows;
Question No 1 will be of short answer type carrying 2 marks each. 10 out of 16 questions distributed uniformly over the entire syllabus are to be answered.
Questions 2,3,4,5,6: 5 Questions to be set and 3 to be answered from Group A
Questions 7, 8: 2 Questions to be set and 1 to be answered from Group B
Questions 9,10,11: 3 Questions to be set and 2 to be answered Group C
Questions 12,13,14: 3 Questions to be set and 2 to be answered Group D

Each question from question Nos 2 to 14 will carry 10 marks.]

UNIT IA

Total Marks : 50 Total No. of Lectures : 70

GROUP A : MATHEMATICAL METHODS OF PHYSICS (44 Lectures)

1. Preliminary Topics

Infinite sequences and series - convergence and divergence, conditional and absolute convergence, ratio test for convergence. Complex-valued functions - analytic functions defined in terms of Taylor series expansion. Functions of several real variables - partial differentiation,

Taylor's series, multiple integrals. Random variables and probabilities - statistical expectation value, variance; Binomial distribution, Gaussian distribution and Poisson distribution – simple examples. (9)

2. Vector Analysis

Transformation properties of vectors; scalar and vector products; Differentiation and integration of vectors; Concept of tensors; Line integral, volume integral and surface integral involving vector fields; Gradient, divergence and curl of a vector field; Gauss' divergence theorem, Stokes' theorem, Green's theorem - application to simple problems; Orthogonal curvilinear co-ordinate systems, unit vectors in such systems, illustration by spherical and cylindrical polar systems. (9)

3. Differential Equations

(a) Ordinary Differential Equations :

Solution of second order linear differential equation with constant coefficients and variable coefficients by Frobenius' method; Solution of Legendre and Hermite equations about $x=0$; Legendre and Hermite polynomials - orthonormality properties. (8)

(b) Partial Differential Equations :

Solution by the method of separation of variables; Laplace's equation and its solution in Cartesian, spherical polar (axially symmetric problems), cylindrical polar ('infinite cylinder' problems) coordinate systems; Wave equation and its plane and spherical wave

solutions.(8)

4. Fourier Series

Fourier expansion – statement of Dirichlet's condition, analysis of simple waveforms with Fourier series. Introduction to Fourier transforms; the Dirac-delta function and its Fourier transform; other simple examples.(5)

5. Matrices

Hermitian adjoint and inverse of a matrix; Hermitian and unitary matrices; Eigenvalue and eigenvector; Similarity transformation; diagonalisation of real symmetric matrices with non-degenerate eigenvalues.(5)

GROUP B : CLASSICAL MECHANICS (21 Lectures)

1. Mechanics of a Single Particle

Velocity and acceleration of a particle in (i) plane polar coordinates - radial and crossradial components (ii) spherical polar and (iii) cylindrical polar co-ordinate system; Time and path integral of force; work and energy; Conservative force and concept of potential; Dissipative forces; Conservation of linear and angular momenta.(6)

2. Mechanics of a System of Particles

Linear momentum, angular momentum, and energy - centre of mass decomposition; Equations of motion, conservation of linear and angular momenta.(6)

3. Rotational Motion

Moment of inertia, radius of gyration; Energy and angular momentum of rotating systems of particles; Parallel and perpendicular axes theorems of moment of inertia; Calculation of moment of inertia for simple symmetric systems; Ellipsoid of inertia and inertia tensor; Setting up of principal axes in simple symmetric cases. Rotating frames of reference – Coriolis and centrifugal forces, simple examples. Force-free motion of rigid bodies - free spherical top and free symmetric top.(9)

Tutorials on Problems and Discussions (5)

UNIT IB

Total Marks 50 Total No. of Lectures : 70

GROUP C GENERAL PROPERTIES OF MATTER (33 Lectures)

1. Gravitation

Newton's law of Gravitation; Gravitational potential and intensity - application of Gauss' theorem and Laplace's equation in simple symmetric problems.(5)

2. Central Force Problem

Motion under central force; Nature of orbits in an attractive inverse square field; Kepler's laws of planetary motion. Rutherford scattering.(6)

3. Elasticity

Stress and strain tensors at any point in a continuous medium; Small deformations, Hooke's law, Interrelations of elastic constants for an isotropic solid. Torsional rigidity; Bending moments and shearing forces, cantilever; Beam supported at both ends; strain energy.(9)

4. Mechanics of Ideal Fluids

Streamlines and flowlines; Equation of continuity; Euler's equation of motion; Streamline motion - Bernoulli's equation and its applications.(5)

5. Surface Tension

Surface energy and surface tension; Angle of contact; Excess pressure on a curved liquid surface; Capillary rise; Saturation vapour pressure on a curved surface.(4)

6. Viscosity

Steady flow of Newtonian fluids; Poiseuille's equation for incompressible fluids; Statement of Stokes' law - terminal velocity; effect of temperature on viscosity; Reynold's number - turbulent flow and critical velocity.(4)

GROUP D : VIBRATIONS, WAVES AND ACOUSTICS (32 Lectures)

1. Vibrations

Linear harmonic oscillator - differential equation and its solution . Free and forced vibrations of a damped harmonic oscillator; resonance; sharpness of resonance. A pair of linearly coupled harmonic oscillators - eigenfrequencies and normal modes. Lissajous figure; **Vibrations of a weakly anharmonic oscillator - generation of harmonics, frequency shift. Basic principle underlying the production of combination tones.**(10)

2. Waves

Linear equation of plane progressive wave motion in one dimension, and in three dimensions; plane wave and spherical wave solutions; intensity of a plane progressive wave; dispersion in wave propagation - group velocity and phase velocity.(7)

3. Transverse vibrations in stretched strings

Wave equation in the linear approximation; eigenfrequencies and eigenmodes for plucked and struck strings; energy of transverse vibrations.(6)

4. Velocity of acoustic waves in isotropic solids, liquids and gases

Derivation of the respective expressions with explanation of the approximations made.(4)

5. Doppler effect in acoustics

Derivation of expression for Doppler shift in frequency.(3)

6. **Ultrasonics**

Basic principles of generation and detection.(2)

Tutorials on Problems and Discussions (5)

PAPER IIA

UNIT IIA

[The setting of questions from different groups is as follows;
Question No 1 will be of short answer type carrying 2 marks each. 5 out of 8 questions distributed uniformly over the entire syllabus are to be answered.

Questions 2,3: 2 Questions to be set from Group A

Questions 4,5,6,7: 4 Questions to be set from Group B

Question no 1 and 4 other Questions are to be answered taking at least 1 from group A

Each question from question Nos 2 to 7 will carry 10 marks.]

Total Marks 50 Total No. of Lectures : 70

THERMAL PHYSICS

Group A: Heat (20 Lectures)

1. Kinetic Theory of Gases

Basic assumptions of kinetic theory, Ideal gas approximation, deduction of perfect gas laws. Maxwell's distribution law (both in terms of velocity and energy), root mean square and most probable speeds. Finite size of molecules : Collision probability, Distribution of free paths and mean free path from Maxwell's distribution. Degrees of freedom, equipartition of energy (detailed derivation not required) : application to specific heat, Dulong and Petit's law.(10)

2. Transport Phenomena

(a) Viscosity, thermal conduction and diffusion in gases. (b) Brownian Motion : Einstein's theory, Perrin's work, determination of Avogadro number.(5)

3. Real Gases

Nature of intermolecular interaction : isotherms of real gases. van der-Waal's equation of state, Other equations of state (mention only), critical constants of a gas, law of corresponding states; Virial Coefficients, Boyle temperature; limitations of van der-Waal's equation of state.(5)

Group B: Thermodynamics (45 lectures)

1. Basic Concepts

Microscopic and macroscopic points of view : thermodynamic variables of a system, State function, exact and inexact differentials.(2)

2. Zeroth Law of Thermodynamics

Thermal equilibrium, Zeroth Law and the concept of temperature. (1)

3. First Law of Thermodynamics

Thermodynamic equilibrium, internal energy, external work, quasistatic process, first law of thermodynamics and applications including magnetic systems, specific heats and their ratio, isothermal and adiabatic changes in perfect and real gases.(5)

4. Second Law of Thermodynamics

Reversible and irreversible processes, indicator diagram. Carnot's cycles-efficiency, Carnot's theorem. Kelvin's scale of temperature, relation to perfect gas scale, second law of thermodynamics – different formulations and their equivalence, Clausius inequality, entropy, change of entropy in simple reversible and irreversible processes, entropy and disorder; equilibrium and entropy principle, principle of degradation of energy.(10)

5. Thermodynamic Functions

Enthalpy, Helmholtz and Gibbs' free energies; Legendre transformations, Maxwell's relations and simple deductions using these relations; thermodynamic equilibrium and free energies. (5)

6. Heat Engines

External combustion engine - Rankine cycle, internal combustion engines – Otto and Diesel cycles.(3)

7. Change of State

Equilibrium between phases, triple point : Gibbs' phase rule (statement only) and simple applications. First and higher order phase transitions, Ehrenfest criterion. Clausius-Clapeyron's equation. Joule-Thomson effect; inversion temperature, regenerative cooling.(7)

(c) Heat Transfer

Thermal conductivity, diffusivity. Fourier's equation for heat conduction – its solution for rectilinear and radial (spherical and cylindrical) flow of heat.

Radiation :

Spectral emissive and absorptive powers, Kirchoff's law, blackbody radiation, energy density, radiation pressure. Stefan-Boltzmann law, Planck's law (no detailed derivation), solar temperature and radiation pyrometer.

Convection :

Importance in atmospheric physics (qualitative), adiabatic lapse rate.(12)

Tutorials on Problems and Discussions (5)

BOOKS

Mathematical Methods

1. Introduction to Mathematical Physics - C. Harper (Prentice-Hall of India).
2. Mathematical Methods - M. C. Potter and J. Goldberg (Prentice-Hall of India).
3. Vector Analysis - M. R. Spiegel, (Schaum's Outline Series) (Tata McGraw-Hill).
4. Tatwiyā Padārtha Bidyā Bhumikā – S. Sengupta, Asok Ghosh and D. P. Roychaudhuri

(W.B. State Book Board (WBSBB)).

Classical Mechanics and General Properties of Matter

1. Theoretical Mechanics - M. R. Spiegel, (Schaum's Outline Series) (McGraw-Hill).
2. Mechanics - K. R. Symon (Addison-Wesley).
3. Introduction to Classical Mechanics - R. G. Takwale and P. S. Puranik (Tata McGraw-Hill).
4. The General Properties of Matter - F. H. Newman and V. H. L. Searle (Radha Publ. House).
5. Mechanics and General Properties of Matter – D. P. Roychaudhuri and S. N. Maiti (Book Syndicate).
6. Padārth Dharma - D. P. Ray Chaudhuri (West Bengal State Book Board).
7. The Feynman Lectures on Physics – Vol I (Addison-Wesley).
8. An Introduction to Mechanics – D. Keppner and R.J. Kolenkow (Tata McGraw-Hill).

Vibrations, Waves and Acoustics

1. Advanced Acoustics - D. P. Ray Chaudhuri (Chayan – Kolkata).
2. Waves and Oscillations - Rathin N. Chaudhury (New Age Publ.).

Thermal Physics

1. Heat and thermodynamics - Zemansky and Dittman (Mc Graw Hill, Kugakusha).
2. Kinetic theory of gases - Leob (Radha Publ. House).
3. Thermodynamics – F. Fermi.
4. Tapgatividyā – Asoke Ghosh (W.B.S.B.B).
5. A Treatise on Heat - Saha and Sribastava (The Indian Press Ltd).
6. Gaser Anabik Tattwa- Pratip Kumar Chaudhuri (W. B. S. B. B).
7. Thermal Physics – S. Garg, R. M. Bansal, C. K. Ghosh (Tata Mc Graw Hill).
8. Heat and Thermodynamics – H. P. Roy and A. B. Gupta.

PART II

PAPER III

[The setting of questions from different groups is as follows;

Question No 1 will be of short answer type carrying 2 marks each. 10 out of 16 questions distributed uniformly over the entire syllabus are to be answered.

Question Nos 2, 3, 4, 5, 6, 7: 6 Questions are to be set, 4 to be answered from Group A

Question Nos 8,9 : 2 Questions are to be set from Group B

Question Nos 10,11 : 2 Questions are to be set from Group c

Question Nos 12,13 : 2 Questions are to be set from Group D

Four questions are to answered taking at least one from each of the Groups B, C, D

Each question from question Nos 2 to 13 will carry 10 marks.]

UNIT IIIA

Total Marks 50 Total No. of Lectures : 70

GROUP A

ELECTRICITY I (65 Lectures)

(SI system should be followed)

1. Units and dimensions

CGS, Gaussian and SI units; conversion between Gaussian and SI units; dimension of various quantities. (2)

2. Electrostatics

Coulomb's law of electrostatics, intensity and potential; Gauss' theorem – its application; Poisson and Laplace's equations; deduction from Gauss's theorem; Uniqueness theorem. Superposition theorem (statement only). Application of Laplace's equation to simple cases of symmetric spherical charge distribution.(9)

3. Multipole expansion

Multipole expansion of scalar potential – monopole, dipole and quadrupole terms; potential and field due to a dipole; work done in deflecting a dipole; dipole-dipole interaction(for both electric and magnetic dipoles); force on dipole in a non-homogeneous field.(6)

4. Dielectrics

Polarisation, electric displacement vector (D); Gauss's theorem in dielectric media; boundary conditions; electrostatic field energy; computation of capacitance in simple cases (parallel plates); spherical and cylindrical capacitors containing dielectrics – uniform and nonuniform.(6)

5. Electrical Images

Solution of field problems in case of a point charge near a grounded conducting infinite plane. Boundary value problem : in uniform external field for (i) conducting spherical shell and (ii) dielectric sphere.(6)

6. Steady current

Ohm's law – Differential form, Kirchoff's Law; Wheatstone bridge – its sensitivity (qualitative discussion only).(4)

7. Magnetic effect of steady current

Lorentz force and concept of magnetic induction; force on linear current element; Biot-Savart's law. $\vec{\nabla} \cdot \vec{B}=0$; magnetic vector potential; calculation of vector potential and magnetic induction in simple cases – straight wire, magnetic field due to small current

loop; magnetic dipole; field due to a dipole; magnetic shell; Ampere's theorem; Ampere's circuital law illustration (straight wire); force between long parallel current carrying conductors; $\vec{\nabla} \times \mathbf{B} = \mu_0 \mathbf{J}$; comparison between static electric and magnetic fields. (12)

9. Field and magnetic materials

Free current and bound current; surface and volume density of current distribution; magnetisation; nonuniform magnetisation of matter; $\mathbf{J}_b = \vec{\nabla} \times \mathbf{M}$; Ampere's law in terms of free current density and introduction of H; line integral of H in terms of free current; boundary conditions for B and H; permanently magnetized body; magnetic scalar potential; application of Laplace's equation to the problem of a magnetic sphere in uniform magnetic field; hysteresis and energy loss in ferromagnetic material; magnetic circuit; energy stored in magnetic field. (12)

10. Electromagnetic induction

Faraday's and Lenz's law; motional e.m.f.-simple problems; calculation of self and mutual inductance in simple cases; inductances in series and parallel; reciprocity theorem. (5)

11. Network

Thevenin Theorem, Norton theorem, Maximum power transfer theorem, Superposition principle, T and P networks (3)

Tutorials on Problems and Discussions (5)

UNIT – IIIB

Total Marks : 50 Total No. of lectures : 70
GROUP B ELECTRICITY II (17 Lectures)

1. Transients in D.C.

Growth and decay of current-charging and discharging of capacitors in L-C-R circuits; oscillatory discharge; time constant; energy stored in an inductance. (4)

2. Alternating current

L-C-R circuits in sinusoidal e.m.f.; application of imaginary operator; phase diagram; power; power factor; resonance in series and parallel circuits; Q-factor; filter selectivity; elementary theory of transformer. A.C. bridge – principle of generalized A.C. bridge; Anderson bridge. Theory of rotating magnetic field – induction motor. (13)

GROUP C : ELECTROMAGNETIC THEORY (25 Lectures)

1. Generalization of Ampere's Law, Displacement Current, Maxwell's Field Equations, Wave equation for electromagnetic (EM) field and its solution – plane wave and spherical wave solutions, transverse nature of field, relation between E and B; energy density of field, Poynting vector and Poynting's theorem, boundary conditions. (8)

2. EM Waves in an isotropic dielectric; wave equation, reflection and refraction at plane boundary, reflection and transmission coefficients, Fresnel's formula, change of phase on reflection, polarization on reflection and Brewster's law, total internal reflection. (6)

3. EM waves in conducting medium; wave equation in conducting medium, reflection and transmission at metallic surface – skin effect and skin depth, propagation of E-M waves between parallel and conducting plates – wave guides (rectangular only). (5)

4. Dispersion : Equation of motion of an electron in a radiation field : Lorentz theory of dispersion – normal and anomalous; Sellmeier's and Cauchy's formulae, absorptive and dispersive mode, half power frequency, band width. (3)

5. Scattering : Scattering of radiation by a bound charge, Rayleigh's scattering (qualitative ideas), blue of the sky, absorption. (3)

GROUP D : ELECTRONICS I (23 Lectures)

1. Diodes

Conductor, insulator and semiconductor (distinction on the basis of band theory of solids – qualitative study); concept of hole, extrinsic semiconductor, p-n junction – space charge and electric field distribution at junctions, forward and reversed bias junctions, depletion region, avalanche and Zener breakdown; I-V characteristics and use of Zener as voltage regulator; light emitting diode; analysis of half-wave and full-wave rectifiers; bridge rectifier with C and P filter.(7)

2. Bipolar Junction Transistors (BJT)

Current component in junction transistor; characteristics in CB and CE configuration, cut off, saturation and active regions; α and β of a transistor and their relations. Output characteristics; load line and Q point; biasing of a transistor – stability factors; hybrid parameters and small signal single stage low frequency CE amplifier (analysis with h-parameter model)-current and voltage gains; input and output impedances, effect of source resistance, power gain; comparison of CB, CC & CE amplifiers (qualitative discussion); emitter follower.(9)

3. Boolean Algebra

Binary, decimal and hexadecimal systems; conversion from one system to another system; 1's complement and 2's complement of a binary number; binary addition and subtraction. (2)

4. Logic Gates

AND, OR, NOT gates – truth tables, circuits of AND and OR gates using diodes and transistors; circuit of NOT gate using transistor; NAND and NOR as universal gate. Combination of gates for obtaining different Boolean function. de Morgan's theorem – simplification of Boolean's expressions. (5)
Tutorials on Problems and Discussions (5)

PAPER IVA

UNIT IVA

[The setting of questions from different groups is as follows;
Question No 1 will be of short answer type carrying 2 marks each. 5 out of 8 questions distributed uniformly over the entire syllabus are to be answered.

Question Nos 2,3,4: 3 Questions are to be set from Group A

Question Nos 5, 6, 7: 3 Questions are to be set from Group B

4 Questions are to be answered taking at least 1 from each group

Each question from question Nos 2 to 7 will carry 10 marks.]

Total Marks : 50 Total No. of lectures : 70

OPTICS (65 Lectures)

Group A : Ray Optics

1. Light as electromagnetic waves wave normals and rays : short wavelength limit and ray(geometrical) optics.(2)

2. Fermat principle, application to reflection and refraction at curved surfaces.(3)

3. Cardinal points of an optical system : two thin lenses separated by a distance, equivalent lens, different types of magnification : Helmholtz and Lagrange, paraxial approximation, introduction to matrix methods in paraxial optics – simple application. (5)

4. Dispersion : Dispersive power of optical systems, dispersive power of prism, chromatic aberration – methods of reduction, achromatic lens combination.(3)

5. Seidel aberration : (only qualitative discussion) Nature and cause of different seidel aberrations, methods of reducing these. (3)

6. Optical instruments : Field of view, entrance and exit pupil microscope, eyepieces-

Ramsden and Huygen.(4)

Group B: Physical Optics

1. Wave theory of light : Huygen's principle; deduction of law of reflection and refraction.(5)
 2. Interference of light waves : Young's experiment; spatial and temporal coherence; intensity distribution; Fresnel's biprism, interference in thin film; fringes of equal inclination and equal thickness; Newton's ring. Michelson's interferometer, application in fine structure study. Multiple beam interference – reflected and transmitted pattern. Fabry-Perot interferometer and application to fine structure study. (15)
 3. Diffraction of light waves : Fresnel and Fraunhofer class, Fresnel's half period zones; explanation of rectilinear propagation of light; zone plate. Fraunhofer diffraction due to a single slit, double slit and circular aperture (qualitative). Plane diffraction grating (transmission). Rayleigh criterion of resolution; resolving power of prism, telescope, microscope and transmission grating. (15)
 4. Polarisation : Different states of polarisation; double refraction (Explanation from Electromagnetic theory), Huygen's construction for uniaxial crystals; polaroids and their uses. Production and analysis of plane, circularly and elliptically polarised light by retardation plates and rotatory polarisation and optical activity; Fresnel's explanation of optical activity; Biquartz and half shade polarimeter. (10)
- Tutorials on Problems and Discussions (5)

BOOKS

Electricity and Magnetism and Electromagnetic Theory

1. Introduction to Electrodynamics – D. J. Griffith, (Prentice Hall, India Pvt. Ltd).
2. Berkeley Series Vol II (Electricity and Magnetism) Purcell (Mc. Graw Hill).
3. The Feynman Lectures on Physics – Vol. II (Addison – Wesley).
4. Electricity and Magnetism - J. H. Fewkes and J. Yarwood (Oxford Univ. Press, Calcutta).
5. Electricity and Magnetism – Chatterjee and Rakshit.
6. Electromagnetic Theory - Reitz, Milford and Christy (Addison – Wesley).

Electronics

1. Integrated Electronics – J. Millman and C. C. Halkias (Mc Graw Hill).
2. Electronic Fundamentals and Applications – D. Chattopadhyay and P. C. Rakshit
3. Electronics Fundamentals and Applications – J. D. Ryder (PHI Pvt. Ltd).
4. Electronic Device and Circuit Theory – R. Boylestad and L. Nashelsky (Prentice – Hall).

Ray Optics and Wave Optics

1. Fundamentals of Optics - F. A. Jenkins and H. E. White (Mc Graw Hill, Kogakusha).
2. Geometrical and Physical Optics - B. S. Longhurst (Orient Longmans).
3. Optics – A. K. Ghatak (Tata Mc Graw Hill).
4. Optics – Hecht and Zajac.
5. Optics – B. K. Mathur.
6. Bhauta Alok Bigyan – B. S. Basak (WBSBB).

Part III

B.Sc. Part III Theoretical

Paper V

[The setting of questions from different groups is as follows;

Question No 1 will be of short answer type carrying 2 marks each. 10 out of 16 questions distributed uniformly over the entire syllabus are to be answered.

Question Nos 2, 3, : 2 Questions are to be set from Group A, 1 to be answered.

Question Nos 4, 5: 2 Questions are to be set from Group B, 1 to be answered.

Question Nos 6, 7, 8: 3 Questions are to be set from Group C, 2 to be answered.

Question Nos 9, 10, 11, 12: 4 Questions are to be set from Group D, 3 to be answered.

Question Nos 13 and 14: 2 Questions are to be set from Group E, 1 to be answered.

Each question from question Nos 2 to 14 will carry 10 marks for each question.]

Each question from question Nos 2 to 14 will carry 10 marks for each question.]

Unit VA (No of Lectures: 65)

Group A: ADVANCED CLASSICAL MECHANICS (20 Lecture periods)

Advanced Classical Mechanics: Generalized coordinates, constraints and degrees of freedom; D'Alembert's principle; Lagrange's equation for conservative systems and its application to simple cases; Idea of cyclic coordinates, its relation with conservation principles; Definition of Hamiltonian, Hamilton's equation (Statement, Derivation by Legendre transformation) and its application to simple cases. Canonically conjugate variables, canonical transformations, Poisson brackets. Small Oscillation- normal modes and eigen frequencies, simple examples.

Group B: SPECIAL THEORY OF RELATIVITY (15 Lecture periods)

Special theory of relativity: Velocity of light: Michelson Morley Experiment and Newtonian Relativity. Postulates of special theory of relativity; simultaneity; Lorentz transformation along one of the axes- length contraction, time dilation and velocity addition theorem. Fizeau's experiment. Four vectors; relativistic dynamics- variation of mass with velocity. Energy momentum and mass energy relations.

Light cone: space like, time like and light like four vectors, light cone, causality

Group C: STATISTICAL PHYSICS (25 Lecture Periods)

1. Statistical Mechanics: microstates and macrostates-classical description in terms of phase space and quantum description in terms of wave functions. Idea of ensemble. Hypothesis of equal a priori probability for microstates of an isolated system in equilibrium.: Microcanonical ensemble. Ergodic hypothesis. Interactions between two systems- thermal, mechanical and diffusive. Statistical definition of temperature, pressure, entropy and chemical potential. Canonical and Grand canonical ensemble. Partition function of a system in thermal equilibrium with heat bath. Law of equipartition of energy, its limit of validity and application.

8

2. Classical Statistics: Maxwell-Boltzmann (MB) distribution law: Derivation (microcanonical) , Calculation of thermodynamic quantities for ideal monatomic gases.

3. Quantum Statistics: Gibbs' Paradox, Identical particle and symmetry requirements. Derivation of FD and BE statistics as the most probable distributions (micro-canonical ensemble). Classical limit of quantum statistics.

5

4. Bose Einstein (BE) distribution law: Derivation, Application of BE statistics to derive Planck's law. Rayleigh Jean's and Wien's law as limiting cases of Planck's law. Phonons and lattice, specific heat of solids: Einstein and Debye's theory, Bose-Einstein condensation (qualitative discussion)

5

5. Fermi-Dirac (FD) distribution law: Derivation, Fermi distribution at zero and nonzero temperatures. Expression for Fermi energy in terms of particle density, Degenerate and non-degenerate Fermi gases. Application of FD statistics to derive specific heat of electrons in metals at low temperatures. Richardson Dushman equation of thermoionic emission.

5

Tutorials on Problems and discussions

5

Unit VB (No of Lectures: 65)

[The setting of questions from different groups is as follows;
Group D: QUANTUM MECHANICS (36 Lecture Periods)

1. Basic Quantum Mechanics: de Broglie hypothesis, Compton effect, Davison-Germer experiment, Heisenberg uncertainty principle. Concept of wave function as describing the dynamical state of a single particle. Group velocity and phase velocities. Classical velocity of a particle and the group velocity of the wave representing the particle. Principle of superposition. Schrödinger equation, Probabilistic interpretation, equation of continuity, probability current density, Boundary conditions on wave function.

9

2. Operators in quantum mechanics: Basic postulates of quantum mechanics, Dynamical variables as linear hermitian operators, eigenvalue equation satisfied by them. Momentum energy and angular momentum operators. Results of measurement of variables. Expectation values. Commutation relations between the operators. Compatible observables and simultaneous measurements. Ehrenfest theorem.

9

3. Time dependent and time independent Schrödinger equation. Solutions, eigenstates, normalization and orthonormality of wave function.

4

4. Simple application of Quantum Mechanics:

One dimensional potential well, boundary condition.

Penetration of rectangular potential barrier in one dimension: derivation of reflection and transmission coefficients.-explanation of alpha decay.

Box normalization. Momentum eigenfunction for a free particle.

Linear Harmonic Oscillator (LHO). Solution of the equation of LHO (by the method of solution of Hermite differential equation approach), zero point energy. Parity of wave function.

Angular momentum operator and their commutation relation. eigen values and eigen functions of L^2 and L_z Theorem of addition of angular momenta (statement with example). Hydrogen atom problem. Schrödinger equation for hydrogen atom

problem, Solution of the radial part and energy eigenvalues (Laguerre polynomial solution to be assumed). Degeneracy of the energy eigenvalues.

18

Group E: ATOMIC SPECTRA, MOLECULAR SPECTRA, X-RAY (24 Lecture Periods)

Atomic Spectra: Spectrum of hydrogen atom. Spectra of alkali metal atoms and its relation to hydrogen spectra. Stern Gerlach experiment and intrinsic spin of electron. Spectra of sodium atom. Doublet structure of D lines of sodium. coupling schemes: L-S, j-j and intermediate coupling.

Magnetic moment of electron, Lande g factor, Vector atom model, space quantization, Normal and Anomalous Zeeman effect.

Pauli exclusion principle, shell structure, Hund's rule. Spectroscopic terms of many electron atoms in the ground state.

16

Molecular spectra: Diatomic molecules-rotational and vibrational energy levels. Basic ideas about molecular spectra. Raman effect and its application (qualitative)

3

X-Ray: Continuous and Characteristic X-rays, Mosley's law and its explanation from Bohr theory.

2

Tutorials on Problems and discussions

5

Paper VI

[The setting of questions from different groups is as follows;

Question No 1 will be of short answer type carrying 2 marks each. 10 out of 16 questions distributed uniformly over the entire syllabus are to be answered.

Question Nos 2, 3, 4 and 5: 4 Questions are to be set from Group A, 3 to be answered.

Question Nos 6 and 7 : 2 Questions are to be set from Group B, 1 to be answered.

Question Nos 8, 9, 10 and 11: 4 Questions are to be set from Group A, 3 to be answered.

Question Nos 12 and 13 : 2 Questions are to be set from Group B, 1 to be answered.

Each question from question Nos 2 to 13 will carry 10 marks for each question]

]

Unit VI A (No of Lectures: 65)

Group A: NUCLEAR PHYSICS (40 LECTURE PERIODS)

1. Gross Properties of nuclei:

Nuclear mass, charge, size, binding energy, spin and magnetic moment. Isobar, isotope and isotones. Mass spectrometer (Bainbridge). Binding energy per nucleon versus mass number curve and its characteristics.

5

2. Nuclear Structure:

Nature of forces between nucleons, nuclear stability and nuclear binding, the liquid drop model (descriptive), Bethe Weizsacker mass formula, application to stability considerations, extreme single particle shell model (qualitative discussions with emphasis on phenomenology with examples)

9

3. Unstable Nuclei:

(a) Alpha decay: Alpha particle spectra, velocity and energy of alpha particles, Geiger Nuttal law.

3

(b) Beta Decay: nature of beta ray spectra, the neutrino, energy levels and decay schemes, positron emission and electron capture, selection rules, beta absorption and range of beta particles, Curie plot.

4

(c) Gamma decay: gamma ray spectra and nuclear energy level, isomeric states, multipolarity transition and selection rules (no derivation). Gamma absorption in matter- photoelectric process, Compton scattering and pair production (qualitative)

4

4. Nuclear Reaction:

(a) Conservation principles in nuclear reactions, Q value, Q equation, Threshold energy, nuclear reaction cross-sections, examples of different types of reactions and their characteristics, Bohr's postulate of compound nuclear reaction, verification of Bohr's compound nucleus hypothesis, stripping and pick up reactions (qualitative discussion).

4

(b) Neutron Physics and Nuclear fission:

Neutrons: discovery, properties and decay of isolated neutrons.

Discovery of nuclear fission, Explanation of nuclear fission using liquid drop model, fission products and energy release. Spontaneous and induced fission transuranic

elements. Chain reaction and basic principle of reactors.

4

5. Elementary Particles:

Four basic interactions in nature and their relative strengths, examples of different types of interactions, Quantum numbers-mass, charge, spin, isotropic spin, intrinsic parity, hypercharge, Charge conjugation. Conservation of various quantum numbers, Classification of elementary particles, hadrons and leptons, baryons and mesons, elementary idea about quark structure of hadrons, octet and decuplet families

7

Group B: Instrumental Method (20 LECTURE PERIODS)

1. Vacuum Techniques: Production of vacuum. Conductance and pumping speed. Rotary oil pump. Mercurt diffusion pump. Measurement of high vacuum. McLeod, Penning and Pirani gauges. Leak detector. 6

6. Particle Accelerators:

Linear Accererators, Simple theory, Usefulness, Cyclotron, basic theory, synchrotron. Electron storage ring (ESR).

8

7. Nuclear Detectors:

GM counter, semiconductor detector for charge particles and γ -rays, phodiodes, charge coupled device camera for detection of em Radiation.

6.

Tutorials on Problems and discussions

5

Unit VI B (No of Lectures: 65)

Group C: SOLID STATE PHYSICS (38 LECTURE PERIODS)

1. Crystal Structure:

Crystalline and Amorphous solids, translational symmetry. Elementary idea about crystal structure, lattice and bases, unit cell, **reciprocal lattice**, fundamental types of lattices, Miller indices, simple cubic, f.c.c. and b.c.c. lattices, **Laue and Bragg equation-simple deduction.**

6

2. Structure of Solids:

Different types of binding, ionic, covalent, metallic and van der Wall's. Band theory of solids, Kronig-Penny Model, energy band structure. Electrons and holes. conductors, semiconductors and insulators. Free electron theory of metals, effective mass, drift current, mobility and conductivity, Wiedemann-Franz law, Hall effect in metals. 12

3 Dielectric properties of materials:

Electronic, ionic and dipolar polarizability, local fields, induced and oriented polarization-molecular field in dielectric, Clasius-Mosotti relation. 5

4 Magnetic Properties of materials:

Dia, para and ferromagnetic properties of solids, Langevin's theory of diamagnetism, Classical and quantum theory of paramagnetism, Curie's law, spontaneous magnetization and domain structure, spontaneous magnetization and its temperature dependence. Curie-Weiss law, explanation of hysteresis.15

GROUP D: LASER AND FIBRE OPTICS (22 Lecture Periods)

1. Laser: Principle of Laser action, Population Inversion, Einstein's A and B coefficients, feedback of energy in a resonator, 3 level and 4 level systems, Helium-Neon and Semiconductor Lasers. Application of Laser. Principle of holography (basic

principle), isotope separation. Precision measurements (frequency and distance)

12

2. Fibre Optics: Optical fibre, core and cladding, total internal reflection, optical fibre as waveguide, step index and graded index fibre, communication through optical fibres, energy loss, band width and channel capacity for a typical system, attenuation and dispersion, splicing and couplers, Fibre optic sensors.

10

Tutorials on Problems and discussions

5

Paper VI

Unit VIIA (No of Lectures: 65)

[The setting of questions from different groups is as follows;
Question No 1 will be of short answer type carrying 2 marks each. 5 out of 8
questions distributed uniformly over the entire syllabus are to be answered.
Question Nos 2, 3, 4, 5,6 and 7: 6 Questions are to be set, 4 to be answered.]

ELECTRONICS II (60 LECTURE PERIODS)

1. Field Effect Transistors (FET):
JFET structure, JFET operation, static, drain and transfer characteristics, pinch off
Common source FET amplifier, small signal low frequency equivalent circuit-
voltage gain. MOSFET-enhancement and depletion type, principle of
operation, drain and transfer characteristics, idea of CMOS 8
2. Feedback in amplifier:
Principle of feedback, negative and positive feedback, voltage and current feedback,
advantages of negative feedback. 5
3. Multistage Amplifier:
Idea of multistage amplifiers, frequency response of a two stage R-C coupled
amplifier. Gain and bandwidth. Class A, B, AB and C amplifiers. Analysis of a single
tuned voltage amplifier. Operating points, principle of operation of power amplifiers.
Class B push pull amplifier. 8
4. Oscillators:
Barkhausen condition of sustained oscillation, sinusoidal oscillators-Hartley, Colpitt,
Wien bridge and crystal oscillators. Relaxation Oscillators-astable, monostable and
bistable multivibrators. 8
5. Operational Amplifiers:
Ideal OP-AMP characteristics, concept of virtual ground, Definition of important
terms in connection with OP-AMP: Offset voltage, CMRR, slew rate. Application of
OP-AMP: Design of Inverting and non-inverting amplifier, Differential amplifier,
Schmitt trigger, Integrator and Differentiator, comparator and function generator and
half wave rectifier.. Solution of linear algebraic equation using OP-AMP. 8
6. Combinational Logic:
Half adder, full adder, digital comparator, decoder, encoder (ROM), multiplexer.
Digital to analog and Analog to digital conversions 6
7. Sequential Logic:
Flip flops-RS, D, JK, edge triggering and clocked operations. Idea about the
5
construction of shift registers and counters.
8. Communication Principles:
Modulation - elementary theory of Amplitude Modulation (AM) and Frequency
Modulation (FM) modulation index. Detection of AM and FM waves. 6
9. Electronic Measuring Instruments: Electronic multimeter; digital voltmeter;
CRO-cathod ray tube-electron emission mechanism, brightness and focussing
control, fluorescent of voltage frequency and phase with CRO. 6
Tutorials on Problems and discussions 5

BOOKS

Mechanics

1. Classical Mechanics – J. Goldstein (Narosa Publ. House).

2. **Classical Mechanics - R. G. Takwale and P. S. Puranik (Tata Mc Graw Hill).**
3. Classical Mechanics – A. K. Roychaudhuri (O. U. P., Calcutta).
4. **Berkeley Physics Course, Vol – I (Mechanics) (Mc Graw Hill).**

Theory of Relativity

1. **Introduction to Special Theory of Relativity - R. Resnick (Wiley Eastern).**
2. Special Theory of Relativity - A. P. French (ELBS).
3. Apekshikata Tattwa - Sriranjana Bandyopadhyay (W. B. S. B. B.)
4. **The Feynman Lectures on Physics, Vol I (Addison – Wesley).**

Statistical Physics

1. **Statistical Physics, F. Mandle (ELBS).**
2. **Fundamentals of Statistical and Thermal Physics, F. Reif, (Mc Graw Hill).**

Quantum Mechanics and Atomic Physics

1. Quantum Mechanics – J. L. Powell and B. Crasemann, (Oxford, Delhi).
2. Quantum Mechanics – F. Schwabl (Narosa).
3. **Quantum Mechanics – A. K. Ghatak and S. Lokenathan (Macmillan, Delhi).**
4. Introductory Quantum Mechanics - S. N. Ghoshal (Calcutta Book House).
5. **A Textbook of Quantum Mechanics – P. M. Mathews and K. Venkatesan (Tata Mc Graw Hill).**

Nuclear and Particle Physics

1. Nuclear Physics – Cottingham and Greenwood (Cambridge University Press).
2. Concepts of Nuclear Physics – R. Cohen (Tata-Mc Graw Hill).
3. Paramanu o Kendrak Gathan Parichay – S. N. Ghoshal (WBSBB).
4. Atomic and Nuclear Physics – S. N. Ghoshal (S. Chand).
5. Nuclear Physics – S. B. Patel (New Age).
6. Nuclei and Particles – E. Segre (Benjamin).

Instrumental Methods

1. Introduction to Physics Applications edited by P. N. Ghosh (Calcutta University).
2. Nuclei and Particles – E. Segre (Benjamin).
3. Atomic and Nuclear Physics – S. N. Ghosal (S. Chand).

Electronics II

1. Integrated Electronics – J. Millman and C. C. Halkias (Mc Graw Hill).
2. Electronic Fundamentals and Applications – D. Chattopadhyay and P. C. Rakshit.
3. Digital Logic and Computer Design – M. Moris Mano, (PHI (Pvt.) Ltd.).
4. Microprocessor Architecture, Programming and Application – R. A. Gaonkar (Willey Eastern Ltd.).
5. Introduction to Microprocessor – Software, Hardware Programming – Laventhal (PHI Ltd.).
6. Electronics – R.K. Kar ().

Laser and Fibre Optics

1. **Laser Principles and Applications – A. K. Ghatak and K. Tyagrajan (Tata – Mc Graw Hill).**
2. Optics and Atomic Physics – B. P. Khandelwal (Sibal Agarwala).
3. Optical Electronic – A. K. Ghatak and K. Tyagrajan.
4. Introduction to Fibre Optics - R. A. Shotwell (EEE, Prentice Hall).

Solid State

1. Introduction to Solid State Physics, C. Kittel (Wiley Eastern).
2. Solid State Physics - D. L. Bhattacharyya (Calcutta Book House).

PRACTICAL PAPERS

Marks Distribution

Part- I:- Paper -IIB - 50.

Part- II:- Paper -IVB - 50,

Part-III:- Paper -VIIB - 50, Paper -VIIIA – 50, Paper -VIIIB - 50 :Total=150.

Laboratory Teaching Classes

One laboratory class (of 3 periods duration) per week should be devoted to teach the following topics during the first year. These lectures should be taken in laboratory and should

be of interactive type so that students also participate in the learning process.

As the course on computer will be taught in early months of first year, students will get sufficient time to use computer in practical classes. The programmes and the results should be collected in the form of a note book and that is to be submitted at the time of practical examination of paper-VII. This Computer Note Book [CNB] must be signed by the class teacher. During the practical examination of Paper VIIB, the examiners will check the CNB

and ask questions on the report presented by the students in their CNB.

Laboratory Teaching

1. Demonstration lectures on use of vernier, micrometer, spherometer, barometer, common balance, etc.; graph plotting -1 Lab-class
- 2.(i) Basic ideas of Probability & Statistics
(ii) Error analysis, significant figures, limits of accuracy of an Experiment-associated choice of equipments. -3 Lab-class
3. Measuring instruments (e.g. Galvanometer) to be used in the laboratory -2 Lab-class
4. Computer-Fundamentals and Programing in C or Fortran -6 Lab-class

Total = 12 Lab-class

In practical classes all data should be recorded directly in the Laboratory Note Book and signed regularly by the attending teachers. This Note Book should be submitted

at the time of final practical examination. No separate fair L.N.B. need be maintained.

PART – I PRACTICAL

PAPER – IIB

Total Marks 50 Time – 4 hours

Distribution of Marks : LNB-5, VIVA-10, Experiment-35; Total = 50.

1. Determination of Young's modulus of the material of a beam by the method of flexure.
2. Determination of moment of inertia of metallic cylinder / rectangular bar about an axis passing through its C.G. and to determine the rigidity modulus of the material of the suspension wire.
3. Determination of the coefficient of viscosity of water by Poiseuille's method.
4. To estimate the temperature of a torch bulb filament from resistance measurement and to verify Stefan's law.
5. Determination of thermal conductivity of a bad conductor of heat by Lee's and Chorlton's method.
6. To calibrate a thermocouple with the help of potentiometer and hence (i) to measure the thermoelectric power at a particular temperature, (ii) to measure an unknown temperature.
7. (a) Determination of the focal length of a concave lens by combination method
(b) To measure the radii of curvature of both the lenses by spherometer and hence to determine the refractive index of the material of the lenses.
(c) To Determine the refractive index of a liquid using a convex lens and a plane mirror.
8. To study the nature of dependence of refractive index (i) of the material of a

prism on the wavelength (λ) of the light used. Hence

(i) To verify the Cauchy relation $n(\lambda) = A + B/\lambda^2$ and to estimate the values of A and B.

(ii) To plot a graph between $dn/d\lambda$ vs $1/\lambda$.

9. To study the nature of dependence of dipolar field of a short bar magnet on distance with the help of a deflection magnetometer and to determine the horizontal component of the Earth's magnetic field.

Part II Practical

Paper IVB

Total Marks 50 Time – 6 hours

Distribution of Marks : LNB-5, VIVA-10, Experiment-35; Total = 50

1. To calibrate a polarimeter and hence to determine the concentration of sugar solution.
2. To determine the wave length of a monochromatic light by Newton's ring method.
3. Measurement of the slit width and the separation between the slits of a double slit by observing the diffraction and interference fringes.
4. To study the variation of mutual inductance of a given pair of co-axial coils by using a ballistic galvanometer.
5. To measure the voltage across the inductance (L), capacitance (C) and resistance(R) of a series LCR circuit for different frequencies of the input voltage with the help of an A.C millivoltmeter. Hence (i) to study the variation of impedance of L and C with frequency of the impressed voltage, (ii) to draw the resonance curve of the series LCR circuit and to determine the Q-factor of the circuit.
6. Verification of Thevenin, Norton and Maximum power transfer theorems using a resistive Wheatstone bridge, d.c. source and d.c. meters.
7. To calibrate a Hall probe with the help of a Ballistic Galvanometer and use the probe to study the variation of magnetic field of an electromagnet with (i) the magnetizing current and (ii) the distance between two pole-pieces.
8. To verify the truth tables of OR, AND & NOT gates using discrete components and that of NOR, NAND & Ex-OR gates using IC's. To establish NAND/NOR gates as universal gate.
To verify De Morgan's theorems.
9. To draw the forward and reverse characteristics of a zener diode and to study its regulation characteristics. Estimate the a.c. resistances of the diode for different diode currents in both forward and reverse bias conditions.
10. To draw the regulation characteristics of a bridge rectifier (i) without using any filter and (ii) using a filter. Determine the ripple factor in both cases by measuring the ripple voltage with the help of an ac meter.
11. To draw the output characteristics of a transistor in C-E and C-B mode.

PART – III PRACTICAL

Paper VIIB

Distribution of Marks: CNB-10 , VIVA: 10 Computer Programming: 15 +15
Total 50

A student has to write , compile and run two programs in the examination. programmes using C/FORTRAN:

A student should learn the following aspects of the programming language:
Constants and Variables, Controls, Standard I/O, 1-D and 2-D array, user defined functions, (subroutines), global and local variables. File I/O, Students are expected to use functions and subroutines in their program.

1. Sorting (bubble sort, selection sort)
2. Reading N numbers. To find their mean, median mode and central moments.

3. To sum a finite series, term by term.
4. To sum an infinite series, term by term with specified accuracy.
5. To find Roots of simple algebraic equations (Newton Raphson & bisection)
6. Integration by trapezoidal rule and Simpson's rule and Monte Carlo random dot.
7. Least square fitting (Generation of synthetic data according to a given function and parameter extraction by fitting . Visualization of the data and the fitted curve using any plotting softwares like gnuplot, xmgrace, python-matplotlib, microcal origin).
8. Matrix manipulation (addition, subtraction, multiplication, trace, transpose).

Note:

Target is to inculcate the ability to write programs by the students themselves. Each year problem sets will be different for each day of examination.

Paper-VIIIA

Total Marks 50 Time 6 hours

Distribution of Marks : LNB-5, VIVA-10, Experiment-35 ;Total=50.

1. To determine the wavelength of a monochromatic light by Fresnel's biprism
- 2.(a) To find the number of lines per centimeter of the transmission grating and hence to measure the wavelength of an unknown spectral line.
(b)To measure the wavelength difference between D1 and D2 lines of sodium using a slit of adjustable width.
3. Verification of Fresnel's equation of reflection of electromagnetic waves with the help of prism and two polaroids.
4. To draw the B-H loop for the material of an anchor ring by ballistic galvanometer and to estimate the energy loss per cycle of magnetisation.
5. (a) To measure the self inductance of two coils by Anderson bridge .To find the total inductance of the above two coils connected in series and hence estimate the coefficient of coupling between the coils.
(b)To study the variation of inductance of two coils in series with angle between their planes by Anderson bridge.
6. To determine Fourier spectrum of (i) square, (ii) triangular and (iii) half sinusoidal waveform by C.R.O.
7. To study the temperature dependence of reverse saturation current in a junction diode and hence to determine the band gap of semiconductor.
8. To study the diffraction pattern of a crossed grating with the help of a LASER source.

Paper-VIIIB

Total Marks 50 Time 6 hours

Part-B. Electronics Experiment : LNB-5, VIVA-10, Expt-35; Total = 50

1. To construct a regulated power supply on a bread board, using
 - (i) a power transistor as pass element,
 - (ii) a second transistor as a feedback amplifier and
 - (iii) a zener diode as a reference voltage source and to study its operational characteristics.
2. (a) To draw the output characteristics of a silicon transistor and to calculate h_{oe} and h_{fe} .
(b) To determine the hybrid parameters of a transistor using a.c. source.
3. To construct and study the frequency response of a voltage amplifier using a transistor in CE mode and to find its bandwidth.
4. To design and test the following circuits using an OPAMP
 - (i) Inverting and non inverting amplifier
 - (ii) Differential amplifier

(iii) Schmitt trigger

(iv) Integrator

(v) Differentiator.

5. (a) To verify various Boolean expressions using IC-gates.

(b) To design half- and full-adder circuits using basic gates and to verify the respective Truth tables.

(c) To design and to verify the following flip-flop operations using basic gates:

(i) S-R , (ii) J-K , (iii) D.

6. To construct Wein Bridge oscillator on a bread board using OPAMP and to study the wave form of the oscillator and calibrate it using CRO.

7 To design and fabricate a temperature controller and to study its performance characteristics.

USE OF PREFABRICATED CIRCUIT PROHIBITED

West Bengal State University

Syllabus

B.Sc. (General) - PHYSICS

Paper I

Group A : Mechanics and General Properties of Matter

50 Lectures

1. Dimensions of Physical Quantities : Principle of dimensional homogeneity
2. Vectors : Axial and polar vectors, dot product and cross product, scalar triple product and vector triple product. Scalar and vector fields - gradient, divergence and curl, statement of divergence theorem, statement of Stokes' theorem.
3. Mechanics of a Particle : (a) Newton's laws of motion, principle of conservation of linear momentum, time and path integral of force, conservative force field, concept of potential, conservation of total energy, equation of motion of a system with variable mass. (b) Rotational motion, angular velocity, angular acceleration, angular momentum, torque, fundamental equation of rotational motion, principle of conservation of angular momentum, radial and cross-radial acceleration.
4. Dynamics of Rigid Bodies : Moment of inertia and radius of gyration - their physical significance, theorems of parallel and perpendicular axes, rotational kinetic energy, calculation of moment of inertia for some simple symmetric systems.
5. Gravitation : Gravitational potential and intensity due to thin uniform spherical shell and solid sphere, escape velocity.
6. Elasticity : Elastic moduli for isotropic homogeneous bodies and their interrelations, torsion of a cylinder, internal bending moment, cantilever, simply supported light beam with concentrated load at the centre, strain energy.
7. Viscosity : Streamline and turbulent motion, Poiseuille's formula, critical velocity, Reynolds number, Bernoulli's theorem, Stokes' law (statement only).
8. Surface Tension : Surface tension and surface energy, molecular theory, angle of contact, elevation and depression of liquid columns in a capillary tube, excess pressure in a spherical bubble and spherical drop.

Group B : Heat and Thermodynamics

30 Lectures

9. Kinetic Theory of Gases : Perfect gas, pressure exerted by it, Maxwell's law of distribution of molecular velocities (statement only) - rms, mean and most probable velocities, degrees of freedom, principle of equipartition of energy - application in simple cases. Equation of state - defects of ideal gas equation, van der Waals equation (qualitative study), critical constants.

10. Thermal Conductivity : Steady state and variable state, thermal and thermometric conductivity, Fourier equation for one-dimensional heat flow and its solution, Ingen Hausz's experiment, cylindrical flow of heat.

11, Thermodynamics : Basic concepts (equilibrium state, state function, exact and inexact differential), internal energy as state function. First law of thermodynamics and its applications. Isothermal and adiabatic changes - relations, indicator diagrams. Reversible and irreversible processes, cyclic processes, second law of thermodynamics, Carnot cycle and its efficiency, entropy and its physical interpretation.

12. Radiation : Nature of radiant heat, emissive and absorptive power, Kirchhoff's law, black body radiation, Stefan's law, Newton's law of cooling, Planck's distribution law (only statement), Wien's displacement law, pyrometer.

Group C : Vibration - Waves and Acoustics

20 Lectures

13. Simple Harmonic Motion : Differential equation and its solution.

14. Superposition of Simple Harmonic Motion : Analytical treatment, Lissajous figures, natural, damped and forced vibration, resonance, sharpness of resonance.

15. Differential Equation of Wave Motion : Plane progressive wave - energy and intensity. Bel, decibel and phon. Superposition of waves, stationary wave, beats. Velocity of longitudinal wave in solid and in gas, velocity of transverse wave in string, Doppler effect.

Group D : Electricity I

15 Lectures

(Use of Vectors are to be encouraged. Only SI units are to be used)

16. Electrostatics: Quantization of charge, Milikan's oil drop experiments. Coulomb's law, intensity and potential - example of point charge, Gauss' theorem- simple applications, potential and field due to an electric dipole, mechanical force on the surface of a charged conductor.

17. Dielectric medium, polarization, electric displacement. Capacitor: parallel-plates and cylindrical, energy stored in parallel plate capacitor.

18. Steady Current: Network analysis - Kirchoff's laws, Thevenin and Norton's theorem, Wheatstone bridge, potentiometer.

19. Thermoelectricity : Seebeck, Peltier, and Thomson effects, laws of thermoelectricity, thermoelectric curve — neutral and inversion temperature, thermoelectric power.

Paper II
(Only SI units are to be used)
Group A: Geometrical Optics

15 Lectures

1. Geometrical Optics: Fermat's Principle, laws of reflection and refraction at a plane surface, refraction at a spherical surface, lens formula. Combination of thin lenses - equivalent focal length.
2. Dispersion and dispersive power, chromatic aberration and its remedy, different types of Seidel aberration (qualitative) and their remedy. Eye-piece : Ramsden and Huygen's type. Astronomical telescope and compound microscope - their magnifying power.

Group B : Physical Optics

20 lectures

3. Light as an electromagnetic wave, Full electromagnetic spectrum, properties of electromagnetic waves, Huygens' principle - explanation of the laws of reflection and refraction
4. Interference of light: Young's experiment, intensity distribution, conditions of interference, interference in thin films, Newton's ring.
5. Diffraction: Fresnel and Fraunhofer class, Fresnel's half-period zones- zone plate. Fraunhofer diffraction due to a single slit and plane transmission grating (elementary theory)- resolving power.
6. Polarization: Different states of polarization, Brewster's law, double refraction, retardation plate, polaroid, optical activity.

Group C : Electricity II

45 Lectures

7. Magnetic effect of current: Biot Savart's law, Ampere's circuital law (statement only), magnetic field due to a straight conductor, circular coil, solenoid, endless solenoid, Magnetic field due to a small current loop - concept of magnetic dipole, Ampere's equivalence theorem.
8. Lorentz force, force on a current carrying conductor in a magnetic field. Torque on rectangular current loop in a uniform magnetic field.
9. Magnetic materials: intensity of magnetization, relation between B, H and M - illustration in the case of bar magnet, magnetic susceptibility - dia, para and ferromagnetic materials - statement of Curie's law. Hysteresis in a ferromagnetic material - hysteresis loss.
10. Electromagnetic induction: self and mutual inductances in simple cases, energy stored in inductor.
11. Varying currents: growth and decay of currents in L-R circuit; charging and discharging of capacitor in C-R circuit.

12. Alternating current: mean and r.m.s. Values of current and emf with sinusoidal wave form; LR, CR and series LCR circuits, reactance, impedance, phase-angle, power dissipation in AC circuit — power factor, vector diagram, resonance in a series LCR circuit, Q-factor, principle of ideal transformer.

Group D : Electronics

15 lectures

13. p-n junction diode — bridge rectifier — capacitance input filter, Zener diode — voltage regulator, Transistors — α and β parameters and their interrelations; output characteristics in CE mode, single stage CE amplifier — approximate expressions of current and voltage gain with the help of 'Load Line'.

14. Digital circuits : binary systems, binary numbers. Decimal to binary and reverse conversions; binary addition and subtraction.

15. Logic gates : OR, AND, NOT gates — truth tables.
Statement of de Morgan's theorems, NOR and NAND as universal gates.

Group E : Modern Physics

30 Lectures

16. Postulates of the Special Theory of Relativity, Lorentz transformation equations (statement only)- formulae of (i) Length contraction; (ii) Time dilation; (iii) Velocity addition; (iv) Mass variation, and (v) Mass-energy equivalence.

17. Quantum theory of radiation : Planck's concept — radiation formula (statement only) — qualitative discussion of photo-electric effect and Compton effect in support of quantum theory; Raman effect.

18. Bohr's theory of hydrogen spectra — concept of quantum number, Pauli exclusion principle.

19. Crystalline nature of solid, diffraction of X-ray, Bragg's law; Moseley's law — explanation from Bohr's theory.

20. Wave nature of material particles, wave-particle duality, wavelength of de Broglie waves, Heisenberg uncertainty principle, Schroedinger equation, particle in a one-dimensional infinite well — energy eigenvalues, wavefunction and its probabilistic interpretation.

21. Binding energy of nucleus — binding energy curve and stability; Radioactivity — successive disintegration — radioactive equilibrium, radioactive dating, radioisotopes and their uses, nuclear transmutation — fission and fusion — nuclear reactor.

Paper – III (Practical.)

Full Marks 100

Continuous Assessment : 80

(Attendance : 40, Class Performance: 30, L.N.B.: 10)

End Semester Viva: 20

Group A

1. Determination of modulus of rigidity of the material of a wire by dynamical method.
2. Determination of moment of inertia of a metallic cylinder – rectangular bar about an axis passing through its C. G.
3. Determination of the coefficient of linear expansion of a metallic rod using an optical lever.
4. Determination of the pressure coefficient of air.
5. Determination of the refractive index of the material of a lens and that on a liquid using a convex lens and a plane mirror.
6. Determination of the focal length of a concave lens by auxiliary lens method or by combination method.
7. Determination of the frequency of a tuning fork with the help of a sonometer (either by using formula or by n-e curve).
8. Determination of the horizontal component of the Earth's magnetic field using a deflection and an oscillation magnetometer.
9. Determination of the resistance of a suspended coil galvanometer by the method of half-deflection and to calculate the figure of merit of the galvanometer (using the same data).
10. To draw I – V characteristics of (i) resistor and (ii) a P-N junction diode in forward biased condition . (Plot both the characteristic curves on the same graph paper. Estimate from the graphs (i) the resistance of the resistor and (ii) the dynamic resistance of the diode for three different currents. One current should correspond to the intersecting point of the two curves.

Group B

Atleast ten experiments must be performed

1. Determination of Young's modulus of the material of a beam by the method of flexure. (single length only)
2. Determination of the coefficient of viscosity of water by Poiseuille's method. (the diameter of the capillary tube to be measured by the travelling vernier microscope)
3. Determination of the surface tension of water by capillary rise method. (Capillary tubes to be supplied)
4. Determination of the refractive index of the material of a prism by drawing $i-\alpha$ curve using spectrometer.
5. To determine the wavelength of a monochromatic light by Newton's ring method.
6. To calibrate a polarimeter and hence to determine the concentration of sugar solution.
7. Determination of the temperature coefficient of the material of a coil using a Carey-foster bridge. (3 sets of reading for both temperatures)

(Resistance per unit length of the bridge wire has to be measured)

8. To draw the e-t curve of a thermocouple using potentiometer and dead-beat galvanometer, and

hence to find out the thermo-electric power of the couple at a specified temperature. (Resistance of the potentiometer wire has to be measured using a P. O. box).

9. To draw the I-V characteristics of the bridge rectifier (i) without using any filter and (ii) using a capacitance input filter. (The bridge rectifier should be fabricated by the student using four diodes. % voltage regulations has to be calculated from each graph at a specified load current.)

10. To draw the reverse characteristics of a Zener diode and to study its voltage regulation characteristics using a variable load. (Breakdown region should be identified in the graph. % voltage regulation has to be calculated for two load currents.)

11. To draw the output characteristics of a transistor in CE configuration (for atleast five base currents) and hence to determine the A. C. current gain from the active region of the characteristics.

12. To verify the truth tables of OR and AND logic gates using diodes. To construct AND, OR and NOT gates from NOR/NAND IC gates on breadboard.

13. To measure the voltage across the inductance (L) , capacitance (C) and resistance (R) of a series LCR circuit for different frequencies of the input voltage with the help of a A. C. milli-voltmeter (or suitable digital meter). Hence to study the variation of impedance of L and C with frequency of the impressed voltage. (value of R should be known)

OR

14. To draw the resonance curve of a series LCR circuit and hence to determine the Q-factor of the circuit.

N. B. All data should be recorded directly in the Laboratory Note book and signed regularly by the attending teachers. This Note Book should be submitted at the time of final practical examination. No separate fair L. N. B. need be maintained.

Paper IV

Mechanics and thermodynamics: Production and measurement of high vacuum : Rotary and diffusion pump, McLeod, Pirani, and Penning gauges.(8 lectures)

Heat engines, thermal efficiency, indicated Horse-power and brake Horse-power, Otto cycle and Diesel cycle, four-stroke petrol and diesel engines, calculation of efficiency and comparison.(8 lectures)

Energy sources : Conventional energy sources: thermal power plant, relevance of Rankine cycle (qualitative discussion), steam turbine, hydro-electric power plant — basic principle. (8 lectures)

Non-conventional energy sources: solar, wind, tidal, geothermal, and biogas sources, elementary idea of production and uses.(8 lectures)

Electronics : Feedback — basic principle — positive and negative feedback, Barkhausen criterion, oscillator, OPAMP — characteristics, uses of OPAMP as amplifier, oscillator, and filter; light-emitting diodes, 7-segment display, SCR, diac and triac. (12 lectures)

Digital electronics : combinational circuits — adder and subtractor, multiplexer, demultiplexer, encoder, decoder, sequential circuits — flip-flop, D and J-K, registers and counters.(8 lectures)

Instruments : cathode-ray oscilloscope, digital multimeter, L and C measurements.(5 lectures)

Communications : Propagation of electromagnetic waves in atmosphere, various layers of atmosphere — ground and sky waves.(4 lectures)

Transmission of electromagnetic waves — amplitude and frequency modulation, calculation of power in amplitude modulation, sideband generation in frequency modulated wave; demodulation — linear diode detector, detection of FM waves, signal-to-noise ratio.(10 lectures)

Transmission through media : coaxial cables, optical fibre — cladding, energy loss, band width and channel capacity, information carrying capacity of lightwaves (qualitative); satellite communication, microwave link — modem and internet.(6 lectures)

Computer :

Computer hardware: basic building blocks, central processing units; memory, hard disk, RAM, ROM, floppy, CD-ROM, memory units — bits and bytes, input-output devices. Computer software : Operating systems — DOS, Unix, Windows.(7 lectures)

Programming in C : basic structure, character set, keywords, identifiers, constants, variables, type declaration, operators — arithmetic, relational, logical, assignment, increment, decrement and operator precedence and associativity, arithmetic expression, evaluation and type conversion, character I/O, escape sequence and formatted I/O, branching and looping, if, if-else, while, do-while, for, arrays (one and two dimensional).(8 lectures)

OR

Programming in Fortran : constants, variables, arrays, dimension-type statements, arithmetic expressions, input and output statements, control statements — jumping, branching, and looping.

Tutorial classes on Programming in C or Fortran.(8 lectures)

Total lecture periods : 100

(A college will have the option of teaching either of the two programming languages)

Part IV B Practical Paper

Total Marks 30

Continuous Assessment: 24 End Semester Viva 6

All the experiments are project type

1. To convert a given an ammeter into a voltmeter and a given a voltmeter into an ammeter. To calibrate the instrument and to measure the internal resistance in each case.
2. To construct an adjustable voltage power source using IC and to study its regulation.
3. To measure the internal resistance of an analog voltmeter and to increase its internal resistance by using an OPAMP.
4. To use OPAMP as inverting, non-inverting, differential amplifier and as an adder.
5. To calibrate a given temperature sensor and to use the sensor to control the temperature of a heat bath.
6. To develop a photo sensor using a photo transistor followed by an amplifier and to use the same to control the switching of a bulb.
7. To familiarize with the operating system and to solve simple problems by programming in C or Fortran as per theoretical syllabus.

West Bengal State University

SYLLABUS, QUESTION PATTERN AND DISTRIBUTION OF MARKS

B.A. (General) in Sanskrit

PART I (GENERAL)

Paper I (Full Marks: 100)

Unit I: Chandomañjarī: Marks 10

Definition and Illustration 2x3=6

Scanning 2x2=4

Recommended Books:

Chandomañjarī: Anil Chandra Basu

Chandomañjarī: Gurunath Vidyanidhi

Chandomañjarī: Yudhisthir Gop

Chandomañjarī: Dilip Kummur Kanjilal

II: Declension and Conjugation: Marks 10

Declension :5 (*nara, sādhu, piṭr, latā, mati, madhu, naḍi, dhenu, badhū, phala, vāri, marut, asmad, yuṣmad, tad, yad*)

Conjugation:5 (*pat, pac, gam, kṛ, bhū, ad, as, han, hu, div, tan, tud, su, kṛi, sev, cur*)

Recommended Books:

Samagra-Vyākaraṇa-Kaumudī: Haralal Bandyopadhyay

Unit III: a) Svapnavāsavadatta: Marks 25

One broad question 12

Translation 6

Or two short notes 2x3=6

Explanation 7

Recommended Books:

Svapnavāsavadatta: Shanti Bandyopadhyay

Svapnavāsavadatta: Anil Chandra Basu

Svapnavāsavadatta: Yadupati Tripathi

Svapnavāsavadatta: Sheshraj Sharma

b) Kādambarī: Śukanāsopadeśa: Marks 15

One broad question 10

Translation of one passage 5

Recommended Books:

Kādambarī(Śukanāsopadeśa): Amal Kumar Bhattacharya

Unit IV: Paniniyan Grammar: Kāraka and Sandhi: Marks 15

Kāraka 10

Sandhi 5

Recommended Books:

Pāṇiniya Śabdaśāstra: Satyanarayan Chakraborty

**Unit V: a) Translation from English or Bengali into Sanskrit: Marks 10
b) Comprehension: Marks 15**

Recommended Books:

Pāṇiniyam: Lahiri and Shastri

Samskr̥ta-Nibandhamālā: Sumita Basu

PART II GENERAL)

PAPER II (Full Marks 100)

Unit I: Abhijñāna-Śakuntala: Marks 40

One broad question 12

Four short notes 4x2=8

Translation (any two) 2x6=12

Explanation 8

Recommended Books:

Abhijñāna-Śakuntala: Anil Chandra Basu

Abhijñāna-Śakuntala: Satyanarayan Chakraborty

Abhijñāna-Śakuntala: Pranab Kumar Datta

Abhijñāna-Śakuntala: Ramendra Mohan Bose

Unit II: Raghuvamśa: Canto I: Marks 30

One broad question 12

Two short notes 2x2=4

Translation 6

Explanation 8

Unit III: Pāṇiniyan Grammar: Kṛt, Taddhita and Samāsa: Marks 20

Kṛt Pratyaya 6

Taddhita Pratyaya 6

Samāsa 8

Recommended Books:

Pāṇiniyam: Lahiri & Shastri

Pāṇiniya Śabdaśāstra: Satyanarayan Chakraborty

Unit IV: Translation from Sanskrit to English or Bengali: Marks 10

Recommended Books:

Samagra-Vyākaraṇa-Kaumudī: Haralal Bandyopadhyay

PAPER III (FULL MARKS: 100)

Unit I: History of Classical Sanskrit Literature: Marks 40

Two broad questions 2x15=30

Two short notes 2x5=10

Recommended Books:

Saṃskṛta Sāhityer Ruparekhā: Biman Chandra Bhattacharya
Saṃskṛta Sāhityer Itihās: Dhirendranath Bandyopadhyay
Saṃskṛta Sāhityer Itihās: Jahnabi Charan Bhowmik
Saṃskṛta Sāhityer Itihās: Yadupati Triparhi
Saṃskṛta Sāhityer Itihās: Debkumar Das

Unit II: Īṣopaniṣad: Marks 10

Translation (any one) 4

Explanation (any one) 6

Recommended Books:

Īṣopaniṣad: Sitanath Goswami
Īṣopaniṣad: Yadupati Tripathi
Īṣopaniṣad: Ashok Kumar Bandyopadhyay

Unit III: Rāmāyaṇa: Bālakāṇḍa (Cantos 1 & 2): Marks 25

One broad question 12

Translation (any one) 5

Explanation (any one) 8

Or short questions (any four) 4x2=8

Recommended Books:

Vālmikīyaṃ Rāmāyaṇam (1st and 2nd Cantos): Jayashri Chattopadhyay

Unit IV: Manusmṛhitā (Chapter VII): Marks 25

One broad question 12

Translation (any one) 5

Explanation (any one) 8

Or short notes (any four) 4x2=8

Or short question (any four) 4x2=8

Recommended Books:

Manusmṛhitā (Chapter VII): Annadashankar Pahari
Manusmṛhitā (Chapter VII): Ashok Kumar Bandyopadhyay
Manusmṛhitā (Chapter VII): Anil Chandra Basu
Manusmṛhitā (Chapter VII): Ashoknath Shastri

PART III (GENERAL)

PAPER IV (FULL MARKS: 100)

Unit I: Kāvyaṇḍa: Ullāsa X: Marks 25

(Selected Alaṅkāras: Upamā, Rūpaka, Utprekṣā, Samāsokti, Apahnuti, Vibhāvanā,

Viśeṣokti, Drṣṭānta, Nidarṣanā, Arthāntaranyāsa)

Definition and Illustration (any three) 3x5=15

Selection (any two) 2x5=10

Recommended Books:

Kāvyaṇḍa: Bijoya Goswami

Unit II: Mahābhārata: Udyogaparvan (Chapter 33, Slokas 16-123): Marks 35

One broad question 12

Explanation (any one) 8

Or Translation (any two) 2x4=8

Short questions (any five) 5x3=15

Unit III: General acquaintance with Sanskrit works on Social, Scientific and

Technical Literature: Marks: 25

One broad question 15

Two short notes 2x5=10

Recommended Books:

Prācīn Bhārater Saṃskṛta Sāhitya: Uday Bandyopadhyay

Unit IV: Composition in Sanskrit: Marks 15



WEST BENGAL STATE UNIVERSITY

UNDERGRADUATE SYLLABUS FOR SOCIOLOGY

B.A. 3 Year General Course

Part I

Paper I: *Basic Concepts in Sociology*

Part II

Paper II: *Sociological Thought*

Paper III: *Society in India*

Part III

Paper IV: *Social Problems in India*

Scheme of Examination

Sociology B.A. 3 Year General

1. All the papers will have full marks of 100; and will have theoretical examination at the end of each part with full marks of 100;
2. Each Module in each paper will have 25 Marks
3. Each Question paper will be divided into five groups, four (A, B, C, D) groups in consonance with the Modules, and one (E) group on full paper;
4. There will be two long questions in each group (A, B, C, D) out of which one has to be answered (1000 words) from each group with 15 marks each;
5. There will be two short questions in each group (A, B, C, D) out of which one have to be answered (400 words) from each group with 05 marks each;
6. In the fifth group (E), there will be 15 very short questions from the full paper out of which 10 have to be answered (50 words) with 02 marks each
7. Abrogation of the above prescribed format while answering (group A, B, C, D), the last answer(s) will not be evaluated;
8. Answer beyond the limit prescribed while answering (group E), the last answer(s) will not be evaluate.

SOCIOLOGY GENERAL (Part I)

PAPER – I

TITLE *Basic Concepts in Sociology*

DESCRIPTION This paper is introductory in nature, and is intended to acquaint the students with sociology as a social science and the distinctiveness of its approach among the social sciences.

REQUIREMENTS AND EXPECTATIONS Students are expected to acquire sociological knowledge by understanding basic concepts in sociology; for students belong to other disciplines this will be an initiation to develop sociological imagination and to look beyond their immediate surrounding.

REQUIRED READINGS

1. Sociology: A Down-to-Earth Approach: James M. Henslin, Pearson; 11th edition 2011
2. An Introduction to Sociology: Ken Browne, 3rd edition, Polity, 2005
3. Contemporary Sociology: An Introduction to Concepts and Theory, M. Francis Abraham, OUP India, 2006
4. Sociology: Essays on Approach and Method: A. Beteille, OUP India 2002
5. The Concise Encyclopedia of Sociology: George Ritzer and J. Michael Ryan (Edits), Blackwell Publishing, 2011
6. Samakalin Samajtatwa: Ganguly & Moinuddin, 2nd Edition, Reena Books: Kolkata, 2013
7. Alex Inkeles: What Is Sociology, PHI Learning, 1964

COURSE OUTLINE

Module I

14 Classes

1. Sociology-The Discipline: Sociology as a science and as an interpretative discipline; impact of industrial and French Revolution on the emergence of sociology; sociology and its relationship with history, economics, political science, psychology and anthropology.
2. Scientific Study of Social Phenomena: Problem of objectivity and value neutrality; issue of measurement in social science; elements of scientific method-concepts, theory and fact, Character of sociological explanations; Understanding and meaning in sociological analysis; Micro and macro studies, Quantitative and Qualitative Method

Module II

14 Classes

3. Basic Concepts: Society, community, association, institution. Culture-components, culture change, diffusion, Cultural-lag, Cultural universals and relativism, ethnocentrism, acculturation; Social Groups-primary, secondary, Formal-Informal, In group-Out group, and reference groups; Social structure, social system, social action; Status and role, role conflict, role set; Norms and values-conformity and deviance; Law and customs; Socialization – theories and agencies; Nature-Nurture Debate, Social interaction
4. Marriage and Family: Types and forms of marriage; family-structure and function; personality and socialization; Social control; family, changing structure of family

marriage and sex roles in modern society; divorce and its implications; gender issues; role conflicts.

Module III

14 Classes

5. Social Stratification: Concepts-hierarchy, inequality and stratification; forms and functions; class-different conceptions of class; class-in-itself and class-for-itself; caste and class; caste as a class, Social justice-equal opportunity and special opportunity; positive discrimination; Social Mobility
6. Social Institutions: Economy, Polity, Education and Religion

Module IV

14 Classes

7. Social Movements: Concepts of social movements; genesis of social movements; ideology and social movement; social movement and social change; types of social movements: Peasant Movement, Women's Movement
8. Social change and Development: Continuity and change as fact and as value; directed social change; social policy and social development.

SOCIOLOGY GENERAL (Part II)

PAPER – II

TITLE *Sociological Thought*

DESCRIPTION This paper will investigate and assess the ideas of classical theorists whose works are foundational for sociology.

OUTCOMES AND EXPECTATIONS This paper is intended to familiarize the students with the social, political, economic and intellectual contexts in which sociology emerged as a distinctive discipline. Its objective is to help students gain an understanding of some of the classical contributions in sociology, and their continuing relevance to its contemporary concerns.

REQUIRED READINGS

1. Masters of Sociological Thought: Lewis A. Coser, Rawat: Jaipur, 1977
2. A Short History of Sociological Thought: Alan Swingewood, PHI Learning, 1991
3. Classical Sociological Theory: George Ritzer, McGraw Hill, 1996
4. How to Read Karl Marx: Ernest Fischer, Aakar: New Delhi 2008
5. The Communist Manifesto (21 February 1848), Karl Marx & Friedrich Engels, Echo Library, 2009
6. Tatwo O Chintarshe Samokalin Samajtatwa: Ramanuj Ganguly, 2nd Ed, Reena Books: Kolkata 2013 (in Bengali)

COURSE OUTLINE

Module I

14 Classes

1. From Social Philosophy to the Emergence of Sociology: Intellectual Context of Enlightenment, and the French and Industrial Revolutions.
2. The pioneers: Comte: positivism
3. The pioneers: Spencer: Social Darwinism, Superorganic Evolution.

Module II

14 Classes

4. The classical thinkers: Durkheim: social solidarity, and suicide
5. The classical thinkers: Weber: authority, and The Protestant Ethic and the Spirit of Capitalism
6. The classical thinkers: Marx: materialist conception of history, and class struggle

Module III

14 Classes

7. School of sociological theory: Functionalist Perspective
8. School of sociological theory: Conflict Perspective
9. School of sociological theory: Social Interaction Perspectives.

Module IV

14 Classes

10. Overview of Social thought in India
11. Overview of Approaches to the Study of Indian Society: a) Structural-Functional Approach; b) Marxist Approach; d) Macro and Micro approaches.

SOCIOLOGY GENERAL (Part II)

PAPER – III

TITLE *Society in India*

DESCRIPTION Presumably the students have familiarity with Indian society by virtue of the fact that mostly they are member of it and that they have observed and experienced some facets of it. However, this familiarity is likely to be superficial, selective and rather fragmentary. The course is aimed at rectifying these limitations by presenting a comprehensive, integrated and empirically-based profile of Indian society.

OUTCOMES AND EXPECTATIONS It is hoped that the sociological perspective on Indian society presented in this course will also enable students to gain a better understanding of their own situation and region.

REQUIRED READINGS

1. Indian Society: Institutions and Change: Rajendra K Sharma, Atlantic Publishers & Dist, 2004
2. Tradition, Rationality, and Change: Essays in Sociology of Economic Development and Social Change: M.S.A Rao, Popular Prakashan, 1972
3. Family and Social Change in Modern India: Giri Raj Gupta, Vikas Publishing House, 1976
4. Social Change in India: B Kuppaswamy, Vikas Publications, 1972
5. Samakalin Bharatiya Samaj: Ganguly & Moinuddin, PHI Learning 2008 (in Bengali)
6. Bharatiya Samaj Prasangey: Aniruddha Choudhury, Chatterjee Publishers, 2001
7. Family, Kinship and Marriage in India: Patricia Uberoi, OUP India, 1994
8. Society in India: Change & Continuity: D.G Mandelbaum, University of California Press, 1970
9. Social Stratification: Dipankar Gupta, OUP India 1991
10. Development and Civil Society: Biswajit Ghosh (Ed), Rawat, 2012
11. On Civil Society: Issues and Perspectives: N.Jayaram, Sage, 2005
12. Understanding Contemporary India: Critical Perspectives: Achin Vanaik & Rajeev Bhargava, Orient BlackSwan, 2010
13. The Furies of Indian Communalism: Religion, Modernity, and Secularization: Achin Vanaik, Verso, 1997
14. The everyday state and society in modern India: C.J. Fuller and Veronique Benei (eds), C. Hurst & Co. Publishers, 2001
15. Social Background of Indian Nationalism (6Th-Edn): A. R. Desai, Popular Prakashan, 2005
16. Tribe, Caste and Religion: R. Thaper (ed.), New Delhi: Macmillan 1977
17. Tribal India today: Nadeem Hashain, (2nd Ed.), Harnam Publications, New Delhi, 1991
18. Religion in India: T. N. Madan, OUP India, 1992
19. Contemporary India: Economy, Society, Politics: Neera Chandhoke & Praveen Priyadarshi, Pearson Education India, 2009
20. India's Agony over Religion: Gerald James Larson, Suny Press, 1995
21. Handbook of Indian Sociology: Veena Das, OUP India, 2006

COURSE OUTLINE

Module I

14 Classes

1. The structure and composition of Indian society: villages, towns, cities; rural-urban linkages; population profile and related issues.

Module II

14 Classes

2. Cultural and ethnic diversity: historically-embedded diversities in respect of language, caste, religious beliefs and practices and cultural patterns; nation-building and national identity.
3. Vulnerable Groups in India: tribes; weaker section, dalits, women and minorities

Module III

14 Classes

4. Basic institutions of Indian society: caste, kinship, family, marriage, religion; caste and class; changing dimensions.

Module IV

14 Classes

5. Convergence and integration: the sharing of material traits, cultural space, language and regional ethos; the evolution of composite cultural legacy; change and transformation in Indian society; Panchayat and Rural Development; Civil Society Organizations.

SOCIOLOGY GENERAL (Part III)

PAPER – IV

TITLE *Social Problems in India*

DESCRIPTION This paper is designed to identify and analyze some of the areas of emerging social problems in Indian society from sociological perspective. They have been classified into four sets: structural, familial, developmental and disorganizational.

REQUIREMENTS AND EXPECTATIONS It is expected the paper will allow students to go beyond the commonsense understanding of the prevailing social problems, and empower them with the understanding of their linkages and interrelationships to their socio-structural context of India.

REQUIRED READINGS

1. Contemporary Social Problems In India: Sibnath Deb, New Delhi, Anmol, 2006
2. Social Problems in India 2 Edition: Ram Ahuja, Rawat, 2011
3. Indian Social Problems: Volume 1, G. R. Madan, Allied,
4. Social problems in India: issues and perspectives: Sunil Kanta Bhattacharyya, Regency Publications, 1994
5. India's social problems: analyzing basic issues: Brij Mohan, Indian International Publications, 1972
6. Contemporary Social Problems of India: Biswanath Ghosh, Himalaya, 1995
7. Social Problems of India: G S Purushothama, Himalaya, 2001
8. Ecology and Equity: The use and Abuse of Nature in Contemporary India: Gadgil, Madhav and Guha, Ramchandra. New Delhi.: OUP, 1996
9. The Pathology of Corruption: Gill, S.S. New Delhi: Harper Collin Publishers 1998
10. Kothari, Rajani (Ed.). 1973. Caste in Indian Politics: Kothari, Rajani, Orient Blackswan, 1973
11. Region, Religion, Caste, Gender and Culture in Contemporary India: Satya Murty, T.V. New Delhi: OUP, 1996
12. Population, Poverty and Sustainable Development: S.R. Mehta (Ed.), Jaipur: Rawat 1997
13. Land, Labour and Rural Poverty: Bardhan, P. New Delhi: OUP, 1984

COURSE OUTLINE

Module I

14 Classes

1. Structure: poverty, inequality of caste and gender, disharmony – religious.

Module II

14 Classes

2. Family: dowry, domestic violence, divorce, problem of elderly

Module III

14 Classes

3. Development: regional disparities, development induced displacement, ecological degradation and environmental pollution, consumerism, crisis of values

Module IV

14 Classes

4. Disorganization: crime & delinquency, white collar crime, corruption, drug addiction, suicide.





West Bengal State University

Berunanpukuria, Barasat, North 24 Parganas, Kolkata: 700126

Following is the syllabus finalized by the Under Graduate Board of Studies in Zoology, Fishery and Industrial fisheries, Sericulture of the W.B.S.U. for the 3-year B. Sc. Honours Course in Zoology. The Part I syllabus has been given in details here which is to be followed from the academic session of 2010-2011. A detailed curriculum on the Part I syllabus is also available now. The details of the Part II and Part III syllabus will follow.

ZOOLOGY

Full marks-800

B.Sc Part-I (1st Year) Zoology (Honours)

PART-I (200 Marks)

Paper-01: Diversity of Animals and Animal behaviours Theory (Full Marks 100)

Module ZH101 : Living kingdoms and protozoans (10)

1. Introduction to the modern classification of living organisms into Kingdoms, magnitude of diversity of living organisms: estimated species richness
2. Introduction to the Kingdom Protozoa: Classifications (up to Phylum only) and examples; Special topics (brief outlines only): contractile vacuoles, structures of cilia, reproduction in *Paramecium*.

Module ZH102: Non-Chordates (35)

1. Species diversity and classifications of non-chordate phyla (upto the levels as mentioned below) with salient features and prominent examples of the animal groups:
Poriferans, Cnidarians, Ctenophorans, Platyhelminths, Aschelminthes, Annelids, Molluscs, Echinoderms, Arthropods (upto subclass), Rotifera, Bryozoa, Hemichordata (only salient features of the Phyla)
2. Special topics to understand the diversity of non-chordate structures and functions:
 - 2.1 Body planes and symmetries, coelom, deuterostome vs protostome (only preliminary conceptual outlines)
 - 2.2 Polymorphisms in Cnidaria
 - 2.3 Coral reef: types, formation, distribution, conservation significance
 - 2.4 Torsions in Gastropods
 - 2.5 Cyclomorphosis in Rotifers
 - 2.6 Excretion in invertebrates with special reference to flame cells, nephridia, coelomoducts and malpighian tubules
 - 2.7 Gas exchange by gills and trachea in Arthropods
 - 2.8 Water vascular system and haemal system in Echinoderms
 - 2.9 Brief overview of invertebrate larval forms

Module ZH103: Chordates (35)

1. Chordate Classifications : (up to orders with salient features and examples, except for birds and mammals only names and examples of the orders)
2. Chordates: special topics reflecting diversity of adaptations
 - 2.1 Feeding in Cephalochordates and Urochordates
 - 2.2 Larval form and metamorphosis in Ascidians
 - 2.3 Experimental analysis of function of a vertebrate structure: study of feeding strike of a venomous snake
 - 2.4 Biting, venom delivery and feeding in snakes
 - 2.5 General features of vertebrate integument and its specialization with reference to exoskeletons
 - 2.6 Evolution of aortic arches in vertebrates
 - 2.7 Evolutionary trend in vertebrate brains
 - 2.8 Tripartite concept of kidney organization
 - 2.9 Ruminant stomachs- Digestive tract specializations as fermentation chambers in herbivore mammals
 - 2.10 Dentitions in vertebrates
 - 2.11 Vertebrae: different types

Module ZH104: Animal Behaviour (20)

1. Tinbergen's four questions on studying animal behaviour;
2. Definitions and examples of– habituation, instinctive behaviour, FAP, imprinting and other programmed learning, cultural transmission
3. Social animals- advantages and disadvantages of living in a group, examples of social animals and outline of their social structures
4. Definition and examples of altruism, eusociality, units of selection (just preliminary ideas)

Paper 02: Evolution and Preliminary Knowledge for Quantification in biology Theory (Full Marks 50)

Module ZH201: Evolution (35)

1. Rise of evolutionary theories: the historical outline- conflict between creationists' idea and evolutionary theories, Lamarck's theory, Theories proposed by Darwin and Wallace, modern form of Darwinian theory including modern synthesis
2. H-W theorem and its significance in evolutionary theory, calculating gene frequencies for H-W and non-H-W populations (very simple problems only), Variations in natural populations.
3. Nature and actions of natural selection – evolution of industrial melanism in *Biston betularia* as example,
4. Genetic Drift, Gene Flow and Mutation Rate (only definitions and outlines of these processes, details of nature of actions by each, mathematical models not necessary)
5. Critical concepts (only preliminary and brief discussions)-
 - 5.1 Application of the concept of adaptation- precise definition of adaptation in evolutionary sense, critique of 'adaptationist program'
 - 5.2 Trends in the evolution of modern horses- outlines only
 - 5.3 Measurement of rates of evolution – with the example of equine teeth including allometry
 - 5.4 Punctuationalist vs. gradualist mode of evolutionary changes
 - 5.5 Heterochrony – as a process of macroevolution, just definitions of the heterochronic processes and examples, including Neoteny and Progenesis
 - 5.6 Process of speciation: concept of reproductively isolated species and models of speciation- Allopatric, Sympatric and Parapatric models

Module ZH202: Preliminary knowledge for quantification in biology (15)

1. Logarithm, Matrices, Permutation and Combination, Probabilities (just preliminary concepts and very simple problems to be worked out)
2. Graphical representation of data- bar chart, histograms, scatter plots, pie charts; Discrete and Continuous variables- examples, Normal distribution (only primary characteristics and examples, detailed mathematical characterizations not required); Mean, Mode and Median, Standard deviation, Variance and Standard error; Simple Correlations; concept of Hypothesis Testing, Tests for goodness of fit- Chi-square, Student t-test for comparing means of two small samples from normal populations.

Paper-03: Practicals

(Full Marks 50)

Module ZH301: Morpho-anatomical studies (23)

Study of distinctive characters in the external morphologies of (5) -

Crab, Prawn, *Achatina*, *Pila*, *Lamellidens*, Honeybee, Spider, Leech, Sea Star, Dogfish, Flatfish, Rohu, *Mystus*, Toad, Frog, House lizard, Garden lizard, Checkered keelback snake, Russel's viper, Pigeon, Bat

Study of exoskeletons (3): fish scales (ctenoid, placoid and cycloid), feathers (different types found in a pigeon)

Study of skeleton and identification of skulls (5):

Skeleton of a guinea-pig,

Skulls of- toad, garden lizard, venomous and non-venomous snakes, bird, dog.

Dissecting the body to reveal anatomical peculiarities (10): in cockroach: digestive system, nervous system, male and female reproductive systems; in *Tilapia/Oreochromis* (urino-genital system, brain and vagus distribution, pituitary gland)

Module ZH302: Identifying important and common animals (12)

Mention the systematic position, specimen name and specimen characters only for the following animals:

Paramoecium, Sponge (*Scypha* and common freshwater sponge), Jelly fish, *Obelia* colony, *Taenia solium*, Liver fluke, *Ascaris*, *Nereis*, *Limnea*, *Bellamya*, Octopus, Cuttle fish, *Daphnia*, *Scylla*, *Ocypode*, *Penaeus*, Scorpion, Cerambycid beetle, Water scorpion, Preying mantis, Aphid, Earwig, Bumble bee, Potter wasp, *Polystes* wasp (common yellow wasp), Sea-star, Sea cucumber, Sea-urchin, Sea-lily, *Balanoglossus*, *Ascidia*, Amphioxus, *Petromyzon*, Myxine, Sting Ray, Flying fish, *Monopterusuchia*, Caecilian, Tree frog, Salamander, Axolotl larva, Skink, *Varanus*, *Ptyas*, *Naja*, Russel's viper, Bandicoot, *Mus musculus*, Flying fox, Pippistrel bat

Module 303: Outdoor animal watching (5)

Field trips to any locations suitable for watching animals in their natural habitats and natural mood as much intensively as possible (for example, watching surface swimming insects in a stream or pond, the inter-tidal fauna in estuary or coast, bird watching, butterfly watching, etc.) and noting down own observations in a field diary.

Lab note book: 5 (should include actual lab sketches)

Viva voce: 5

Readings Suggested :

Text Books

Pechenik, J.A., Biology of Invertebrates, TMH, 2002

Kardong, K. V., [Vertebrates, 3rd ed., TMH ed.2002](#)

Taylor, Green and Stout, Biological Sciences Cambridge LPE

Manning, A. and M. S. Dawkins, M.S., An Introduction to Animal Behaviour, Cambridge Univ. Press, Indian Ed.

Ridley, Mark, Evolution, Blackwell, 2nd Ed., 1999

Reference books :

Rupert, E.E., R.S. Fox and R.D. Barnes, Invertebrate Zoology: A functional Evolutionary Approach, Thomson, 7th Ed, 2004

Pough et al., Vertebrate Life, Pearson LPE, [6th ed., 2003](#)

Hildebrand, M., Analyses of Vertebrate Structure, John Wiley & sons, 1995

Meglitsch, Paul A. & Frederick R. Schram, Invertebrate Zoology, OUP, 3rd edition, 1991.

Gadagkar, R. Survival Strategies, Universities Press

Chapman, J.L. and M.J. Reiss, Ecology: principles and applications, Cambridge LPE

Futuyma, D., Evolutionary Biology, Sinauer Associates

And relevant web materials



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ZOOLOGY

B.Sc Part-II (2nd Year) Zoology (Honours)

PART II - 300 Marks

Paper-IV (Theory) : Genetics, Cell and Molecular Biology, Biochemistry and Biophysics (100)

Group A (50) : Genetics, Cell Biology and Molecular Biology

Module 401: Genetics (20)

1. Significance of Mendel's experiments and laws, Concepts and examples of -Test Cross and Back Cross, Incomplete Dominance/Codominance, Multiple Alleles, Epistasis, Polygenic inheritance
2. Chromosomal aberrations, gene mutations and human diseases (Down's, Klienfelter's, Turner's, Cri du Chat, Sickle cell, Haemophilia, Thallassimia, Albinism – only genetical aspects here, details of physiological consequences not required), Sex chromosomes and sex-linked inheritance
3. Linkage and Recombination – Types and outcome, linkage disequilibrium, 3-point cross

Module 402: Cell Biology and Molecular Biology (30)

1. Units of biological measurements and microscopy
2. Plasma membrane : lipid bilayer, membrane proteins and membrane transport - brief outline only
3. Other organelles : introduction to structure and functions of mitochondria, GERL
4. Cell Cycle : preliminary concept
5. Replication : only outline of the mechanisms
6. Transcription : only outline of the mechanisms
7. Translation : only outline of the mechanisms
8. Gene expression-lac operon, trp operon (only introductory outline of the processes)
9. Types of mutations
10. Transposable genetic elements (preliminary introductions)
11. Genetic engineering- preliminary concepts and common examples
12. Introductory principles of common methods used in cellular and molecular biology: PCR, RFLP, DNA fingerprinting, Gene sequencing

Group B : Biochemistry and Biophysics (50)

Module 403: Biochemistry (30)

1. Chemical evolution of biomolecules (outline only)
2. Biological significance of water
3. Structural identities of biomolecules : Carbohydrates, Amino Acids, Peptides, Lipids (preliminary outlines of lipids), nucleic acids
4. Enzymes (major classes of enzymes –mode of actions and examples) and enzyme kinetics
5. Metabolic pathways: Glycolysis, HMP shunt, Kreb's cycle, electron transfer system (outline), Gluconeogenesis, Glycolysis, beta oxidation,

Module 404 : Biophysics (20)

1. Three-dimensional structure of proteins (preliminary concepts only) : peptide bonds, alpha helix, beta conformation, common examples of globular proteins
2. Structure of nucleic acids (preliminary concepts only) : DNA and RNAs
3. Chromosome structure including Nucleosomes (preliminary concepts only)
4. Introductory principles of common methods used in biochemistry and biophysics : Chromatography, Ultracentrifuge, Electrophoresis, X-ray crystallography, Immunoelctrophoresis & Western blotting

Paper V (Theory): Taxonomy, Ecology, Biodiversity & Microbiology, Parasitology, Immunology (100)

Group A (50): Taxonomy and Systematics, Ecology and Biodiversity

Module 501: Taxonomy and Systematics (10)

1. Modern definitions of taxonomy and systematics, philosophy and working of modern taxonomy, Linnean hierarchy,
2. Concept of a species in taxonomic practice
3. ICZN and its important rules,
4. Cladistics: simple introductory concept and examples.

Module 502: Ecology (25)

1. Ecology of populations: survivorship curves, life history tables, age-sex pyramids, population growth models (exponential and logistic models only)
2. Ecology of communities : defining a community, measuring species diversity, species interactions (competition and coexistence, predation, herbivory, mutualism), succession and concept of climax, Theory of Island Biogeography (introductory concepts only)
3. Ecosystems ecology: trophic structure, energy flow, nutrient cycling

Module 503 : Biodiversity and Wildlife Conservation (15)

1. Biodiversity: concept of biodiversity, Importance of biodiversity, biodiversity hotspots, India- a megadiversity country, CBD, Indian Biodiversity Act.
2. Wildlife Conservation: Major forest types and their locations in India, Major wildlife of India - their Indian distribution, present status, conservation efforts (PAs- major sanctuaries and national parks, Indian Wildlife Act, IUCN categories, Project tiger as a case study)

Group B (50): Microbiology, Parasitology, Immunology

Module 504: Microbiology (15)

1. The study of microbial structure
2. Microbial Nutrition
3. Microbial growth
4. Control of Microorganisms by Physical and Chemical agents
5. Pathogenicity of Microorganisms
6. Human diseases caused by Virus (polio, avine influenza) Bacteria (cholera, tuberculosis), Fungi (ringworm)

Module 505: Parasitology (15)

1. Concept of parasitism
2. Origin and evolution of parasitism, host parasitic interactions,
3. Parasitic adaptation: physiological, bio-chemical, Zoonosis, Myiasis
4. Identifying characters, life cycles, mode of infections of important parasites – *Entamoeba*, *Giardia*, *Fasciola*, *Taenia*, *Ascaris*

Module 506: Immunology (20)

1. What is Immunology: a short preview of the development of the subject
2. Innate (Nonspecific) and Acquired (Specific) immunity.
3. Central dogma of Immune system: (a) Cells of Immune system (b) Organs of Immune system- Primary & Secondary lymphoid organs.
4. Concept of Antigen & Antigen Presentation: Antigenic determinant (for ABO and Rh group only)
5. The Major Histocompatibility Complex : Antigen processing & presentation
6. Concept of T Cell-Antigen recognition and activation [Intracellular signal transducing enzymes excluded] : Structure and function of TCR complex, APC-T Cell interaction,
7. Concept of B Cell Activation and Antibody production [Intracellular signal transducing enzymes excluded]: Structure & Function of Immunoglobins [class switching among Immunoglobulin gene excluded].Antigenic determinants of Immunoglobins (Isotype, Allotype & Idiotype).
8. Cytokines (source & function of IL-1, IL-2, IL-4, IL-5, IL-6, IL-8, IL-10, IL-12, Interferons, Tumor Necrosis Factors, Tumor Growth Factors, GM-CSF, M-CSF).
9. The Complement System (Basic concepts & Types only)
10. Techniques in Immunology: ELISA, RIA, Immunodiffusion Techniques,

Paper VI: Practicals (100)

Group A : 50

1. Pedigree analyses (8) : simple pedigrees of Mendelian and common sex-linked traits
2. Statistical tests of data and decision making (8) : Chi square test for goodness of fit and student t test for comparing means of two small samples from normal populations (paired/unpaired)
3. Database preparation, analyses and graphical presentation by EXCEL in Microsoft/Open Office (7)
4. Ecological study (12) – Sampling techniques in field ecology- Quadrat, Transects, Pitfall, Measuring species diversity of given sample of a community
5. Documentation of local fauna (5): documentation of different species of wild birds, mammals, butterflies, mollusks, fishes, amphibians, reptiles, any other common group of animals (any one group to be chosen by the college for a year and not to be repeated in succeeding year) found naturally in the localities around the college.
6. Viva voce (5)
7. Lab Note book (5)

Group B : 50

1. Uses of microscope, stages and ocular micrometer and camera lucida for cellular study (5)
2. Chromosome preparations : Onion root tip (mitotic stages), Grasshopper testes (meiotic stages) and Drosophila larvae (Polytene chromosome and imaginal disc) (15)
3. Biochemical tests (20)- Qualitative tests for unknown carbohydrates and proteins, colorimetric assay of protein (Lowry's method) and glucose (Nelson and Somogyi method), Preparation of Buffers – PBS, TRIS-Cl,
4. Viva voce (5)
5. Lab Note book (5)

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Text books and references will be prescribed along with the detailed curriculum, soon to be available in this website

Module 401: **Genetics**

Text Book :

Principle of Genetics by Robert H. Tamarin
TMH, 2002

Or

Principles of Genetics by Gardner et al.
8th Ed. Wiley Paper back

References :

Genetics : Analysis of Genes and Genomes by Hartl and Jones; 6th ed., Jones and Bartlett publishers, 2005

Genetics by Strickberger

Module 402: **Cell and Molecular Biology**

Text Book :

Chapters on Cellular structures and Molecular Biology in Integrated Principles of Zoology by Hickman, Roberts and Larson; McGraw Hill

or

Principle of Genetics by Robert H. Tamarin

TMH, 2002

Or

Principles of Genetics by Gardener et al.

8th Ed., Wiley Paperback

References :

Molecular Biology of the Cell by Alberts et al.

Molecular Biology of the gene by Watson et al.

Lehninger Principles of Biochemistry by Nelson and Cox

Module 403: **Biochemistry**

Text Book :

Chapters on Biomolecules and biochemical processes in Integrated Principles of Zoology by Hickman, Roberts and Larson; McGraw Hill

or

Lehninger Principles of Biochemistry by Nelson and Cox

Or

Biochemistry by Stryer

References :

Harper's Illustrated Biochemistry, 28th ed.

Module 404: **Biophysics**

Text Book :

Lehninger Principles of Biochemistry by Nelson and Cox

Or

Biochemistry by Stryer

References :

Standard Internet Sources

Module 501: **Taxonomy and Systematics**

Text Book :

Taxonomy and Systematics by Mayr and Ashlock

References :

Standard internet sources

Module 502: **Ecology**

Text Book :

Ecology : Theory and applications by Peter Stiling, PHI-EEE, 4th edition

References :

Ecology: principles and applications by Chapman and Reiss, Cambridge Low Priced ed.,

Ecology by Charles Krebs

Module 503: **Biodiversity and Wildlife Conservation**

Text Book/ source :

Webpages for Biodiversity, Indian Forests and Wildlife at en.wikipedia.org/wiki

Biodiversity Profile of India in Madhav Gadgil's Home page at

ces.iisc.ernet.in/hpg/cesmg/indiabio.html

Biodiversity and Species category Homepages at www.iucn.org

Module 504: **Microbiology**

Text Book :

Microbiology by Prescott, Harley & Klein, 5th Edition; 2002

Or

Microbiology by Pelczar et al. Mc Grew Hill, 5th Ed.

References :

Standard internet sources

Module 505: **Parasitology**

Text Book :

Outlines & Highlights For Human Parasitology By Roberts and Janovy, Academic Internet Publishers, 6th Ed.

Or

Parasitology by Bogitsh, Carter and Alteman, Academic Press, Indian Edition, 2006

References :

Outlines & Highlights For Human Parasitology By Bogitsh, Academic Internet Publishers

Module 506: **Immunology**

Text Book :

NMS-Immunology by R. Hyde, Williams and Wilkins

Or

Basic Immunology : Functions and disorders by Abbas and Litchman, W. B. Sanders & Co.

References :

Kuby's Immunology by Goldsby, Kindt and Osborn, W.H. Freeman

Background reading: Students are advised to read thoroughly the following text book before reading topics in the text books specified above to develop their fundamental understanding of the subjects.

Integrated Principles of Zoology by Hickman et al., McGrawHill 11th ed. or later editions. (Free downloadable soft copies of the book is also available through internet)

Students are also to be encouraged to use free internet sources including free downloadable softcopies of books on relevant subjects

For achieving good results, students are advised to study prescribed text books and other reading materials thoroughly and thoughtfully instead of mugging readymade notes.



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ZOOLOGY

B.SC Part-III (3rd Year) Zoology (Honours)

Part III – 300 Marks

Paper-VII (Theory): Animal Physiology, Endocrinology and Reproductive biology, Histology (100)

Module 701: Animal Physiology (40)

1. Transport across cell surface membrane. Donnan membrane equilibrium
2. Functions of mammalian blood: Oxygen transport and CO₂ transport
3. Neurophysiology: Generation of action potential and propagation of nerve impulse in myelinated and non-myelinated nerve fibers. Synaptic and neuro-muscular junctions: structure and functions
4. Respiration: Gill respiration in fishes, respiration in air-breathing fishes, respiration in Avian lungs
5. General architecture of skeletal (striated) muscles and smooth muscle: Ultrastructure of skeletal muscle sarcomere, molecular structure of actin and myosin. Muscle contraction: sliding filament theory
6. Swim bladder and its function in teleost fishes
7. Water and osmotic regulations: problems in marine cyclostomes, elasmobranchs and teleosts, freshwater teleosts, in hot desert environment (camel) and examples of significant adaptations solving it by different animal groups
8. Urine formation in human kidney
9. Bioluminescence: occurrence, mechanism of production

Module 702: Endocrinology and Reproductive Biology (40)

1. Classification of vertebrate hormones based on chemical nature and mechanism of action (names and examples only)
2. Hormone delivery systems: Endocrine, neuroendocrine, paracrine, neurocrine, autocrine (Definitions and examples only)
3. Feedback control of hormone secretion: negative and positive.
4. Hormone biosynthesis (including sites of synthesis, outlines only): Thyroid hormones (T₃, T₄), testosterone, estrogen, progesterone, adreno-cortical hormones, Insulin, Adrenal catechol amines
5. Physiologic functions of hormones: Insulin, glucagon, T₃ and T₄
6. Hormonal control of spermatogenesis
7. Hormonal control of mammalian ovarian cycle, differences between estrous and menstrual cycle
8. Mechanism of hormone actions (outline only): Cytoplasmic receptor, nuclear receptor, membrane receptor, HRE, HSP, cAMP, cGMP, IP₃-DAG, tyrosine kinase, calcium-calmodulin

9. Endocrine disorders (symptoms and causes only): Diabetes insipidus; IDDM & NIDDM, Hypothyroidism and Hyperthyroidism, Conn's and Cushing's syndrome

Module 703: Histology (20)

1. Basic tissue types: epithelial, connective, cardiac and nervous tissue (typical structure of neuron and types of neuron, glial cells, etc.)
2. Membrane specializations of epithelia. (Intercellular surface [cell junctions], luminal surfaces and basal surfaces)
3. Exocrine glands: Types of and discharge of secretory products (merocrine, apocrine, holocrine)
4. Principles of tissue fixation, staining
5. Histology of: stomach, pancreas, testis, ovary, thyroid, lymph node (outline of structures)
6. Histological structure of mammalian nephron and functions of each regions

Paper VIII (Theory): Developmental biology, Environmental Pollutions and Toxicology, Medical Zoology, Economic Zoology (100)

Module 801: Developmental Biology (30)

1. Outlines of historical concepts and experience in emergency of developmental biology- Induction, Fate map, Spemann and Mangold's organizer transplant experiments, von Baer's laws
2. Germ layers and its contributions to the development of different tissues in vertebrates
3. Origin of germ cells. Structural features of sperms n eggs in sea urchins and in mammals. Gametogenesis in mammals
4. Fertilization: external fertilization in sea urchins, internal fertilization in mammals (in depth molecular details not required)
5. Cleavage: Types of cleavage found in animals and animals groups that exhibit a type, outlines of cleavage process in *C. elegans*, Zebra fish, *Xenopus* and chick
6. Gastrulation: generalized patterns, brief outlines of the process in *C. elegans*, Zebra fish, *Xenopus* and chick
7. Organogenesis: development of brain in chicken
8. Conceptual outlines (very brief) of – Cell potency and stem cells, sex determination in *Drosophila* & Man, Environmental sex determination in reptiles, HOX genes in development

Module 802: Environmental Pollutions and Toxicology (20)

1. Environmental pollutions (nature of sources of pollutants, impact on ecosystems and humans, remedies): water, soil, air and sound pollutions
2. Environmental laws: major ones applicable in West Bengal
3. Toxicology: including its significance as a branch of Science
4. Dose-response relationships
5. In Vivo and In vitro toxicity tests
6. Introduction to the concepts of detoxification mechanisms

Module 805: Medical Zoology (15)

1. Mosquito-borne diseases: Malaria and Filariasis - causative agents and their life cycle, mode of infections in man, major modes of treatments, major vector species in India, their ecology and life cycles, control measures
2. Mosquito-borne diseases: Dengue and DHF, Chikungunya - causative virus, symptoms and treatments
3. Visceral Leishmaniasis (Kala Azar) - causative species and vectors in West Bengal
4. Common ticks and mites in human surroundings and diseases caused by them

Module 806: Economic Zoology (35)

1. Fishes and fishery: Diversity of indigenous freshwater, estuarine, marine fishes and shell fishes in West Bengal. Invasive and exotic species of fishes in West Bengal. Techniques of modern pisciculture and prawn culture. Problems related to wild prawn seed collections in Sunderbans, fish productivities in India and West Bengal, ecology and degradation of freshwater fish habitats and decrease in wild fish stocks (very brief idea)
2. Sericulture: Silks and Silk worms, sericulture practices – methods, scopes and problems
3. Apiculture: Honey bees and their behaviors in relation to bee-keeping, popular methods of beekeeping, scopes and problems
4. Lac culture: Lac and lac insects, host plants and lac cultivation, scopes and problems
5. Poultry birds: Different breeds, their advantages and disadvantages, importance of indigenous breeds
6. Cattle, goat and lambs: Different breeds, their advantages and disadvantages, importance of indigenous breeds

Paper IX: Practical (100)

Group A: 50

1. Physiology: Blood slide preparations (from goat/rat) to identify and study the characteristic features of different types of WBC, total count of WBC. Determination of hemoglobin content of goat/rat blood by Sahli's haemoglobinometer. Human blood pressure and Pulse measurements, etc. (15)
2. Microtomy: Paraffin section cutting and mounting, H & E staining of histological tissues and identifying the stained slide (name, identifying characters only). [Fixation and paraffin embedding procedure should be demonstrated in the class] (15)
3. Determination of soil and water pH (with pH meter); Quantification of free CO₂ and dissolved O₂ (Winkler's method) in water sample (10)
4. Viva voce (5)
5. Lab Notebook (must include actual lab notes and sketches) (5)

Group B: 50

1. Developmental Biology: Identification of chick's embryonic stages (at 24, 48, & 96 hours of incubation. Identification of fry stages of carp fish (any cultivated carp species) (10)
2. Morpho-metric studies: Mouth parts and fins of fishes (any major carp, *Mystus*, Tilapia), different aspects of *Acatina*, *Pila*, *Bellamya*, Ants (Total length, Head length, Trunk and Petiole length, Gaster length of any size big sized easily identify effectively available ant like *Camponotus*, *Oecophila*, and *Tetraponera*) (15)
3. Medical entomology: Identification of *Culex*, *Aedes* and *Anopheles* mosquitoes from whole mount dry specimens. Identification of *Plasmodium*, *Entamoeba*, *Giardia*, *Fasciola*, *Ascaris*, *Wuchereria* (15)
4. Viva voce (5)
5. Lab Notebook (must include actual lab notes and sketches) (5)



West Bengal State University
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SYLLABUS
For The
B.Sc in Zoology (Hons.)

The following syllabus (Part II) has been proposed by the UG-BOS in Zoology of W.B.S.U for being implemented from the year 2011

PART II - 300 Marks

Paper-IV (Theory) : Genetics, Cell and Molecular Biology, Biochemistry and Biophysics (100)

Group A (50) : Genetics, Cell Biology and Molecular Biology

Module 401: Genetics (20)

1. Significance of Mendel's experiments and laws, Concepts and examples of - Test Cross and Back Cross, Incomplete Dominance/Codominance, Multiple Alleles, Epistasis, Polygenic inheritance
2. Chromosomal aberrations, gene mutations and human diseases (Down's, Klienfelter's, Turner's, Cri du Chat, Sickle cell, Haemophilia, Thallassimia, Albinism – only genetical aspects here, details of physiological consequences not required), Sex chromosomes and sex-linked inheritance
3. Linkage and Recombination – Types and outcome, linkage disequilibrium, 3-point cross

Module 402: Cell Biology and Molecular Biology (30)

1. Units of biological measurements and microscopy
2. Plasma membrane : lipid bilayer, membrane proteins, membrane transport-brief outline
3. Other organelles : introduction to structure and functions of mitochondria, GERL
4. Cell Cycle : preliminary concept
5. Replication : outline of the mechanisms
6. Transcription : outline of the mechanisms
7. Translation : outline of the mechanisms
8. Gene expression-lac operon, trp operon
9. Types of mutations

10. Transposable genetic elements
11. Genetic engineering- concept and examples
12. Principles (outline) of common methods used in cellular and molecular biology: PCR, RFLP, DNA fingerprinting, Gene sequencing

Group B : Biochemistry and Biophysics (50)

Module 403: Biochemistry (30)

1. Biological significance of water
2. Structural identities of biomolecules : Carbohydrates, Amino Acids, Peptides and Proteins, Lipids (preliminary outlines of lipids)
3. Enzymes (major classes of enzymes –mode of actions and examples) and enzyme kinetics
4. Metabolic pathways (structure to be included) : Glycolysis, HMP shunt, Krebs's cycle, electron transfer system (outline), Gluconeogenesis, Glycolysis, beta oxidation,

Module 404 : Biophysics (20)

1. Diffusion, Osmosis, Donnan equilibrium,
2. Physico-chemical structure of nucleic acids : DNA and RNAs,
3. Nucleosome concept
4. Principles of common methods used in biochemistry and biophysics : Chromatography, Ultracentrifuge, Electrophoresis, X-crystallography, Immunoelectrophoresis & Western blotting

Paper V (Theory) : Taxonomy, Ecology, Biodiversity & Microbiology, Parasitology, Immunology (100)

Group A (50): Taxonomy and Systematics, Ecology and Biodiversity

Module 501: Taxonomy and Systematics (10)

1. Modern definitions of taxonomy and systematics, philosophy and working of modern taxonomy, Linnaean hierarchy,
2. Concept of a species in taxonomic practice
3. ICZN and its important rules,
4. Cladistics: simple introductory concept and examples.

Module 502: Ecology (25)

1. Ecology of populations: survivorship curves, age-sex pyramids, population growth models (exponential and logistic models only)
2. Ecology of communities : defining a community, measuring species diversity, species interactions (competition and coexistence, predation, herbivory, mutualism), succession and concept of climaxes, Theory of Island Biogeography (introductory concepts only)
3. Ecosystems ecology: trophic structure, energy flow, nutrient cycling

Module 503 : Biodiversity and Wildlife Conservation (15)

1. Biodiversity: concept of biodiversity, Importance of biodiversity, biodiversity hotspots, India- a megadiversity country, CBD, Indian Biodiversity Act.
2. Wildlife Conservation: Major forest types and their locations, Major wildlife of India - their Indian distribution, present status, conservation efforts (PAs- major sanctuaries and national parks, Indian Wildlife Act, IUCN categories, Project tiger as a case study)

Group B (50): Microbiology, Parasitology, Immunology

Module 504: Microbiology (15)

1. The study of microbial structure
2. Microbial Nutrition
3. Microbial growth
4. Control of Microorganisms by Physical and Chemical agents
5. Pathogenicity of Microorganisms
6. Human diseases caused by Virus, Bacteria, Fungi and Protozoa (only major diseases caused by each)

Module 505: Parasitology (15)

1. Concept of parasitism, origin and evolution of parasitism, host parasitic interactions, parasitic adaptation: physiological, bio-chemical, Zoonosis, Myiasis
2. Identifying characters, life cycles, mode of infections of important parasites – *Entamoeba*, *Giardia*, *Trypanosoma*, *Fasciola*, *Taenia*, *Ascaris*

Module 506: Immunology (20)

1. Overview & Concept of Immunology: Preview of development of this subject; Innate (Nonspecific) and Acquired (Specific) immunity.

2. Central dogma of Immune system: (a) Cells of Immune system and its know-how- Phagocytes and APCs (Dendritic Cell, Macrophage, Monocyte, Neutrophil, Basophil, Eosinophil), Mast Cell, T lymphocytes (Th1, Th2, Cytotoxic T cells, Tr and Tm), NK Cells, B Cells & Plasma Cells, Hematopoietic bone marrow cells. (b) Organs of Immune system- Primary & Secondary lymphoid organs.
3. Concept of Antigen & Antigen Presentation: Antigenic determinant, Change of antigenic determinant in ABO Blood group antigen, Rh Factor, The Major Histocompatibility Complex and its involvement in Antigen processing & Presentation, Structure of MHC molecules,
4. Concept of T Cell-Antigen recognition and activation [Intracellular signal transducing enzymes excluded] : Structure and function of TCR complex, APC-T Cell interaction, T Cell maturation in Thymus, Differentiation and function of T Cells (Th1, Th2, Cytotoxic T cells), Involvement of Physical & Chemical Co-stimulation (Co-stimulatory molecules, Cytokine & Chemokine).
5. Concept of B Cell Activation and Antibody production [Intracellular signal transducing enzymes excluded]: Structure & Function of Immunoglobins [class switching among Immunoglobulin gene excluded].Antigenic determinants of Immunoglobins (Isotype, Allotype & Idiotype).
6. Cytokines (source & function of IL-1, IL-2, IL-4, IL-5, IL-6, IL-8, IL-10, IL-12, Interferons, Tumor Necrosis Factors, Tumor Growth Factors, GM-CSF, M-CSF).
7. The Complement System (Basic concepts & Types only), Hypersensitive Reactions (Basic concepts & Types only)
8. Techniques in Immunology: ELISA, RIA, Immunodiffusion Techniques,

Paper VI: Practicals (100)

Group A : 50

1. Pedigree analyses (10) : simple pedigrees of Mendelian and common sex-linked traits
2. Statistical tests of data and decision making (10) : Chi square test for goodness of fit and student t test for comparing means of two small samples from normal populations (paired/unpaired)
3. Database preparation, analyses and graphical presentation by EXCEL in Microsoft/Open Office (10)
4. Ecological study (15) – Sampling techniques in field ecology- Quadrat, Transects, Pitfall, Measuring species diversity of given sample of a community
5. Documentation of local fauna (5): documentation of different species of wild birds, mammals, butterflies, mollusks, fishes, amphibians, reptiles, any other common group of animals (any one group to be chosen by the college for a year and not to be repeated in succeeding year) found naturally in the localities around the college.

Group B : 50

1. Uses of microscope, stages and ocular micrometer and camera lucida for cellular study (5)
2. Chromosome preparations : Onion root tip (mitotic stages), Grasshopper testes (meiotic stages) and chironomid larva (lampbrush chromosome) (20)
3. Biochemical tests (25)- Qualitative tests for unknown carbohydrates and proteins, colorimetric assay of protein (Lowry's method) and glucose (Nelson and Somogyi method), Preparation of Buffers – PBS, TRIS-Cl, Ringer's solution.

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Text books and references will be prescribed along with the detailed curriculum, soon to be available in this website

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Question patterns :

Questions of 1, 3 and 5 marks totalling the assigned marks for the module from each module in all paper.

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Please note that the marks and paper distribution for three years / parts of B.Sc. in Zoology (Hons) would be following. The syllabus and marks distribution for Part I remain as it is now ongoing (implemented for the first year of 2010-2011). Any previously prescribed pattern of syllabus and marks distribution for the Part II and Part III for B.Sc. in Zoology (Hons) is to be ignored.

PART-II : 300 Marks

Paper-04 (Theory): 100 marks

Group A: Genetic & Cell and Molecular Biology

Module 401: Genetics (20)

Module 402: Cell and Molecular Biology (30)

Group B: Biochemistry and Biophysics

Module 403: Biochemistry (30)

Module 404: Biophysics (20)

Paper 05 (Theory) : 100 marks

Group A : Taxonomy and Systematics, Ecology, Biodiversity and Wildlife Conservation (50)

Module 501: Taxonomy and Systematics (10)

Module 502: Ecology (25)

Module 503: Biodiversity and Wildlife Conservation (15)

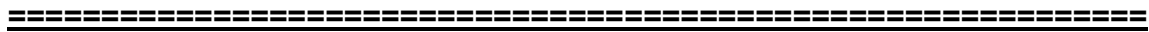
Group B : Microbiology, Parasitology and Immunology (50)

Module 504: Microbiology (15)

Module 505: Parasitology (15)

Module 506: Immunology (20)

Paper 06 (Practicals): 100 marks



PART-III : 300 Marks

Paper-07 (Theory) : 100 marks

Module 701: Animal Physiology (40)

Module 702: Histology and Histopathology (20)

Module 702: Endocrinology and Reproductive Biology (40)

Paper-08 (Theory) : 100 marks

Module 801: Developmental Biology (35)

Module 803: Environmental Biology and Toxicology (20)

Module 804: Medical Zoology (10)

Module 805: Economic and Applied Zoology (35)

Paper 09: Practical (100)





West Bengal State University
(Barasat, N-24 Parganas, India, Pin Code 700126)

SYLLABUS
For The
B.Sc in Zoology (Hons.)

PART-III-300 Marks
DRAFT SYLLABUS (June 2012)

Paper-VII: Theory (100)

Module 701: Animal Physiology (40)

1. Transport across cell surface membrane, Donnan membrane equilibrium
2. Functions of mammalian blood: Oxygen transport and CO₂ transport
3. Neurophysiology: Generation of action potential and propagation of nerve impulse in myelinated and non-myelinated nerve fibers. Synaptic and neuro-muscular junctions : structure and functions
4. Respiration: gill respirations in fishes, respiration in air-breathing fishes, respiration in avian lungs
5. General architecture of skeletal (striated) muscle and smooth muscle; Ultrastructure of skeletal muscle sarcomere, molecular structure of actin and myosin, Muscle contraction: sliding filament theory
6. Swim bladder and its functions in teleost fishes
7. Water and osmotic regulations : problems in marine cyclostomes, elasmobranchs and teleosts, freshwater teleosts, in hot desert environments (camel) and examples of significant adaptations solving it by different animal groups
8. Urine formation in human kidney
9. Bioluminescence: occurrence, mechanism of production

Text Book:

Animal Physiology by Kurt Neilsen-Schmidt, Cambridge Univ. Press, New Delhi, 2002 Indian Ed.

References:

Textbook of Medical Physiology by A.C. Guyton & J.E. Hall

Module 702: Endocrinology and Reproductive biology (40)

1. Classification of vertebrate hormones based on chemical nature and mechanism of action (names and examples only).
2. Hormone delivery systems: Endocrine, neuroendocrine, paracrine, neurocrine, autocrine (Definitions and examples only)

3. Feed back control of hormone secretion: negative and positive.
4. Hormone biosynthesis (including sites of synthesis, outlines only): Thyroid hormones (T₃, T₄), testosterone, estrogen, progesterone, adreno-cortical hormones, Insulin, Adrenal catecholamines.
5. Physiologic functions of hormones: Insulin, glucagon, T₃ and T₄.
6. Hormonal control of spermatogenesis
7. Hormonal control of mammalian ovarian cycle, differences between estrous and menstrual cycle.
8. Mechanism of hormone actions (outlines only): cytoplasmic receptor, nuclear receptor, membrane receptor, HRE, HSP, cAMP, cGMP, IP₃—DAG, tyrosine kinase, calcium-calmodulin
9. Endocrine disorders (*symptoms and causes only*): Diabetes insipidus; IDDM & NIDDM, Hypothyroidism and hyperthyroidism, Conn's and Cushing's syndrome.

Text Book :

Endocrinology by Turner and Baxter

References:

Textbook of Medical Physiology by A.C. Guyton & J.E. Hall

Module 703: **Histology (20)**

1. Basic tissue types: epithelial, connective, cardiac and nervous tissue (typical structure of neuron and types of neuron, glial cells etc)
2. Membrane specializations of epithelia. (Intercellular surface [cell junctions], luminal surfaces and basal surfaces.).
3. Exocrine glands: Types and discharge of secretory products (merocrine, apocrine, holocrine).
4. Principles of tissue fixation, staining,
5. Histology of: stomach, pancreas, testis, ovary, thyroid, lymph node. (Outline of structures).
6. Histological structure of mammalian nephron and functions of each regions.

Text Books :

Basic Histology: Text & Atlas by Luiz Carlos Junqueira et al. Macgregor-Hill (also visit- <http://www.freebook4u.net/2011/03/basic-histology-text-atlas-11th-edition.html>)

References:

1. Histology: A Text and Atlas by Ross & Reith. Lippincott Williams
2. Histology & Cell Biology by Kurt E. Johnson; Harwal Publishing Company
3. A Text book of Histology: practical guide by J.P. Gunashekharan, 2nd Ed. Elsevier India

Paper VIII: Theory (100)

Module 801: **Developmental Biology (30)**

1. Outlines of historical concepts and experiments in the emergence of developmental

- biology- Induction, Fate map, Spemann and Mangold's organizer transplant experiments, von Baer's laws.
2. Germ layers and its contributions to the development of different tissues in vertebrates.
 3. Origin of germ cells, Structural features of sperms and eggs in sea urchins and in mammals, Gametogenesis in mammals,
 4. Fertilization: external fertilization in sea urchins, internal fertilization in mammals (in depth molecular details not required)
 5. Cleavage : Types of cleavage found in animals and animal groups that exhibit a type, outlines of cleavage process in *C. elegans*, Zebra fish and *Xenopus* and chick
 6. Gastrulation: generalized patterns, brief outlines of the process in *C. elegans*, Zebra fish, *Xenopus* and chick
 7. Organogenesis : development of brain in chicken
 8. Conceptual outlines (very brief) of – Cell potency and Stem Cells, Sex determination in *Drosophila* and Man, Environmental sex determination in reptiles. HOX genes in development

Text Books :

Principles of Development : by Lewis Wolpert, Jim Smith, Tom Jessell, Peter Lawrence (3rd Ed. OUP, India)

References :

Developmental Biology by Scott Gilbert

Module 802: Environmental Pollutions and Toxicology (20)

1. Environmental pollutions (nature and sources of pollutants, impacts on ecosystems and humans, remedies): water, soil, air and sound pollutions
2. Environmental laws: major ones applicable in West Bengal
3. Toxicology: including its significance as a branch of Science
4. Dose-response relationships
5. In vivo and In vitro toxicity tests
6. Introduction to the concepts of detoxication mechanisms

Text Books:

1. Rana, S. V.: **Environmental Pollution - Health and Toxicology**

2. Curtis D Klaassen: **Casarett and Doull's Toxicology**

Module 805: Medical Zoology (15)

1. Mosquito-borne diseases: Malaria and Filariasis- causative agents, their life cycle, modes of infections in man, major modes of treatments, major vector species in India, their ecology and life cycles, control measures
2. Mosquito-borne diseases: Dengue and DHF, Chikungunya- causative virus, symptoms and treatments

3. Visceral Leishmaniasis (Kala-azar)- causative species and vectors in West Bengal
4. Common ticks and mites in human surroundings and diseases caused by them

Text Book:

Hati, A. K., *Medical Entomology*, Allied Publishers

Module 006: Economic Zoology (35)

1. Fishes and fishery: diversity of indigenous freshwater, estuarine, marine fishes and shell fishes in West Bengal. Invasive and exotic species of fishes in West Bengal. Techniques of modern pisciculture and prawn culture. Problems related to wild prawn seed collections in Sunderbans, fish productivities in India and West Bengal, ecology and degradation of freshwater fish habitats and decrease in wild fish stocks (very brief idea)
2. Sericulture: silks and silk worms, sericulture practices- methods, scopes and problems
3. Apiculture: Honey bees and their behaviours in relation to bee-keeping, popular methods of bee keeping, scopes and problems
4. Lac culture: Lac and lac insects, host plants and lac cultivation, scopes and problems
5. Poultry birds: different breeds, their advantages and disadvantages, importance of indigenous breeds
6. Cattle, goats and lambs: different breeds, their advantages and disadvantages, importance of indigenous breeds

Text Books:

Economic Zoology- Shukla and Upadhyaya. Rastogi Pub., 2nd Ed, 2005

References :

- *Fish and Fisheries of India* by Jhingran. Hindustan Publishing
- *Encyclopedia of Economic Zoology*. 2 vols. By Khan, A. A. (Editor), 2007. Anmol Publications. 2007
- *Freshwater Aquaculture* by Santhanam *et al.*
- *Aquaculture* by T. V. R. Pillay
- *Animal Husbandry* by G. C. Banerjee
- *Sericulture & Silk Industry* by D. C. Sarkar
- *Lac Culture* by N. Ghorai
- *Bee keeping in India* by ICAR
- *Livestock & Poultry Production* by Singh and Moore

Paper IX: Practical (100)

GROUP A : Full Marks 50

1. Physiology: Blood slide preparations (from goat/rat) to identify and study the characteristic features of different types of WBC, total count of WBC. Determination of haemoglobin content of goat/rat blood by Sahli's haemoglobinometer. Human B.P. and pulse measurements etc. (15)
2. Microtomy: Paraffin section cutting and mounting, H&E staining of histological tissues and identifying the stained slide (name, identifying characters only). [fixation and paraffin embedding procedure should be demonstrated in the class] (15)
3. Determination of soil and water pH (With pH meter); Quantification of free CO₂ and dissolved O₂ (Winkler's Method) in water sample (10)
4. Viva voce (5)
5. Lab Note Book (must include actual lab notes and sketches) (5)

Group B : Full Marks 50

1. Developmental Biology: Identification of chick's embryonic stages (at 24, 48 & 96 hrs. of incubation. Identification of fry stages of a carp fish (any cultivated carp species) (10)
2. Morpho-metric studies: mouth parts and fins of fishes (any major Carp, *Mystus*, *Tilapia*), different aspects of shells of *Acatina*, *Pila*, *Bellamya*, Ants (Total length, Head length, Trunk and Petiole length, Gaster length of any big sized easily available ant like *Camponotus*, *Oecophila*, *Tetraopnera*) (15)
3. Medical entomology: Identifications of *Culex*, *Aedes* and *Anopheles* mosquitoes from whole mount dry specimens. Identification of *Plasmodium*, *Entamoeba*, *Giardia*, *Fasciola*, *Ascaris*, *Wuchereria* (15)
4. Viva voce (5)
5. Lab Note Book (must include actual lab notes and sketches) (5)



West Bengal State University
(Barasat, North 24 Parganas)

Syllabus (2009-2010)
Zoology (General)

Full Marks for Three Years Degree Course – 400

Part – I (1st Year), 100 Marks

Paper – I (Theoretical, 100 marks)

Part – II (2nd Year), 200 Marks

Paper – II (Theoretical, 100 marks)

Paper – III (Practical, 100 marks)

Part – III (3rd Year / Final Year), 100 marks

Paper – IV A (Theoretical – 60 marks)

Paper – IV B (Practical – 40 marks)

Part – I

Paper – I (Theory, 100 marks)

Group A – Nonchordates (30 marks)

30 classes

1. Classification with distinctive features and suitable examples of sub kingdom Protozoa (upto Phyla) and Phylum Porifera, Cnideria, Platyhelminthes, Nematelminthes, Annelida, Arthropoda, Mollusca and Echinodermata (upto Sub class).

2. General structure and function of the following with reference to the specimens mentioned:

i) Locomotion: a) Microfibrils (*Amoeba*), b) Cilia (*Paramoecium*), c) Parapodia (*Neanthes*).

ii) Feeding and digestion: a) Microphagy (*Amoeba*), b) Macrophagy (Hydra), c) Filter feeding (*Balanoglossus*)

iii) Respiration: a) Ctenidium and Pulmonary sac (*Pila*), b) Trachea and Booklung (cockroach, scorpion).

iv) Excretion: a) Flame cell (*Taenia*), b) Nephridia (Earthworm), Malpighian tubules (Cockroach)

v) Circulation: a) Open circulation (Cockroach), b) Closed circulation (Earthworm), Haemal circulation (Starfish)

vi) Neural integration: a) Integration - simple and complex nerve nets b) Nervous system (Earthworm, Cockroach, Apple snail)

vii) Reproduction and Life cycle: a) Fission (*Amoeba*), b) Conjugation (*Paramoecium*),

c) Sexual (Earthworm), d) Metagenesis (*Obelia*), e) Metamorphosis in insects.

Group B – Chordates (30 marks)

30

classes

1. Classification of Phylum Chordata with distinctive features and suitable examples

- Fishes and Aves (upto Sub class); Amphibia, Reptilia and Mammalia (upto living orders).

2. a) Functional anatomy in relation to filter feeding (*Branchiostoma*); circulation with special reference to portal system.

b) Structure and function of the following:

i) Integument - general structure and function; glands in general and integumentary derivatives (scales in fishes; horny scales and plates in reptiles; feathers of birds; hair of mammals).

ii) Digestive system - pharynx (*Ascidia*); stomach (*Columba* and *Bos*).

iii) Respiratory system - gills (fish); accessory respiratory organs (fish); lungs (birds and mammals).

iv) Excretory system – pro-, meso- and meta-nephric kidneys in vertebrates.

v) Circulatory system - single circuit heart (fish); double circuit heart (amphibia and mammals); modification of aortic arches in vertebrates.

vi) Nervous system - Brain of *Bufo*; origin and distribution of cranial nerves in vertebrates.

Group C – Parasitology and Endocrinology (20 marks)

15

classes

1. a) Parasitism (definition and different types) b) an outline idea of other interspecific interactions (symbiosis, commensalism and mutualism).

2. Life history, pathogenicity and clinical features of i) *Entamoeba histolytica*, ii) *Plasmodium vivax*, iii) *Ascaris*.

3. General characters of hormones.

4. Mammalian endocrine glands (pituitary, thyroid and pancreas with their hormonal functions).

Group D – Ecology, Ecosystem and Environment (20 marks)

15

classes

1. Definition, components, energy flow, food chain, food web, ecological pyramids.

2. Population – definition and growth.

3. Community – definition and types.

4. Pollution – air, water and noise.

5. Global warming and its impact on environment.

6. Concept of EIA.

Part – II

Paper – II (Theory, 100 marks)

Group A – Evolutionary Biology (30 marks) **30**
classes

1. Definition of Systematics and Taxonomy.
2. Species as unit of evolution (definition and types: biological, monotypic and polytypic).
3. Chemical basis of origin of life.
4. Darwinism and synthetic theory of evolution.
5. Hardy-Weinberg equilibrium in relation to natural selection - a brief idea.
6. Anatomical and physiological adaptation: aquatic, desert and volant animals.
7. Zoogeographical realms and their subdivisions with characteristic fauna.

Group B – Cell and Molecular Biology (30 marks) **30**
classes

1. Ultrastructure and function of plasmamembrane, GERL system and ribosome.
2. Chromosome structure-nucleosome model.
3. Cell cycle (basic idea).
4. Physico-chemical structure and properties of DNA and RNA.
5. Nucleic acids as genetic material.
6. Mechanism of replication, transcription and translation in *E. coli*
7. Modes of inheritance of autosomal and sex-linked genes in man; Thalassemia and Haemophilia.
8. Linkage and recombination.
9. Point mutation and changes in chromosome number with reference to chromosomal aberrations. Down syndrome and Klienfelter syndrome.
10. Sex determination in *Drosophila* and man.

Group C – Developmental Biology (20 marks) **20**
classes

1. Spermatogenesis and oogenesis.
2. Fertilization in sea-urchin.
3. Types of eggs and cleavage; process of cleavage in frog and chick
4. Gastrulation in frog and chick
5. Placentation in mammals.

Group D – Physiology and Biochemistry (20 marks) **20**
classes

1. Formed elements in vertebrate blood; clotting and coagulation; ABO blood

group and Rh factor.

2. Enzyme - classification and characteristics; mechanism of enzyme action; effects on enzymes action (substrate concentration, pH and temperature).
3. Classification of carbohydrate, protein and lipid; Concept of glycolysis and Krebs's cycle.
4. Neoglucogenesis.
5. A brief idea on muscle contraction.
6. Physiology of nerve impulse and synaptic transmission and neuromuscular junction.

Paper - III (Practical, 100 marks)

1. Dissection

Cockroach- Digestive, nervous and female reproductive system
Tilapia (*Oreochromis* sp) – urinogenital system and brain,

2. Mounting and preparation:

- a) Mouth parts of cockroach.
- b) Setae of earthworm.
- c) Cycloid, ctenoid and placoid scales.
- d) Blood film of rat and haemolymph of cockroach (Leishman/Giemsa stain).
- e) Gut content of cockroach for parasites.
- f) Whole mount of aquatic micro-arthropods.
- g) Epithelial cells from buccal smears.

3. Identification with reasons:

- a) Bones:** Skull, vertebrae, limb and girdle bones of *Columba* and *Cavia*.
- b) Histological slides:** T.S. of mammalian ileum, lung, liver, pancreas, testis, ovary, kidney and thyroid.
- c) Non-chordate specimens:** *Amoeba*, *Plasmodium*, *Paramoecium*, *Scypha*, *Obelia*, Sea-anemone, *Ascaris*, Leech, Centiped, Miliped, *Scorpion*, *Lamellidens*, *Achatina*, *Loligo*, *Starfish*, *Balanoglossus*.
- d) Chordate specimens:** *Ascidia*, *Branchiostoma*, *Petromyzon*, *Scoliodon*, *Anabas*, tree frog, Axototl larva, *Tylototriton*, *Gecko*, *Hemidactylus*, *Mabuia*, *Turtle*, *Naja*, *Chiroptera*.

4. Report on field study tour:

Any **one (1)** site of Zoological importance: (Zoogarden, Museum, Sericulture centre, Apiculture centre, Fisheries, Agricultural firm or such places).

5. Viva-voce

6. Laboratory Note book

Part – III

Paper - IV A (Theory – 60 marks)
60 classes

Aquaculture - Principles, definition and scope. Fisheries resources of India (inland and off-shore). Exotic fishes - their merits and demerits. Induced breeding and its importance. Basic principles of different aquaculture system (Polyculture and Integrated farming). Marine pearl culture, culture of prawn and shrimps.

Sericulture – Characteristics of sericulture industry and its scope; kinds of silk worm, host plants. Life history and rearing of *Bombyx mori*, harvesting and processing of cocoon, reeling and extraction of silk, pest on mulberry plants and diseases of *Bombyx mori* and control measures.

Apiculture - Types of honey bees, modern methods of apiary management, products and its uses. Problems and prospects.

Pest and Pest Management – Pest - definition, types, life history and control i) *Scirpophaga*, ii) *Sitophilus* and iii) *Bandicoota*, Concept on IPM.

Poultry and Poultry Management - Duck and fowl - Types of breeds, rearing and disease management.

Wild life and Biodiversity –

1. Conservation of Wild life – Importance and strategies, Concept of Biosphere Reserve, National Park and Wild life Sanctuary.
2. Basic concept of Biodiversity, Biodiversity hotspot.
3. Endangered Indian mammals, Animal Cruelty Prevention Act.

Biotechnology and Immunology –

1. Basic concept of genetic engineering and cloning;
2. Concept of immunity;
3. Outline structure and classification of immunoglobulin; antigen-antibody reaction;
4. Basic principle of vaccination.

Paper – IV B (Practical 40 marks)

1. Experimental works:

- i) Estimation of dissolved O₂ content of water.
- ii) Estimation of dissolved free CO₂ content of water.
- iii) Pedigree analysis: sex-linked recessive, autosomal recessive and dominant.
- iv) Determination of ABO blood group and Rh factor.
- vii) Measurement of pH of water.
- viii) Sampling of zooplankton and extraction of soil micro-arthropods.
- ix) Tests for food colors/ adulteration: mustard oil, red chili powder, turmeric powder, toxic colors in vegetables/ sweets.

2. Field excursion: (submit report of field excursion at **any one** place from below) i) Estuarine/ freshwater fish farm.

- ii) Poultry centre.
- iii) Apiary.
- iv) Sericulture centre.
- v) Places of wildlife interest (sanctuary, national park, biosphere reserve etc)
- vi) Agricultural farms for pest study and idea of IPM practices.
- vi) Species diversity studies in forest ecosystem/coastal regions.

3. Identification: (write specimen characters, scientific name and applied importance)

Plasmodium, microfilaria of *Wuchereria bancrofti*, *Taenia solium*, *Scirpophaga insertulas*, *Sitophilus oryzae*, *Leucinodes orbonalis*, *Anomis sabulifera*, *Bombyx mori*, *Lepisma*, Termite, *Bandicoota bengalensis*, *Labeo rohita*, *L. bata*, *Catla catla*, *Cirrhinus mrigala*, *Hypophthalmichthyes molitrix*, *Cyprinus carpio*, *Ctenopharyngodon idella*, *Lates calcarifer*, *Temialosa ilisha*, *Penaeus monodon*, *Macrobrachium rosenbergi*.

4. Viva-voce

5. Laboratory Note book