Ramakrishna Mission Vidyamandira

Curriculum for B.Sc. General in Electronics under CBCS
Session: 2021-22, 2022-23

Programme Specific Outcome:

The curriculum and syllabus for Bachelor degrees is aimed to outcome based teaching learning process. The curriculum and syllabus have been structured in such a way that each of course meets some or more of the following outcomes. Student outcomes describe what students are expected to know and be able to do by the time of the undergraduate course. These involve the skills and knowledge that students acquire as they progress through the program. The key outcomes are stated as below:

i. Ability to apply theoretical knowledge of circuit and devices and knowledge of logical and computational mathematics that are relevant and appropriate to the domain analysis.
ii. Ability to analyse a problem based on real life application, identify and define the designing requirements, which may be appropriate to the specific solution.
iii. Ability to implement, evaluate and justify the system based on some circuits and devices to meet the desired needs.
iv. Understanding of professional, ethical, legal, security, social issues and responsibilities related to the domain of application.
v. Ability to analyze the local and global impact of the application on individuals, organizations, and society.
vi. Ability to incorporate IT / Electronic system and Tele-communication based solutions and services to the society.
vii. Ability to use and apply conventional and current technical concepts and practices in the core development areas of Electronics industry and Tele-communication Engineering.
viii. Development of ability to assist and manage the execution of an effective project plan.

Distribution of Courses:

Semester I			
Course Code	**Paper Code**	**Course Title**	**Credit**
ELG1	ELG1 [Th]	Network Analysis and Analog Electronics (Theory)	4
	ELG1 [Pr]	Network Analysis and Analog Electronics (Practical)	2

Semester II			
Course Code	**Paper Code**	**Course Title**	**Credit**
ELG2	ELG2 [Th]	Analog ICs and Communication (Theory)	4
	ELG2 [Pr]	Analog ICs and Communication (Practical)	2

Semester III			
Course Code	**Paper Code**	**Course Title**	**Credit**
ELG1	ELG1 [Th]	Network Analysis and Analog Electronics (Theory)	4
	ELG1 [Pr]	Network Analysis and Analog Electronics (Practical)	2

Semester IV			
Course Code	**Paper Code**	**Course Title**	**Credit**
ELG2	ELG2 [Th]	Analog ICs and Communication (Theory)	4
	ELG2 [Pr]	Analog ICs and Communication (Practical)	2

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

Syllabus for B.Sc. Electronics (General)

For the session 2021-23

Semester – I/III (July - December)

Course – ELG1

Course Outcome:

i) Ability to study and identify various circuit elements and electronic devices.

ii) Ability to study and analyze different circuits and networks.

iii) Ability to obtain theoretical knowledge of construction and characteristics of various electronic devices and also to have the idea of working of those devices.

iv) Ability to design and study circuits based on those devices and motivate the students to do hands-on experiments in the laboratory.

Network Analysis and Analog Electronics
(Theory)
Paper : ELG1 / Th
(Lectures: 50 hrs)

Marks: 50+25* **Credit: 4**

A: Network Analysis:

1. Electric Circuit Components: Resistors – types, configuration, colour coding, variable resistors, power rating; Capacitors – types, configuration, voltage rating, capacitor coding; Inductor coils – self-inductance and mutual-inductance, air-core and iron-core coils, variable inductance; Transformers: step up and step down. [4]

2. Network Theorems: Voltage and Current sources, Conversion of Voltage source into Current source and vice-versa, Dependent and Independent sources; Kirchoff's current law (***KCL***) and Kirchoff's voltage law (***KVL***), Circuit analysis using KCL and KVL; Mesh analysis and Node analysis; Star (***T*** or ***Y***) and Delta (***Pi*** or **Δ**) network, ***T*** to ***Pi*** and ***Pi*** to ***T*** conversions, Problem solving;

Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Superposition theorems, Reciprocity theorem, Principle of Duality, Applications to simple problems. [7]

3. Transient response and resonance: Charging and discharging of a capacitor in ***CR*** circuit. Forced oscillations in a ***RLC*** circuit (qualitative), series resonance, ***Q*** factor, parallel resonance (basic idea). [3]

B: Analog Electronics:

4. Introduction to Semiconductor Junction Diode: Band theory of solids (basic idea), Semiconductor – Intrinsic and Extrinsic, Formation of PN junction diode, Device fabrication steps (basic idea), Formation of Depletion layer and barrier field, Diode Equation and I-V Characteristics, Reverse Saturation Current, Idea of Static and Dynamic resistance; Zener and Avalanche Breakdown, Zener Diode, Zener Diode as Voltage Regulator. [4]

5. Junction Diode Applications: DC Load Line analysis, Quiescent (***Q***) Point; Rectifiers, Half Wave Rectifier, Full Wave Rectifiers (Center tapped and Bridge), Circuit Diagrams, Working and Waveforms, Ripple factor and Efficiency; Filter, Shunt capacitor filter, Its role in Power Supply, Output Waveform and Working, Expressions for Load and Line Regulation. [5]

6. Bipolar Junction Transistor: Construction, Principle and Working of NPN/PNP Transistor, Terminology, CE, CB and CC configurations and characteristics, Regions of operation (Active, Cut-off and Saturation), Current Gains $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$, Relations between $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$, Leakage Currents. [4]

7. Transistor Biasing: Need for Biasing, DC Load Line and Operating (***Q***) Point, Thermal Runaway, Stability of Biased BJT circuit and Stability Factors, Fixed Bias, Collector to Base Bias, Voltage Divider Bias and Emitter Bias, Circuits and Working. [4]

8. BJT Amplifiers: Small Signal Analysis of Single Stage CE Amplifier, h-Parameter Equivalent Circuit, Frequency Response, Input and Output Impedance, Current and Voltage Gains;

Amplifier Classes: Class A, B, AB and C Amplifiers, Their operation principle with example circuits, Comparison of efficiency for various classes. (Basic Idea).

Cascaded Amplifiers: Two-stage ***RC*** coupled amplifier and its frequency response. [6]

9. Feedback Amplifiers and Sinusoidal Oscillators: Concept of Feedback, Feedback types: Negative and Positive Feedback, Feedback Fraction and Feedback Ratio, Topologies and Practical Circuits, Advantages of Negative Feedback (Basic Idea).

Concept of Oscillators: Advantages of Positive Feedback (Basic Idea), Barkhausen Criterion for Sustained Oscillations, Phase-shift Oscillator, Colpitt's and Hartley Oscillators, Determination of Frequency and Condition of Oscillation. [7]

10. Unipolar Devices: Field Effect Transistors, Basic Structure and Types; JFET: n-channel and p-channel, Construction, Working and I-V Characteristics (Output and Transfer), Pinch-off voltage; MOSFET: Construction, MOS Capacitor, Channel Formation, n-channel (NMOS) and p-channel (PMOS), Threshold Voltage (Ideal and Real), Current-Voltage Relation, Depletion and Enhancement type (Normally ON/OFF) MOSFET, FET parameters. Advantages of FETs over BJTs. [6]

***Examination Marks Distribution:**

End Semester Marks:	50
Mid-Semester Marks:	20 (Scaling Down from 25)
Class Attendance:	05
Total:	75

Text / Reference Books:

1. *Circuit Theory*, A. Chakraborty, Dhanpat Rai & Co. (Pvt.) Ltd.
2. *Foundations of Electronics*, Chattopadhyay and Rakshit, New Age.
3. *Fundamental Principle of Electronics*, B. Ghosh, Books & Allied.
4. *Basic Electronics*, Theraja, S. Chand.
5. *Electronic Devices and Circuit Theory*, R. L. Boylestad and L. Nashelsky, Pearson Education.
6. *Basic Electronics and Linear Circuits*, N. N. Bhargava et. al., TMH.
7. *Analog and Digital Electronics*, Taraprasad Chattopadhyay, CBS Pub and Distributors.
8. *Basic Electronics*, K.K.Ghosh, Platinum Publisher.
9. *Electronics (Classical and Modern)*, Dr. R. K. Kar, Books & Allied.
10. *Foundations of Electronics*, Cogdell, Pearson.
11. *Electricity and Magnetism*, Yearwood.
12. *Network Analysis*, D. Roychowdhury, New Age.
13. *Circuits and Networks*, Sudhakar Shyammohan, Tata McGraw Hill.
14. *Electronics o Betar Bigyan Porichoy (Bengali)*, Animesh Roy and Pradip Kr. Dutta, Poschimbongo Rajyo Pustok Parsat.
15. *Electricity and Magnetism*, Chattopadhyay and Rakshit, New Central.
16. *Electric Circuits: Schaum's Solved Problems Series*, Nasar, Tata McGraw Hill.
17. *Electric Circuits: Schaum's Outline Series*, Nahvi and Edminister, Tata McGraw Hill.
18. *Essentials of Circuit Analysis*, Boylestad, Pearson.
19. *Engineering Circuit Analysis*, Hyat, Kemmerly and Durbin, Tata McGraw Hill.
20. *Applied Circuit Analysis*, Sadiku, Musa and Alexander, Tata McGraw-Hill.
21. *Electric Circuits*, Bel, Oxford.
22. *Circuits*, Carlson, Cengage.
23. *Network Analysis and Synthesis*, Kuo, Wiley.
24. *Introduction to Electric Circuits*, Dorf and Svoboda, Wiley.
25. *Network Theory: Analysis and Synthesis*, Ghosh, PHI.
26. *Electrical Circuits: An Introduction*, Smith and Alley, Cambridge.
27. *Electronic Devices and Circuits*, Bell, Oxford.
28. *Electronic Circuits: Discrete and Integrated*, Schilling and Belove, Tata McGraw Hill.
29. *Microelectronic Circuits*, Sedra, Smith and Chandorkar, Oxford.
30. *Integrated Electronics: Analog and Digital Circuits and Systems*, Millman and Halkias, Tata McGraw Hill.
31. *Electronic Circuits: Analysis and Design*, Neamen, Tata McGraw Hill.
32. *2000 Solved Problems in Electronics, Schaum's Outline Series*, Cathey, Tata McGraw Hill.
33. *Electronic Devices and Circuits: An Introduction*, Mottershead, PHI.
34. *Semiconductor Devices and Circuits*, Dutta, Oxford.
35. *Electronic Devices and Circuits*, Rashid, Cengage.
36. *Electronic Devices and Circuits*, Bogart, Beasley and Rico, Pearson.

Network Analysis and Analog Electronics
(Practical)
Paper : ELG1 / Pr
(Lectures: 20 hrs)

Marks: 25** **Credit: 2**

1. Verification of Thevenin's theorem and Norton's theorem.
2. Verification of Superposition theorem and Maximum power transfer theorem.
3. To study the series resonant RLC circuit and determine the resonant frequency, bandwidth and the Q factor.
4. To draw the static characteristic of forward-biased p-n junction diode and to determine the saturation current, diode quality factor, the dc and ac resistances at specified voltage.
5. To study the forward and reverse static characteristics of a Zener diode and to determine the breakdown voltage and dynamic resistance after breakdown.
6. To study the load and line regulation of a voltage regulator constructed using Zener diode.
7. To study half-wave and full-wave rectifier with and without capacitor filter. The waveform is to be studied with the help of a CRO.
8. To study the bridge-rectifier with and without filter. The waveform is to be studied with the help of a CRO.
9. Study of the I-V Characteristics of the Common Emitter Configuration of BJT and obtain r_i, r_o, β.
10. Study of the I-V Characteristics of a JFET.

****Marks Distribution:** ***Full Marks* = 25** (Exam will be conducted with Total Marks 50 and Scaled Down to 25)

***A. End Semester Practical Examination*:**	**25**	**(Evaluated by External Examiner)**
***B. Continuous Laboratory Work Assessment*:**	**20**	**(Evaluated by Internal Examiner)**
***C. Attendance and Class performance*:**	**05**	**(Evaluated by Internal Examiner)**
A+B+C	**50**	
Total = (A+B+C)/2:	**25**	

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.*

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Syllabus for B.Sc. Electronics (General)

For the session 2021-23

Semester – II/IV (January - June)
Course – ELG2

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 : ELG2 / Th
(Lectures: 50 hrs)

Marks: 50+25* **Credit: 4**

A: Analog ICs:

1. OPAMP and its Applications: Amplifier Fundamentals: Op-Amp Characteristics – voltage gain, input impedance, output impedance; input bias current, input offset current, input offset voltage, common mode rejection ratio (CMRR), Slewrate, Bandwidth. Op-Amp in open loop comparator mode, transfer characteristics; Different applications. Introduction to IC 741. [3]

Op-Amp in closed loop: Negative feedback and Positive feedback configuration;

Linear Op-Amp circuits: Concept of virtual short; Inverting and Non-inverting amplifiers, Unity Gain amplifier / Buffer, Adder, Phase shifter, Difference amplifier, Ideal and Practical Integrators, Differentiators. Analysis of some typical Op-Amp circuits. [5]

Non-linear Op-Amp circuits: Positive feedback comparators / Schmitt triggers; Peak-detector; Sample-Hold circuit. Wave form generators, Wien-bridge Oscillator, Multivibrators. [6]

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): Basic Concepts of Successive Approximation type ADC, Dual slope ADC. [4]

2. Clock and Timer Circuit (IC 555): Functional Block Diagram of IC 555, IC 555 properties and basic operation. Astable and Monostable multivibrators: Schematic Circuit and Principle of Operation. Application as a pulse generator and rectangular / square wave generator. [3]

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, 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. [7]

4. Amplitude Modulation and Demodulation: Definition of Amplitude Modulation (AM), Representation, Modulation Index, Expression for Instantaneous Voltage, Power Relations, Frequency Spectrum, Concept of Double Side Band with Carrier (DSBFC), Double Side Band suppressed Carrier (DSBSC), Single Side Band suppressed Carrier (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. [6]

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

Demodulation: FM Detector, Slope Detector Circuit, Principle of Working and Waveforms, Block Diagram of FM Transmitter and Receiver, Comparison of AM and FM. [6]

6. Analog Pulse Modulation: Channel Capacity, Sampling Theorem, Basic Principles of Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM) and Pulse Position Modulation (PPM), Modulation and Detection Technique for PAM, PWM and PPM, Multiplexing, Frequency Division Multiplexing (FDM) and Time Division Multiplexing (TDM) [5]

7. Digital Modulation Techniques: Need for Digital Transmission, Block Diagram of Digital Transmission and Reception, Pulse Code Modulation (PCM), 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. [5]

***Examination Marks Distribution:**

End Semester Marks:	50
Mid-Semester Marks:	20 (Scaling Down from 25)
Class Attendance:	05
Total:	75

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6. *Analog and Digital Electronics*, Taraprasad Chattopadhyay, 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 Betar Bigyan Porichoy (Bengali)*, Animesh Roy and Pradip Kr. Dutta, Poschimbongo Rajyo Pustok Parsat.
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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.
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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. Saha Misra, 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 : ELG2 / Pr
(Lectures: 20 hrs)

Marks: 25** **Credit: 2**

Section-A: Hardware implementation of the following circuits:

1. To Design an Inverting and Non-Inverting Amplifiers using Op-Amp (IC741) for DC Voltage of given Gain.
2. To Design Adder and Subtractor Circuit using Op-Amp in Inverting and Non-Inverting Mode.
3. To Investigate use of Op-Amp as Integrator.
4. To Investigate use of Op-Amp as Differentiator.
5. To Design Wien Bridge Oscillator for given Frequency using an Op-Amp.
6. To Design Astable Multivibrator of given Specification using IC 555 Timer.
7. To Design Monostable Multivibrator of given Specification using IC 555 Timer.
8. To design and study the amplitude modulator and demodulator circuit.

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

9. To Verify the Thevenin's and Norton's Theorems.
10. Design and Analyze the Series and Parallel LCR Circuits.
11. Design the Inverting and Non-Inverting Amplifier using an Op-Amp of given Gain.
12. Design and Verification of Op-Amp as Integrator / Differentiator.
13. Design a Wein's Bridge Oscillator of given Frequency.
14. Design the CE Amplifier of a given Gain and Study its Frequency Response.

****Marks Distribution:** ***Full Marks* = 25** (Exam will be conducted with Total Marks 50 and Scaled Down to 25)

***A. End Semester Practical Examination*:**	**25 (Evaluated by External Examiner)**
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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.