RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

Syllabus for B.Sc. Electronics (General)

Semester – II/IV (January - June)
Course – ELTG2

Course Outcome:

i) Ability to identify Integrated Circuits (ICs) and study their characteristics.

ii) To impart the basic concepts of Analog ICs such as Operational Amplifier (OPAMP) and Timer Chip (IC 555), with hands-on experiments using them in the laboratory.

iii) To gain knowledge of various means of electronic communication.

iv) To have theoretical knowledge of various technologies of different communication means and to get practical experience of those in the laboratory.

Analog ICs and Communication
(Theory)
Paper: ELTG2

Marks: 50 **Credit:** 4

A: Analog ICs:

1. OPAMP and its applications: Open and closed loop characteristics: voltage gain, input impedance, output impedance; input bias current, input offset current, input offset voltage, common mode rejection ratio (CMRR), Slew-rate; Schematic of Internal Structure and Working Principle. Inverting amplifier, Concept of virtual ground, Scale Changer, Phase Shifter, Non-inverting amplifier, Concept of virtual short, Unity gain buffer and its importance in circuit application, Adder (Analog) Circuit, Differential amplifier / Subtractor Circuit,

Differentiator, Integrator, Voltage comparator, Peak detector; Schmitt-trigger circuit and its operation. IC 741.

Digital to Analog Convertor (DAC), DAC types, Weighted Resistor DAC and R-2R Ladder DAC, Schematic circuit and Principle of Operation. Analog to Digital Convertor (ADC): Only Basic Concept. [8]

2. Clock and Timer circuit (IC 555): Functional Block Diagram of IC 555, IC 555 properties and basic operation. Astable and Monostablemultivibrators: Schematic Circuit and Principle of Operation. Application as a pulse generator and rectangular/square wave generator. [4]

B: Communication:

3. Electronic Communication: Introduction to Communication, Means and Modes, Need for Modulation, Block Diagram of an Electronic Communication System, Brief Idea of Frequency Allocation for Radio Communication System in India (TRAI), Electromagnetic Communication Spectrum, Band Designations and Usage, Channels and Base-Band Signals.

Noise, Internal and External Noises, Signal-to-Noise (S/N) Ratio and Noise Figure. [5]

4. Amplitude Modulation and Demodulation: Definition, Representation, Modulation Index, Expression for Instantaneous Voltage, Power Relations, Frequency Spectrum, Concept of DSBFC, DSBSC, SSBSC: Generation and Detection, Limitations of AM.

Demodulation: AM Detection, Diode Detector Circuit, Principle of Working and Waveforms, Concept of VSB, Block Diagram of AM Transmitter and Receiver. [5]

5. Frequency and Phase Modulation / Demodulation: Definition, Representation, Modulation Index, Frequency Spectrum, Bandwidth Requirements, Frequency Deviation and Carrier swing, Equivalence between FM and PM, Generation of FM using VCO.

Demodulation: FM Detector, Slope Detector Circuit, Principle of Working and Waveforms, Block Diagram of FM Transmitter and Receiver, Comparison of AM and FM. [5]

6. Analog Pulse Modulation: Channel Capacity, Sampling Theorem, Basic Principles of PAM, PWM and PPM, Modulation and Detection Technique for PAM only, Multiplexing, FDM and TDM [4]

7. Digital Modulation Techniques: Need for Digital Transmission, Block Diagram of Digital Transmission and Reception, Pulse Code Modulation, Sampling, Quantization (Uniform and Non-uniform), Quantization Error, Companding, Encoding, Decoding, Regeneration.

Concept of Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK), Advantages and Disadvantages of Digital Communication.

Characteristics of Data Transmission Circuits, Shannon Limit for Information Capacity, Bandwidth Requirements, Data Transmission Speed: Bit rate and Baud Rate, Effect of Noise, Cross Talk, Echo Suppressors, Distortion & Equalizer. [7]

8. Radio-wave communication: Characteristics of electromagnetic wave, propagation of radio waves at different frequencies, structure of the atmosphere, ground wave propagation, sky wave propagation, concept of critical frequency and virtual height, maximum usable frequency and skip distance (qualitative discussions only). Space wave communication (Basic Idea). Satellite communication (Basic Idea) [5]

9. Cellular Communication: Concept of Cellular Mobile Communication, Frequency Bands used in Cellular Communication, Concept of Cell Sectoring and Cell Splitting, Absolute RF Channel Numbers (ARFCN), Frequency Reuse, Roaming and Hand Off, Authentication of SIM Card of Subscribers, IMEI Number, Need for Data Encryption, Architecture (Block Diagram) of Cellular Mobile Communication Network.

Concept of GSM, CDMA, TDMA and FDMA, Comparison of TDMA and FDMA Technology, Simplified Block Diagram of Cellular Phone Handset, Comparative Study of GSM and CDMA. Qualitative concepts of 2G, 3G and 4G, Qualitative idea of GPS Navigation System. [7]

Text / Reference Books:

1. Foundations of Electronics, Chattopadhyay and Rakshit, New Age.
2. Fundamental Principle of Electronics, B. Ghosh, Books & Allied.
3. Basic Electronics, Theraja, S. Chand.
4. Electronic Devices and Circuit Theory, R. L. Boylestad and L. Nashelsky, Pearson Education.
5. Basic Electronics and Linear Circuits, N. N. Bhargava et. al., TMH.
6. Analog and Digital Electronics, TaraprasadChattopadhyay, CBS Pub and Distributors.
7. Basic Electronics, K.K.Ghosh, Platinum Publisher.
8. Electronics (Classical and Modern), Dr. R. K. Kar, Books & Allied.
9. Electronics o BetarBigyanPorichoy (Bengali), Animesh Roy and Pradip Kr. Dutta, PoschimbongoRajyoPustokParsat.
10. Electronic Devices and Circuits, Bell, Oxford.
11. Foundations of Electronics, Cogdell, Pearson.
12. Electronic Circuits: Discrete and Integrated, Schilling and Belove, Tata McGraw Hill.

13. Microelectronic Circuits, Sedra, Smith and Chandorkar, Oxford.
14. Integrated Electronics: Analog and Digital Circuits and Systems, Millman and Halkias, Tata McGraw Hill.
15. Semiconductor Devices and Circuits, Dutta, Oxford.
16. Electronic Devices and Circuits, Rashid, Cengage.
17. Electronic Devices and Circuits, Bogart, Beasley and Rico, Pearson.
18. OP-Amp and Linear Integrated circuits, Gaykwad, Pearson.
19. OP-Amp and Linear Integrated circuits, Coughlin and Driscoll, PHI.
20. OP-Amp and Linear Integrated Circuits, Roychodhury and Jain , New Age
21. Modern Digital and Analog Communication Systems, B.P. Lathi, Zhi Ding, Oxford University Press.
22. Electronic communication system, Kennedy, Davis, TMH.
23. Wireless Communication and Networks: 3G and Beyond, I. SahaMisra, TMH Education.
24. Wireless Communications: Principles and Practice, T.S., PHI Learning.
25. Wireless Communications, A. Goldsmith, Cambridge University Press.
26. Lee's Essentials of Wireless Communications, MH Prof. Med/Tech.
27. Wireless Digital Communications: Modulations and Spread Spectrum Applications,K. Feher, Prentice Hall.
28. Wireless Communications and Networking, J. W. Mark and W. Zhuang, PHI.
29. Wireless Networks: Applications and Protocols, T. S. Rappaport, Pearson Education.
30. Electronic communication system, Prasanna, Kennedy, Davis, Tata McGraw Hill.

Analog ICs and Communication
(Practical)
Paper: ELTG2

Marks: 25 **Credit:** 2

Section-A: Hardware implementation of the following circuits:

1. To Design an Inverting and Non-Inverting Amplifiers using Op-Amp (741/351) for DC Voltage of given Gain.

2. (a) To Design Inverting Amplifier using Op-Amp (741/351) and Study its Frequency Response. (b) To Design Non-Inverting Amplifier using Op-Amp (741/351) and Study Frequency Response.

3. To Add two DC Voltages using Op-Amp in Inverting and Non-Inverting Mode.

4. To Study Zero-Crossing Detector and Comparator.
5. To Design Precision Differential Amplifier of given I/O Specification using Op-Amp.
6. To Investigate use of Op-Amp as Integrator.
7. To Investigate use of Op-Amp as Differentiator.
8. To Design Wien Bridge Oscillator for given Frequency using an Op-Amp.
9. To Design a Circuit to Simulate the Solution of Simultaneous Equation and 1st/2nd Order Differential Equation.
10. To Design AstableMultivibrator of given Specification using IC 555 Timer.
11. To Design MonostableMultivibrator of given Specification using IC 555 Timer.
12. To design and study the amplitude modulator and demodulator circuit.

Section-B: SPICE/MULTISIM Simulations for Electronic Circuits and Devices:

13. To Verify the Thevenin's and Norton's Theorems.
14. Design and Analyze the Series and Parallel LCR Circuits.
15. Design the Inverting and Non-Inverting Amplifier using an Op-Amp of given Gain.
16. Design and Verification of Op-Amp as Integrator.
17. Design and Verification of Op-Amp as Differentiator.
18. Design the 1st Order Active Low Pass and High Pass Filters of given Cutoff Frequency.
19. Design a Wein's Bridge Oscillator of given Frequency.
20. Design Clocked SR and JK Flip Flops using NAND Gates.
21. Design 4-Bit Asynchronous Counter using Flip Flop ICs.
22. Design the CE Amplifier of a given Gain and Study its Frequency Response.

Text / Reference Books:

1. Advanced Practical Physics (Vol 1), B. Ghosh.
2. Advanced Practical Physics (Vol 2), B. Ghosh.
3. An advanced course in Practical Physics, Chattopadhyay and Rakshit, New Central Book Agency.
4. Basic Electronics: A Text Lab Manual, Zbar, TMH.
5. Laboratory Manual for Electronic Devices and Circuits, Bell.
6. Practical Physics, D. K. Maiti.
7. PSpice using OrCAD, Rashid, PHI.