

*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

<b>Part-I</b>		<b>F.M: 100</b>	
	<b>Paper I</b>	<b>Marks</b>	<b>Lectures/periods</b>
Theory	ELTG 122 101A. Electron Device & Passive Circuits	50	50
	ELTG 122 101B. Linear Active Circuits	50	50
<b>Part-II</b>		<b>F.M: 200</b>	
	<b>Paper II</b>	<b>Marks</b>	<b>Lectures/periods</b>
Theory	ELTG 122 201A. Digital Electronics	50	50
	ELTG 122 201B. Modern Electronic Instrumentation	50	50
	<b>Paper III</b>		
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
<b>Part-III</b>		<b>F.M: 100</b>	
	<b>Paper IV</b>	<b>Marks</b>	<b>Lectures/periods</b>
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- $\Pi$  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. Cirrcuit 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.

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- (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<sup>l</sup>, 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.