ಬೆಂಗಳೂರು
ನಗರ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

BENGALURU
CITY UNIVERSITY

ಆಗು ನೀ ಅನಿಕೇತನ
BE BOUNDLESS

BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM

(as per SEP 2024)

Syllabus for B.Sc. Electronics

(I to IV Semesters)

2025 - 26

BENGALURU CITY UNIVERSITY

B.Sc. Electronics Curriculum
for I to IV Semester
(*According to SEP – 2024 Regulations*)

Subject: ELECTRONICS
(2025 - 26 Onwards)

Bengaluru City University
Bengaluru

July – 2025

CONTENTS

ಬೆಂಗಳೂರು
ನಗರ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

BENGALURU
CITY UNIVERSITY

Office of the Registrar, Central College Campus, Dr. B.R. Ambedkar Veedhi, Bengaluru – 560 001.
PhNo.080-22131385, E-mail: registrarbcu@gmail.com

No.BCU/Syn/BoS/Electronics-UG/ತಿಕ /2021-22 Date: 27.12.2021

NOTIFICATION

Sub: Correction in the title of 'Electronic Science' Course as 'Electronics' reg

Ref: 1. Letter of the Chairman BoS in the Electronics dt. 16.12.2021
2. Statutes No. 9.1.29 of the Bangalore University regarding Dept. of Studies
3. Approval of the Vice-Chancellor dated:23.12.2021

****

In pursuance of the Statutes referred (2) above and by the direction of the Vice-Chancellor the title of the B.Sc 'Electronic Science' Course is corrected as 'Electronics'. Necessary corrections in the BCU admission portal & other relevant records shall be effected accordingly.

REGISTRAR

Copy to:
1. The Chairman BoS in Electronics, BCU
2. The Dean Faculty of Science, BCU
3. All Affiliated Science Colleges, BCU
4. The Registrar (Evaluation), BCU
5. The Finance Officers, BCU
6. PS to Vice-Chancellor / Registrar / Registrar(Evaluation)
7. University Website

Bengaluru City University Bengaluru

Central College Campus, Bengaluru-560 001.

ಬೆಂಗಳೂರು ನಗರ ವಿಶ್ವವಿದ್ಯಾಲಯ
BENGALURU CITY UNIVERSITY
ಆಗು ಏ ಅಪರಿಮಿತ
BE BOUNDLESS

Proceedings of the BoS in Electronics (UG).

Proceedings of the Board of Studies (BoS) in Electronics (UG) meeting held on **June 27th, July 1st & 2nd, 2025** in the Natural Science Block, Central College Campus, Bengaluru City University, Bengaluru.

The Members were present for the meeting are:

Sl. No.	Name	Designation	Signature
1.	Dr. Naveen Kumar S K, Senior Professor& Chairman, Department of Electronics, Mangalore University, Mangalore–574199	Chairman	
2.	Dr. M Subramanya Bhat Associate Professor& Head, Department of Electronics, Vijaya College, R V Road, Bengaluru– 560004	Member	
3.	Smt. V Madhumathi Associate Professor& Head, Department of Electronics, MES Degree College, Malleswaram, Bengaluru -560010	Member	consented
4.	Sri. Vijay Kumar A Patil Associate Professor, Department of Electronics, Basaveshwara College of Commerce, Arts and Science, II Block Rajajinagar, Bengaluru -560010	Member	
5.	Sri. K G Lakshminarayana Associate Professor, Department of Electronics, Vijaya College, Jayanagar, Bengaluru– 560011	Member	
6.	Dr. Mohana H K Associate Professor, Department of Electronics, Seshadripuram First Grade College, Yelahanka New town, Bengaluru -560064	Member	
7.	Ms. Jyothi V Associate Professor, Department of Electronics, Vijaya College, R V Road, Bengaluru– 560004	Member	
8.	Smt. Akilandeswari R Associate Professor& Head, Department of Electronics, Sindhi Degree College, Hebbal, Bengaluru.	Member	
9.	Sri. Parthasarathy N Associate Professor, Department of Electronics, Govt. First Grade College K R Puram, Bengaluru.	Member	
10	Dr. Mohan Keshava K K Associate Professor & Head, Department of Electronics, Maharani Cluster University, Palace Road, Bengaluru.	Member	consented.

In the beginning, The Chairman extended warm welcome to all the BoS Members and thanked them for accepting the assignment.

The main agenda of the meeting to prepare, discuss & approve the followings.

1. Ratification of I & II Semester B.Sc. Electronics (UG) SEP-2024 Scheme Syllabus for 2024-25 Batch.
2. III & IV Semester B.Sc. Electronics (UG) SEP-2024 Scheme Syllabus for 2024-25 Batch & onwards
3. Question Paper Pattern for SEP-2024, "B.Sc. Electronics (UG)" Theory.
4. Question Paper Pattern for SEP-2024, "B.Sc. Electronics (UG)" Practical.
5. Panel of Examiners for the Academic year 2025-26
6. Approval to start B.Sc. Electronics new Combination for UG Course in affiliated colleges
7. Approval to Start M.Sc. Electronics PG Course in University Campus
8. Approval to Commencement of BEA (Bachelor of Electronics Applications) new UG course in different affiliated colleges

The agenda of the meeting i.e., framing of syllabus for the III & IV Semester B.Sc. Degree in Electronics under SEP-2024, was taken for discussion. After thorough discussions the following resolutions were made.

Resolutions:

1. The suggested **model course structure** for the UG degree of the Bengaluru City University under SEP-2024 Programme for the academic year 2025-26 and onwards was discussed and approved.

2. Syllabus and Scheme for the **First and Second** semester B.Sc. degree programme in Electronics was discussed, revamped and approved.

3. Syllabus and Scheme for the **Third and Fourth** Semester B.Sc. degree programme in Electronics was prepared and discussed. The board resolved to approve third and fourth semester syllabus for Electronics to be implemented effective from academic year 2024-25 batch and onwards.

4. Question paper pattern for both **Theory and Practical**, scheme of evaluation/ assessment and award of Internal Assessment (IA) marks were discussed and approved.

5. Eligibility criteria for **admission** to B.Sc. degree programme in Electronics were discussed and resolved to approve as follows:
   "Who have passed **PUC/10+2/ITI/ Diploma** (Electronics / Electrical / Medical Electronics/Computer Science/Telecommunications) or equivalent."

6. It was resolved that number of students for practical shall be **ten students** (10) per Batch.

7. The **panel of Examiners** B.Sc. in Electronics for the academic year 2024-25 was prepared and approved.

8. The Board also discussed & approved the Commencement of **new combinations** for B.Sc. (UG) courses with PECs (Physics, Electronics & Computer Science) and ECsSt (Electronics, Computer Science & Statistics) from 2026-27 & onwards in different affiliated colleges under Bengaluru City University.

9. The Board also discussed & approved the Commencement of Post Graduate (PG) course **M.Sc. in Electronics** Programme in Bengaluru City University, Central College Campus, Bengaluru, to help the student community of Bengaluru City University for pursuing their higher studies in Electronics.

10. The Board understood the Commencement of **BEA** (**Bachelor of Electronics Applications**) Programme in different affiliated colleges under Bengaluru City University which will help the student community to pursue professional & industrial need course.

Finally, the Chairman extended vote of thanks to all BoS members for their active participation.

Dr. Naveen Kumar SK
Chairman
BoS in Electronics (UG)
Bengaluru City University
Bengaluru-01

Bengaluru City University Bengaluru

Central College Campus, Bengaluru-560 001.

ಬೆಂಗಳೂರು ನಗರ ವಿಶ್ವವಿದ್ಯಾಲಯ BENGALURU CITY UNIVERSITY

ಹಗು ಧೀ ಅಭೀಕ್ಷಾ BE BOUNDLESS

Program Structure and Course Discipline for I to IV Semester B.Sc. Electronics

(*According to SEP – 2024 Regulations*)

From the Academic Year 2025-26

Sl. No.	Semester	Course Code	Course Title	Teaching Hours/Week			Examination				Total Credits
				L	T	P	Examination Hours	CIA Marks	SEE Marks	Total	
1	I	DSC-ELECT1	Analog and Digital Electronics- I	4	0	0	3	20	80	100	3
2		DSC-ELECP1	Analog and Digital Electronics Lab-I	0	0	3	3	10	40	50	2
1	II	DSC-ELECT2	Analog and Digital Electronics- II	4	0	0	3	20	80	100	3
2		DSC-ELECP2	Analog and Digital Electronics Lab- II	0	0	3	3	20	80	100	2
1	III	DSC-ELECT3	Embedded C and Digital Design using Verilog - III	4	0	0	3	20	80	100	3
2		DSC-ELECP3	Embedded C and Digital Design using Verilog Lab - III	0	0	3	3	10	40	50	2
3		ELE. Elective 3.1	Renewable Energy and Energy harvesting	2	0	0	2	20	80	100	2
4		ELE. Elective 3.2	Power Electronics & E-Vehicles	2	0	0	2	20	80	100	2
1	IV	DSC-ELECT4	Advanced Communication Systems	4	0	0	3	20	80	100	3
2		DSC-ELECP4	Advanced Communication Systems Lab-IV	0	0	3	3	10	40	50	2
3		ELE. Elective 4.1	Computer Networks	2	0	0	2	10	40	50	2
4		ELE. Elective 4.2	Meditronics	2	0	0	2	20	80	100	2

Preamble

This model curriculum content for B.Sc. Electronics as per SEP-2024 is intended to enable the graduates to respond to the current needs of the industry and equip them with skills relevant for national and global standards. The framework encourages innovation in teaching-learning process and appropriate assessment of student learning levels.

Introduction

B.Sc. Electronics is a program which needs to develop a specialized skill set among the stake holders to cater to the need of industries. The curriculum is designed to help students to analyse, appreciate, understand and critically engage with learning of the subject and also to provide better learning experience to the stake holders. Apart from imparting disciplinary knowledge, the curriculum is aimed to equip the students with competencies like problem solving and analytical reasoning which provide them high professional competence. The University is expected to encourage its faculty concerned to make suitable pedagogical innovations, in addition to teaching learning processes suggested in the model curriculum, so that the Course/Programme learning outcomes can be achieved.

Significance of Electronics

Nowadays, Electronics has made unprecedented growth in terms of new technologies, new ideas and principles. The research organizations and industries that work in this frontier area are in need of highly knowledgeable, skilled and scientifically oriented manpower. This manpower can be available only with flexible, adaptive and progressive training programs and a cohesive interaction among the institutions, universities and industries.

The key areas of study within Electronics subject comprise: Semiconductor devices and its application, Analog and digital circuit design, Microprocessors & Microcontroller systems, Computer coding / Programming in high level languages etc. and also modern applied fields such as Embedded systems, Data communication, Robotics, Control systems, IoTs, etc,.

Eligibility criteria

Students who have passed PUC/ 10+2 / ITI / Diploma (Electronics / Electrical / Information Science / Medical Electronics/ Computer Science/ Telecommunications) or equivalent are eligible for opting Electronics in UG program.

Program Objectives

The overall objectives of the B.Sc. Electronics program are to:

- Provide students with learning experiences that develop broad knowledge and understanding of key concepts of electronics and equip students with advanced scientific / technological capabilities for analysing and tackling the issues and problems in the field of Electronics.

- Develop ability in students to apply knowledge and skills acquired to solve specific problems in Electronics.

- Develop abilities in students to design and develop innovative solutions for the benefit of society.

- Provide students with skills that enable them to get employment in various organisations, industries, pursue higher studies, research assignments and turn as entrepreneurs.

Program outcomes

- Ability to apply knowledge of logical thinking and basic science for solving Electronics related problems.

- Ability to perform Electronics experiments, as well as to analyse and interpret data.

- Ability to design and manage Electronic systems or processes that conforms to a given specification within ethical and economic constraints.

- Ability to identify, formulate, analyse and solve the problems in various sub disciplines of Electronics.

- Ability to use Modern Tools / Techniques.

Course Pattern and Scheme of Examination for B.Sc. in Electronics

Sl. No.	Semester	Title of the Paper	Teaching Hours	Hours / week		Examination Pattern Max. & Min. Marks /Paper						Duration of Exam (Hours)		Total Marks / paper	Credits	
						Theory			Practical							
				Theory	Practical	Max.	Min.	IA	Max.	Min.	IA	Theory	Practical		Theory	Practical
1	**I**	**ELE-CT1:** Analog and Digital Electronics- I	**60**	**4**	**3**	**80**	**32**	**20**	**40**	**16**	**10**	**3**	**3**	**150**	**3**	**2**
2	**II**	**ELE-CT2:** Analog and Digital Electronics- II	**60**	**4**	**3**	**80**	**32**	**20**	**40**	**16**	**10**	**3**	**3**	**150**	**3**	**2**
3	**III**	**ELE-CT3:** Embedded C and Digital Design using Verilog - III	**60**	**4**	**3**	**80**	**32**	**20**	**40**	**16**	**10**	**3**	**3**	**150**	**3**	**2**
		ELE-Elective : 3.1 / 3.2	**30**	**2**	**-**	**80**	**32**	**20**	**-**	**-**	**-**	**2**	**-**	**100**	**2**	**-**
4	**IV**	**ELE-CT4:** Advanced Communication Systems - IV	**60**	**4**	**3**	**80**	**32**	**20**	**40**	**16**	**10**	**3**	**3**	**150**	**3**	**2**
		ELE-Elective : 4.1 / 4.2	**30**	**2**	**-**	**80**	**32**	**20**	**-**	**-**	**-**	**2**	**-**	**100**	**2**	**-**

Scheme of Internal Assessment Marks: **THEORY**

Sl. No.	Particulars	IA marks
1	Internal Tests (Minimum of Two)	**10**
2	Assignments /Seminar / Case Study / Project work / Reports on - visits to industries/exhibitions/science center's / active participation in Electronics competitions, etc.	**10**
	TOTAL Theory IA Marks	**20**

Scheme of Internal Assessment Marks: **PRACTICAL**

Sl. No.	Particulars	IA marks
1	Practical Tests	**05**
2	Report on datasheet of electronic devices / Seminar on electronics experiments/ Active participation in practical classes	**05**
	TOTAL Practical IA Marks	**10**

FIRST SEMESTER

Syllabus for Core Subjects

Course Title: ELE-CT1: ANALOG AND DIGITAL ELECTRONICS-I	Course Credits: 3
Total Contact Hours: 56 Hrs.	Duration of ESA: 4 Hrs.
Formative Assessment Marks: 20 marks	Summative Assessment Marks :80 marks

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research.
2. Acquire experimental skills, analyzing the results and interpret data.
3. Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets/ systems / processes that conforms to a given specification within ethical and economic constraints.
4. Capacity to identify and implementation of the formulae to solve the electronic related issues and analyses the problems in various sub disciplines of electronics.
5. Capability to understand the working principles of the electronic devices and their applications.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**
Aptitude to apply Logic thinking and Basic Science knowledge forproblem solving in various fields of electronics both in industries and research	**x**					
To acquire experimental skills, analyzing the results and interpret data.						
Ability to design / develop / manage / operation and maintenance ofsophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.						
Capacity to identify and implementation of the formulae to solve the electronic related issues and analyses the problems in various sub disciplines of electronics.						

ELE - CT1: **Analog and Digital Electronics - I** 56 Hours.

UNIT – 1 14 Hrs.

Network Theorems: KCL & KVL, Superposition, Thevenin's, Norton's, Maximum Power Transfer and Reciprocity Theorems. DC analysis of RC circuits, AC analysis of RLC series and parallel Resonant Circuits.

PN junction diode, Zener diode: Working, characteristics and applications.

Rectifiers: Half wave and Full wave rectifiers, expressions for output voltage, ripple factor and efficiency (bridge rectifier), Shunt capacitor filter.

Voltage regulator: Line and Load regulation, Zener diode as voltage regulator – circuit diagram, load and line regulation, disadvantages. Fixed and Variable IC Voltage Regulators (78xx, 79xx, LM317), Clippers and Clampers, Voltage Multipliers. SMPS block diagram.

UNIT – 2 14 Hrs.

Bipolar Junction Transistor: Types, Construction, working and configurations, characteristics in CE mode, leakage currents, Current gains α, ß and ɣ and their inter-relations, dc load line and Q point. Transistor as a switch.

Transistor biasing: Thermal runaway, stability and stability factor. Types of biasing, Voltage Divider Bias.

Amplifier: classification, parameters, derivation for voltage and current gain of CE amplifier using r_e- model. Advantages of CC amplifier. Two stage RC Coupled Amplifier – circuit, working and its Frequency Response. Concept of feedback-positive and negative- advantages and disadvantages.

UNIT – 3 14 Hrs.

Number System: Decimal, Binary and Hexadecimal number systems, base conversions, representation of signed and unsigned numbers. Addition, subtraction, BCD code (8421), Gray code, error checking and correction codes, ASCII codes.

Positive and negative logic, Boolean laws, Duality Theorem, De Morgan's Theorems, logic gates- AND, OR, NOT,NAND, NOR, XOR & XNOR. Universal property of NOR and NAND gates. SOP and POS, Minterm, Maxterm, SSOP, SPOS, Simplification of Boolean expressions, K-Map for 3 and 4 variables.

UNIT – 4 14 Hrs.

Half Adder, Full Adder, Half Subtractor, Full Subtractor. 4-bit parallel binary adder, 2-bit magnitude comparator. Encoder: 4:2 encoder, decimal to BCD priority encoder (74147). Decoder: 2:4 decoder using AND gates, 3:8 decoder using NAND gates, BCD to decimal decoder(7445), BCD to 7- Segment decoder(7446), Multiplexer: 4:1 multiplexer, 1:4-De-multiplexer (logic diagram and truth table of each).

REFERENCES:

1. Robert L Boylestad, "Introductory circuit analysis", 5th edition, Universal Book 2003.
2. R S Sedha, "A Text book of Applied Electronics", 7th edition, S. Chand and Company Ltd. 2011.
3. A.P. Malvino, "Principles of Electronics", 7th edition, TMH, 2011.
4. Electronic devices and circuit theory by Boylestad, Robert Nashelsky, 11th Edn, Pearson, 2013.
5. David A. Bell "Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2015.
6. Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia, (1994)
7. Digital Principles and Applications, A.P. Malvino, D.P. Leach and Saha, 7th Edn, TMH, 2011.
8. Fundamentals of Digital Circuits, Anand Kumar, 2ndEdn, PHI Learning Pvt. Ltd. 2009.
9. Digital Circuits and Systems, K R Venugopal and K Shyla, Tata McGraw Hill, 2011
10. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, PHI Learning, 2001.
6. M. Nahvi & J. Edminister, "Electrical Circuits", Schaum's Outline Series, TMH, 2005
7. S. A. Nasar," Electrical Circuits", Schaum's outline series, Tata McGraw Hill, 2004
8. J. Millman and C. C. Halkias, "Integrated Electronics", Tata McGraw Hill, 2001
9. A.S. Sedra, K.C. Smith, A.N. Chandorkar "Microelectronic circuits", 6th Edn., Oxford University Press, 2014
10. J. J. Cathey, "2000 Solved Problems in Electronics", Schaum's outline Series, TMG, 1991.

Course Title: ELE-CP1: ANALOG AND DIGITAL ELECTRONICS-I Lab	Course Credits: 2
Total Contact Hours: 56 Hrs.	Duration of ESA: 4 Hrs.
Formative Assessment Marks: 10 marks	Summative Assessment Marks: 40 marks

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research.
2. To acquire experimental skills, analyzing the results and interpret data.
3. Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets/ systems / processes that conforms to a given specification within ethical and economic constraints.
4. Capacity to identify and implementation of the formulae to solve the electronic related issues and analyses the problems in various sub disciplines of electronics.
5. Capability to use the Modern Tools / Techniques.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with ProgramOutcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6
Aptitude to apply Logic thinking and Basic Science knowledge forproblem solving in various fields of electronics both in industries and research						
To acquire experimental skills, analyzing the results and interpret data.	x					
Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.						
Capacity to identify and implementation of the formulate to solve the electronic related issues and analyze the problems in various subdisciplines of electronics.						
Capability to use the Modern Tools / Techniques.						

ELE-CP1: **ANALOG AND DIGITAL ELECTRONICS-I Lab**

(Hardware implementation and Analysis of Circuit using Simulation Software)

(Minimum **Eight** Experiments)

1. Demonstration Experiments: Hands on Experimental Skills and Familiarization with
   a) Electronic components
   b) Resistance in series, parallel and series-parallel
   c) Capacitors and inductors in series and parallel
   d) Multimeter and LCR meter – checking of components / measurements.
   e) Voltage sources in series, parallel and series-parallel
   f) Voltage and current dividers
   g) Measurement of Amplitude, Frequency & Phase difference using oscilloscope
2. Verification of Thevenin's Theorem.
3. Verification of Maximum Power Transfer.
4. Verification of Superposition Theorem.
5. Study of the I-V Characteristics of a P-n junction diode.
6. Study of the I-V Characteristics of a Zener diode
7. Study of half wave rectifier without and with shunt capacitor filter.
8. Study of full wave bridge rectifier without and with shunt capacitor filter.
9. Study of Zener diode as a Voltage Regulator.
10. Study of Clipping, Clamping and Voltage Multiplier circuits.
11. Designing and testing of fixed positive and negative voltage regulators using 78xx and 79xx series ICs.
12. Designing and testing of variable voltage regulator using IC LM317.
13. Study of Transistor characteristics in CE configuration.
14. Study of Voltage divider bias circuit.
15. Study of single stage CE amplifier.
16. Study of two-stage RC-coupled CE amplifier.
17. Study of Series and Parallel Resonance circuits.
18. Verification of truth tables of OR, AND, NOT, NAND, NOR, XOR and XNOR gates using respective ICs.
19. Universal property of NAND and NOR gates.
20. Binary to Gray and Gray to Binary code conversion and parity checker using XOR gates IC 7486.
21. 2-bit Comparator using logic gates.
22. Multiplexer & DE multiplexer Circuits.
23. Encoder & Decoder circuits.

Using analog simulator (LT spice, Circuit Logix, NI Multisim, Circuitmake, EasyEDA, Every Circuit, PSpice, Docircuits, etc.,) at least Five experiments are to be performed.

SECOND SEMESTER

Course Title: ELE - CT2: ANALOG AND DIGITAL ELECTRONICS-II	Course Credits: 3
Total Contact Hours: 56 Hrs.	Duration of ESA: 4 Hrs.
Formative Assessment Marks: 20 marks	Summative Assessment Marks: 80 marks

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Understand and study the behavior of the semiconductor devices i.e., I-V characteristics of various MOSFET devices the knowledge can be extended for understanding the behavior /characteristics/ response of unknown / novel devices.
2. Applying the standard device models to explain/calculate critical internal parameters ofsemiconductor devices.
3. Understanding and characterizing the behavior of known/unknown/novel power electronic devicessuch as UJT, SCR, Diac, Triac etc.
4. Understanding and operation and applications of linear integrating circuit – Op-amp and using it for various applications.
5. Understanding the working of basic logic gates, concepts of Boolean algebra and techniques toreduce/simplify Boolean expressions and their applications.
6. Synthesizing and Analyzing combinatorial and sequential circuits and their applications inelectronics, designing the registers and counters.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with ProgramOutcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6
Understand and study the behavior of JFET device.	x					
Understanding and characterizing the behavior of known/unknown/novel power electronic devices such as UJT, SCR, Diac, Triac etc.	x					
Acquainting and familiarization of the experimental skills to determine the behavior of semiconductor devices.	x					
Capable of analyzing the device characteristics and responses.	x					
Understanding the working of basic logic gates, concepts of Boolean Algebra and techniques to reduce/simplify Boolean expressions and their applications.	x					
Synthesizing and Analyzing combinatorial and sequential circuits and their applications in electronics	x					

ELE - CT2: **ANALOG AND DIGITAL ELECTRONICS-II** 56 Hours.

UNIT – 1 14 Hrs.

Varactor diode, Schottky diode, Tunnel diode - LED, LCD, Solar Cell: working and applications for each.

JFET: Types, working, characteristics of n-channel JFET, parameters and their relationships, Comparison of BJT and JFET.

MOSFET: Types, CMOS – inverter, circuit and working, IGBT construction and working.

UJT: working, equivalent circuit and characteristics, intrinsic stand-off ratio, Relaxation oscillator.

SCR: working, characteristics, equivalent circuit, applications.

Diac and Triac: characteristics, equivalent circuit, working and applications for each.

UNIT – 2 14 Hrs.

Op-Amp: Differential Amplifier, Block diagram of Op-Amp, Characteristics of an Ideal and Practical Op-Amp, Open and closed loop configuration, Frequency Response, CMRR, Slew Rate and concept of Virtual Ground.

Applications of Op-Amps: Inverting and non- inverting amplifiers, Summing amplifier, Differentiator, Integrator, Logarithmic amplifier, Comparator.

Filters: First order active Low pass, High pass and Band pass Butterworth filters.

Oscillators: Barkhausen criterion for sustained oscillations, crystal oscillators**,** Phase Shift oscillator, Wien-bridge oscillator using Op-amp.

IC 555Timer: Astable and Mono stable multivibrator circuits.

UNIT – 3 14 Hrs.

Logic Families: Pulse characteristics, Logic Families-classification of digital ICs.

Characteristics of logic families, circuit description of TTL NAND gate with totem pole and open collector. TTL IC terminology. CMOS NAND, Comparison of TTL and CMOS families.

Digital to Analog Converter: DAC with binary weighted resistor and R-2R resistor ladder network. Analog to Digital converter: Successive approximation method-performance characteristics.

Sequential Logic Circuits: Flip-Flops - SR Latch, Level and Edge Triggered concept, Clocked RS, D, JK and T Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. Master- Slave JK Flip-Flops. Applications of Flip-Flops in semiconductor memories, RAM, ROM and types.

UNIT – 4 14 Hrs.

Registers and Counters: Types of Shift Registers (up to 4-bits), its applications. Ring counter, Johnson counter applications. Asynchronous Counters: Logic diagram, Truth

table and timing diagrams of 4-bit ripple counter, modulo-n counters, 4-bit Up-Down counter, Synchronous Counter: 4-bit counter, Design of Mod 3, Mod 5 and decade Counters using K-maps.

Basic computer system: Block diagram, Input and output devices, interfacing techniques, expansion of memory, programming techniques, flowchart, types of languages.

REFERENCES:

1. Robert L Boylestad, "Introductory circuit analysis", 5th edition. Universal Book 2003.
2. Electronic Devices Conventional Current Version by Thomas L. Floyd, 10th edition, Pearson, 2018
3. David A. Bell "Electronic Devices and Circuits", 5th Edition, Oxford Univesity Press, 2015
4. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edn., Prentice Hall., 2000
5. Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, Oxford University Press. 2011,
6. R S Sedha, "A Text book of Applied Electronics", 7th edn., S Chand and Company Ltd., 2011
7. Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia, 1994
8. Digital Principles and Applications, A.P. Malvino, D P Leach and Saha, 7th Edition, TMH, 2011.
9. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, PHI Learning Pvt. Ltd. 2009
10. Digital Circuits and Systems, K R Venugopal and K Shyla, Tata McGraw Hill, 2011
11. Digital Circuits and systems, Venugopal, Tata McGraw Hill. 2011
12. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, PHI Learning. 2001
13. Digital Principles, Schaum's Outline Series, R. L. Tokheim, TMH., 1994
14. Digital Electronics, S.K. Mandal, 1st Edition, McGraw Hill., 2010.

Course Title: ELE-CP2: ANALOG AND DIGITAL ELECTRONICS - II Lab	Course Credits: 2
Total Contact Hours: 56 Hrs.	Duration of ESA: 4 Hrs.
Formative Assessment Marks: 10 marks	Summative AssessmentMarks: 40 marks

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research.
2. To acquire experimental skills, analyzing the results and interpret data.
3. Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.
4. Capacity to identify and implementation of the formulae to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.
5. Capability to use the Modern Tools / Techniques.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with ProgramOutcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6
Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research						
To acquire experimental skills, analyzing the results and interpret data.	x					
Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.	x					
Capacity to identify and implementation of the formulate to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.						
Capability to use the Modern Tools / Techniques.	x					

ELE-CP2: **ANALOG AND DIGITAL ELECTRONICS –II Lab**

(Hardware and Circuit Simulation Software)

(Minimum **Eight** Experiments)

1. Study of JFET characteristics – determination of parameters.
2. Study of single stage JFET amplifier.
3. UJT characteristics and relaxation oscillator
4. SCR characteristics.
5. Design of inverting and non-inverting amplifier using Op-amp & study of frequency response.
6. Op-amp inverting and non-inverting adder, subtractor and averaging amplifier.
7. Design and study of differentiator and integrator using op-amp for different input waveforms.
8. Design and study of Wien bridge oscillator using op-amp.
9. Design and study of RC phase shift oscillator using op-amp.
10. Design and study of first order high-pass and low-pass filters using op-amp.
11. Study of Crystal oscillator using op-amp.
12. Astable multivibrator using IC-555 timer.
13. Monostable multivibrator using IC-555 timer.
14. Digital to Analog Converter using binary weighted resistor method.
15. Study of Clocked RS and D Flip-Flops using NAND gates.
16. Study of Clocked JK and T Flip-Flops using NAND gates.
17. Study of mod-16 asynchronous counter using JK Flip-Flop.
18. Study of decade counter using JK Flip-Flop.
19. Study of 4-bit Shift Register – SISO.

Using analog simulator (LT spice, Circuit Logix, NI Multisim, Circuitmake, EasyEDA, Every Circuit, PSpice, Docircuits, etc.,) at least Five experiments are to be performed.

THIRD SEMESTER

Syllabus for Core Subjects

Course Title: ELE – CT3: EMBEDDED C AND DIGITAL DESIGN USING VERILOG	Course Credits: 3
Total Contact Hours: 56 Hrs.	Duration of ESA: 4 Hrs.
Formative Assessment Marks: 20 marks	Summative Assessment Marks :80 marks

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research.
2. Acquire experimental skills, analyzing the results and interpret data.
3. Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets/ systems / processes that conforms to a given specification within ethical and economic constraints.
4. Capacity to identify and implementation of the formulae to solve the electronic related issues and analyses the problems in various sub disciplines of electronics.
5. Capability to understand the working principles of the electronic devices and their applications.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with ProgramOutcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**
Aptitude to apply Logic thinking and Basic Science knowledge forproblem solving in various fields of electronics both in industries and research	**x**					
To acquire experimental skills, analyzing the results and interpret data.						
Ability to design / develop / manage / operation and maintenance ofsophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.						
Capacity to identify and implementation of the formulae to solve the electronic related issues and analyses the problems in various sub disciplines of electronics.						
Capability to understand the working principles of the electronic devicesand their applications.	**x**					

ELE – CT3: **Embedded C and Digital Design using Verilog** 56 Hours.

Unit 1 14 Hrs.

Embedded Systems: Introduction, applications, Difference between embedded and general-purpose computing, concepts of embedded hardware (MCUs, memory, peripherals)

C Programming: Data types, operators, control structures. Functions, recursion, Pointers, arrays, strings, structures, unions, Dynamic memory.

Embedded C: Difference between C and Embedded C, Data types, Bit manipulation, Fixed vs floating point, Using const.

Unit2 14 Hrs.

Microcontroller 8051: Introduction, Architecture, IO Programming using C, Logical operations using C, Memory-mapped I/O, Registers and SFRs, Clock system, Reset circuits, Timers and Counters, Interrupts and ISR, UART (Serial Communication), LCD and Keyboard interfacing, ADC, DAC and Sensor Interfacing(Temperature), PWM.

Embedded C with Hardware: Setting up toolchain (compiler, linker, debugger), Writing, building, and flashing firmware, Using IDE (Keil, MPLAB, STM32CubeIDE, Code Composer Studio, or GCC + Makefile), Debugging techniques

Unit 3 14 Hrs.

Introduction to Verilog, Structure of HDL Module, Comparison of VHDL and Verilog Introduction to Simulation and Synthesis Tools, Test Benches. Language Elements- Keywords, Identifiers, Comments, format, Integers, reals and strings. Logic Values, Data Types-net types, undeclared nets, scalars and vector nets, Register type, Parameters. Delays, brief description - data flow style, behavioral style, structural style, mixed design style, simulating design. Expressions, Operands and Operators.

Unit 4 14 Hrs.

Gate level Modeling: Introduction, built in Primitive Gates, multiple input gates, Tristate gates, pull gates, MOS switches, bidirectional switches, gate delay, array instances, and implicit nets.

Data flow Modeling: Continuous assignment, net declaration assignments, delays, net delays.

Behavioral Modeling: Procedural constructs, timing controls, block statement, procedural assignments, conditional statement, loop statement, procedural continuous assignment.

REFERENCES:

1. E. Balaguru swamy, "Computing fundamentals and C programming", 4th,Edition, TMH,2008.
2. Yashavant Kanetkar, "Let us C", 18th edition, BPB Publications, 2021.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D Mckinlay, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson,2011
4. E. Balaguru swamy, "Programming in ANSI C", 2nd Edition.TMH, 2010.
5. Samir Palnitkar, "Verilog HDL: A guide to digital design and synthesis", Pearson, 2nd edition,2006.
6. J Bhasker, "A Verilog HDL Primer", 3rd Edition, BS Publications,2008.
7. Nazesh M Botros, "HDL programming VHDL and Verilog". Dream tech press, 2009 reprint.

Course Title: ELE – CP3: EMBEDDED C AND DIGITAL DESIGN USING VERILOG	Course Credits: 2
Total Contact Hours: 56 Hrs.	Duration of ESA: 4 Hrs.
Formative Assessment Marks: 10 marks	Summative AssessmentMarks: 40 marks

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research.
2. To acquire experimental skills, analyzing the results and interpret data.
3. Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.
4. Capacity to identify and implementation of the formulae to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.
5. Capability to use the Modern Tools / Techniques.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with ProgramOutcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**
Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research						
To acquire experimental skills, analyzing the results and interpret data.	**x**					
Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.	**x**					
Capacity to identify and implementation of the formulate to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.						
Capability to use the Modern Tools / Techniques.	**x**					

ELE-CP3: **Embedded C & Digital Design using Verilog – LAB**

Section – A: **C – Programming**:

- C Programming Fundamentals:(Minimum "**THREE**" programs to be executed)

1. Fibonacci series up to given limit.
2. Factorial using recursion and iteration.
3. Menu-driven program using functions for math operations
4. Find max and min in an array
5. Implement linear and binary search

- Embedded C Fundamentals - (With Hardware): (Minimum "**THREE**" programs to be executed)

1. Blinking an LED Initialize I/O ports, Toggle an LED with a simple delay loop

Blink one LED with a 1-second delay

Modify to blink at 0.5 seconds

2. Switch Interface & Debouncing: Read switch input, Control an LED based on switch state

Toggle LED when switch is pressed, Implement software debounce, Turn on LED only while switch is held high.

3. Timer-based LED Control: Configure Timer 0/1 in mode 1 (16-bit) Use timer for precise delays of 1 second, Blink LED using hardware timer (no delay loops), Vary LED blinking rate using different timer reload values
4. LCD interfacing to display "HELLO WORLD" with static and scrolling format of display
5. PWM & Motor Control: Generate PWM signal (using timer or software), Control speed of motor with PWM

Section B: **Digital Design Using Verilog with FPGA kit**

(Minimum **SIX** Programs is to be written and executed)

1. Realization of gates using Verilog code.
2. Realize Adder/Subtractor (Half) circuits using Verilog data flow description.
3. Realize Adder/Subtractor (Full) circuits using Verilog data flow description.
4. Realize the following code converters using Verilog behavioural description.
   a) Gray to Binary and vice-versa.
   b) Binary to excess 3 and vice-versa.
5. To realize 4-bit ALU using Verilog program.
6. To realize using Verilog behavioural description: 8:1 multiplexer, 8:3 encoder.
7. To realize using Verilog behavioural description: 1:8 DE multiplexer, 3:8 decoder.
8. To realize using Verilog behavioural description flip flops:
   (a) D-type (b) JK - type (c) T-type
9. To realize counters: Up/down (Binary) using Verilog behavioural description.
10. To realize counters: Up/down (BCD) using Verilog behavioural description.

Note: It is suggested to carry out one **mini project** on **Embedded C** for awarding **IA marks**

- **List of simulators:**
  - Keil µVision Simulator
  - Proteus Design Suite
  - PICSim Lab
  - QEMU (Quick Emulator)
  - Web-Based Microcontroller Simulators

- **Exercise programs :**

1. Display a welcome message using printf()
2. Accept and display user details (name, age, etc.)
3. Perform arithmetic operations on two integers
4. Evaluate a compound expression using all arithmetic operators
5. Demonstrate use of relational and logical operators
6. Convert temperature between Celsius and Fahrenheit
7. Check if a number is even or odd using if-else
8. Implement a calculator using switch-case
9. Generate multiplication tables using forloop
10. Write a function to check for prime numbers
11. Count vowels, digits, and spaces in a string
12. Perform string operations: copy, reverse, compare

Syllabus for Elective Subjects

ELE – Elective 3.1: **Renewable Energy and Energy harvesting** 26 Hours.

Learning Objectives:

- To introduce various kinds of renewable energy sources.
- To understand the scenario of power generation in both conventional and non- conventional in Indian context.

Unit-I 8 Hrs.

Conventional Energy sources:

Coal, Oil, Natural Gas, Nuclear power and Hydro - their utilization pattern in the past, present and future projections of consumption pattern - Sector-wise energy consumption – environmental impact of fossil fuels – Energy scenario in India – Growth of energy sector and its planning in India. Non-Conventional Energy Sources: Solar Energy, Wind Energy, Energy from Biomass & Biogas, Ocean Thermal Energy Conversion, Tidal Energy, Geothermal Energy, Hydrogen Energy, Fuel Cell, Magneto Hydro-Dynamics Generator, Advantages& Limitations of Non-Conventional Energy Sources

Unit-II 9 Hrs.

Solar Energy

Solar cells for direct conversion of solar energy in to electric power, Solar cell parameter, Solar cell VI characteristics, Efficiency, single crystal silicon solar cells, polycrystalline silicon solar cells, Cadmium supplied solar cells, Application of solar energy- solar water heating – space heating and space cooling- solar photovoltaic cell – solar distillation - solar pumping - solar furnace- solar cooling – solar greenhouse. Photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping etc. - solar PV power plant – Net metering concept, problems.

Unit-III 9 Hrs.

Wind and Bio mass energy

Nature of the wind – power in the wind – factors influencing wind – wind data and energy estimation -wind speed monitoring - wind resource assessment - Betz limit - site selection - wind energy conversion devices - classification, characteristics,

applications

Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - direct combustion – biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - types of biogas Plants - applications - alcohol production from biomass – bio diesel production – Urban waste to energy conversion - Biomass energy programme in India. Electricity observed in living systems, Problems.

REFERENCES:

1. Non-Conventional Energy Sources, G. D. Rai, Khanna Publication.
2. Non-Conventional Energy Resources, B. H. Khan, The McGraw Hill Publishers. FLUID ECHANICS
3. Properties of Matter – Brijlal & Subramanyam, Eurasia Publishing House, 1991
4. Heat and Thermodynamics, D.S. Mathur, S.Chand& Co Ltd
5. Heat and Thermodynamics - Mark W.Zemansky and Richard H. Basic, McGraw Hill, New York, seventh edition.
6. Theory and experiment on Thermal Physics- P.K.Chakrabarti
7. Heat and Thermodynamics- Brijlal & Subramanium, S.Chand
8. An Introduction to Mechanics, D. Kleppner and R. J. Kolenkow
9. Thermal Physics- Kittel, CBS Publishers, 1987.

Experiments

1. Solar cell dark and illuminated characteristics
2. Solar cell - Spectral response
3. Calorific value of Biomass samples
4. Demonstrate the understanding of the operational details of the Wind Lab laboratory equipment and to plot a graph of current verses time.
5. Determine the speed of the wind turbine
6. Comparison of performance of solar pumps vs. conventional pumps
7. Wind turbines, Savonius rotors
8. Compare the amount of biogas that is produced from different types of biomass
9. Characteristics of a photocell

ELE – Elective 3.2: **Power Electronics and Electric Vehicles** 26 Hours.

Prerequisites: Basic knowledge of Electrical Circuits and Semiconductor Devices.

Course Description

This course introduces the fundamental principles of Power Electronics and their essential role in the operation of Electric Vehicles (EVs). Students will gain an understanding of key power converter topologies, common EV architectures, and the application of power electronics in EV propulsion, energy storage, and charging systems.

Course Objectives

Upon successful completion of this course, students will be able to:

1. Identify and describe the characteristics of common power semiconductor devices.
2. Explain the operation of basic DC-DC, AC-DC, and DC-AC power converters.
3. Outline the main components and architectures of various electric vehicle types.
4. Describe the application of power electronics in EV motor drives, battery management, and charging.
5. Discuss emerging trends in EV power electronics.

Unit 1: **Fundamentals of Power Electronics** 9 Hrs.

This unit lays the groundwork by introducing power semiconductor devices and the essential DC-DC and AC-DC conversion principles.

Introduction to Power Electronics & Devices

Overview: Role of power electronics in modern systems, specifically EVs.

Power Semiconductor Devices: Diodes, MOSFETs & IGBTs V-I characteristics, switching behavior, key advantages in power applications, Brief mention of Wide Bandgap Devices (SiC, GaN) for EVs.

Device Protection: Introduction to snubber circuits.

DC-DC Converters

Principles: Basic operation, role in voltage conversion.

Step-Down (Buck) Converter: Circuit, operation (continuous mode), voltage conversion ratio.

Step-Up (Boost) Converter: Circuit, operation (continuous mode), voltage conversion ratio.

Control Basics: Introduction to Pulse Width Modulation (PWM).

Unit 2: **AC Conversion and EV Fundamentals** 9 Hrs.

AC-DC Converters (Rectifiers)

Uncontrolled Rectifiers: Single-phase full-wave rectifier (bridge), concepts of average DC voltage, ripple.

Controlled Rectifiers (Brief): Introduction to phase control using Thyristors (SCRs), basic concept.

Power Factor Correction (PFC): Why it's needed, brief overview of active PFC.

DC-AC Converters (Inverters)

Introduction: Role in converting DC battery power to AC for motors.

Single-Phase Inverters: Half-bridge and full-bridge topologies, square wave output.

Three-Phase Inverters: Basic operation, 6-step waveform generation.

Pulse Width Modulation (PWM) for Inverters: Sinusoidal PWM (SPWM) for harmonic reduction.

Unit 3: **Power Electronics in Electric Vehicles** 8 Hrs.

Electric Vehicle Fundamentals

EV Classification: BEVs, HEVs, PHEVs, FCEVs – basic definitions and characteristics.

EV Architectures: Simple block diagrams of series, parallel, and BEV powertrains.

Key EV Components: Electric Motors: Introduction to PMSM and Induction Motors used in EVs. Batteries: Types (Li-ion focus), basic characteristics (voltage, capacity, C-rate), overview of Battery Management System (BMS) functions.

Bidirectional DC-DC Converters: Importance in EV applications (e.g., HEVs, V2G).

Power Electronics in EV Applications & Trends

Motor Drives: Role of the inverter in controlling electric motors (basic concepts of speed control).

Regenerative Braking: Principle and energy recovery.

EV Charging Systems: On-board vs. Off-board charging, AC Charging (Level 1 & 2), DC Fast Charging (Level 3), Basic block diagram of a typical EV charger.

Auxiliary Power: Brief mention of DC-DC converters for 12V/48V systems.

Future Trends: Brief discussion on V2G and wide bandgap device adoption.

REFERENCES: (Selected chapters for brevity)

1. **"Power Electronics: Converters, Applications, and Design"** by Ned Mohan, Tore M. Undeland, William P. Robbins. Wiley. (Focus on first few chapters for devices and basic converters)
2. **"Electric Vehicles: Principles, Design and Applications"** by Iqbal Husain. CRC Press. (Focus on introductory chapters and powertrain)

FOURTH SEMESTER

Syllabus for Core Subjects

Course Title: ELE – CT4: ADVANCED COMMUNICATION SYSTEM	Course Credits: 3
Total Contact Hours: 56 Hrs.	Duration of ESA: 4 Hrs.
Formative Assessment Marks: 20 marks	Summative Assessment Marks :80 marks

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research.
2. To acquire experimental skills, analyzing the results and interpret data.
3. Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.
4. Capacity to identify and implementation of the formulae to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.
5. Capability to use the Modern Tools / Techniques.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with ProgramOutcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**
Aptitude to apply Logic thinking and Basic Science knowledge forproblem solving in various fields of electronics both in industries and research	**x**					
To acquire experimental skills, analyzing the results and interpret data.						
Ability to design / develop / manage / operation and maintenance ofsophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.						
Capacity to identify and implementation of the formulae to solve the electronic related issues and analyses the problems in various sub disciplines of electronics.						
Capability to understand the working principles of the electronic devicesand their applications.	**x**					

ELE – CT4: **Advanced Communication Systems** 56 Hours.

Unit 1 14 Hrs.

T-lines- Types, Primary and secondary constants, concept of standing waves. Noise and its effects. Block diagram of electronic communication system, **Modulation**-need, types of analog modulation.

Amplitude Modulation – representation, modulation index, instantaneous voltage, frequency spectrum, power relations. Limitations of AM.

Frequency Modulation- representation, modulation index, frequency spectrum, bandwidth requirements, frequency deviation and carrier swing.

Pulse Modulation- Types, PAM, PWM and PPM. Detailed discussion of PCM with its advantages, disadvantages and applications.

Digital Communication: Block diagram of digital communication, Advantage and disadvantages of digital transmission systems.

Characteristics of data transmission circuits–Shannon limit for information capacity. Bit Rate and Baud, bandwidth requirements, data transmission speed, noise, cross talk, echo suppressors, distortion and equalizer.

Digital Modulation – Types (ASK, FSK, PSK, QPSK, 16QAM and 64 QAM), definition and waveforms and applications of each. MODEM– modes.

Unit 2 14 Hrs.

Antenna Systems- Radiation mechanism, resonant and non-resonant antennas, Ungrounded and grounded antenna. Types- Folded dipole, micro strip, dish, helical, horn, and loop antennas.

Satellite Communication-Need, types of orbits, advantages of geostationary satellites. Satellite visibility, Block diagram of satellite transponder, Uplink and downlink systems, Satellite earth station, path loss.

Radar - Microwaves Frequency bands and applications. RADAR principle, maximum unambiguous range, Pulsed RADAR system, RADAR range equation-derivation, factors influencing maximum range, Doppler effect. MTI and FM CW RADAR systems.

Unit 3 14 Hrs.

Optical Fiber Communication- Need for OFC. Block diagram of OFC system. Fiber optic cables, light propagation through fiber – step index fiber, graded index fiber, Snell's law, numerical aperture. Light sources – requirements, LEDs and semiconductor

laser diodes. Photo detectors – PN, PIN and avalanche photodiodes. Losses in optical fibers – Rayleigh scattering, absorption, leaky modes, bending, joint junction losses. Advantages and disadvantages of OFC over metallic cables.

Unit 4 14 Hrs.

Cellular Communication- Mobile communication, cell and cell splitting, frequency bands used in cellular communication, Absolute RF channel numbers (ARFCN), frequency reuse, roaming and hand off, authentication of the SIM card of the subscribers, IMEI number, data encryption, block diagram of cellular mobile communication network, Multiplexing-FDMA, WCDMA, TDMA, OFDMA, GSM. Block diagram of cellular phone handset.

REFERENCES:

1. Kennedy & Davis, “Electronic Communication Systems”, 4th edition, TMH.
2. Wayne Tomasi, “Advanced Electronic Communication Systems”, 6th edition, Prentice Hall.
3. Skolnik, “Introduction to RADAR systems”, McGraw Hill.
4. Roddy and Coolen, “Electronic Communication”, 4th edition, PHI.
5. B.P. Lathi, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press.
6. Gerd Keiser, “Optical Fibre Communication”, 3rd Edition, McGraw Hill.
7. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press

Course Title: ELE – CP4: ADVANCED COMMUNICATION SYSTEM	Course Credits: 2
Total Contact Hours: 56 Hrs.	Duration of ESA: 4 Hrs.
Formative Assessment Marks: 10 marks	Summative AssessmentMarks: 40 marks

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research.
2. To acquire experimental skills, analyzing the results and interpret data.
3. Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.
4. Capacity to identify and implementation of the formulae to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.
5. Capability to use the Modern Tools / Techniques.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with ProgramOutcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	**1**	**2**	**3**	**4**	**5**	**6**
Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research						
To acquire experimental skills, analyzing the results and interpret data.	**x**					
Ability to design / develop / manage / operation and maintenance of sophisticated electronic gadgets / systems / processes that conforms to a given specification within ethical and economic constraints.	**x**					
Capacity to identify and implementation of the formulate to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.						
Capability to use the Modern Tools / Techniques.	**x**					

ELE-CP3: Advanced Communication Systems – LAB

(Minimum **Eight** Experiments)

1. Amplitude modulator and Demodulator
2. FM modulator using IC8038
3. Pre –emphasis and De- emphasis
4. IF amplifier
5. Frequency Multiplier
6. PAM modulator
7. Second order Active low pass /High pass filter
8. Band Elimination Filter
9. Numerical Aperture of OFC
10. Study of ASK generation and Detection
11. Study of FSK generation and Detection
12. Study of PSK generation and Detection
13. QPSK modulator and demodulator
14. Study of SMPS using PWM.

Syllabus for Elective Subjects

ELE – Elective 4.1: **Computer Networks** 26 Hours.

Unit 1: Fundamentals and Internetworking 8 Hrs.

Protocol Layering, The OSI Model, TCP/IP Protocol Suite, Introduction to Physical Layer: Transmission, Impairments, Data Rate Limits, Performance, Introduction to Data-Link- Layer: Link-Layer Addressing,, Error Detection and Correction: Block Coding, Cyclic Codes, Checksum

Unit 2 : Data Link and Network Layer 9 Hrs.

Data Link Control: Data-Link Layer Protocols, HDLC, Point-To-Point (PPP), Media Access Control (MAC): CSMA, CSMA/CD, CSMA/CA, Reservation, Polling, Token Passing, FDMA, TDMA, CDMA, Network-Layer Services, Packet Switching, Network-Layer Performance, IPV4 Addresses, Network Layer Protocols: Internet Protocol (IP), ICMPv4, Mobile IP, Unicast Routing: Routing Algorithms, Unicast Routing Protocols, Next Generation IP: IPv6 Addressing

Unit 3: Transport and Application Layer 9 Hrs.

Introduction to Transport Layer: Introduction, Transport-Layer Protocols, Transport-Layer Protocols: User Datagram Protocol, Transmission Control Protocol: TCP Services, TCP Features, Segment, A TCP Connection, TCP Congestion Control, Flow Control, Error Control, Application Layer: WWW, E-MAIL, Domain Name System (DNS), Quality of Service: Flow Control To Improves QoS, Integrated Services

Computer Network Experiments

1. To study about components and specifications of Laptop and Desktop.
2. Installation and introduction of simulation tools packet tracer
3. Study of different types of network cables.
4. Familiarization with Transmission media and tools: Co-axial cable, UTP cable, Crimping tool, Connectors
5. Study of network IP address configuration (Classification of address, static and dynamic address)
6. Study of network devices (Switch, Router, Bridge)

REFERENCE:

1. A.S Tanenbaum, Computer Networks, 4th Edition, PHI, 2003
2. Behrouz A. Foruzan, Data communication and Networking, 4th Edition,TMH,2004
3. Larry L. Peterson and Bruce S. Davie, “Computer Networks A System Approach”, 5th Edition, MKP, 2012.
4. James F. Kurose , Keith W. Ross, “ Computer Networking, A Top-Down Approach”, 5thEdition, Pearson, 2012.

ELE – Elective 4.2: **Meditronics** 26 Hours.

Unit 1: 8 Hrs.

Foundations of Medical Electronics: Role of electronics in healthcare and diagnostics, Classification of medical electronic devices: diagnostic, therapeutic, assistive, Bioelectric signals overview: ECG, EEG, EMG – characteristics and relevance, Electrode types and signal pickup: ECG, EEG, EMG probes, Signal conditioning essentials: amplifiers, active filters, isolation circuits, Noise sources and mitigation techniques in medical signal processing

Unit 2: 9 Hrs.

Diagnostic and Therapeutic Electronics: Design and working of ECG, EEG, and EMG machines: block-level understanding Electronics in pulse oximeters and blood pressure monitors

Overview of imaging modalities: X-ray, CT, and ultrasound electronic subsystems Pacemakers and defibrillators: basic circuitry and operational principles, Infusion pumps and ventilators: embedded control and monitoring systems, Maintenance, calibration, and reliability in medical equipment

Unit 3: 9 Hrs.

Embedded Systems and Safety in Medical Devices: Biomedical sensors: pressure, temperature, flow, oxygen saturation, Introduction to embedded systems in medical devices: Block diagram, Wireless health monitoring and the Internet of Medical Things (IoMT), Data acquisition systems for remote diagnostics, Electrical safety: leakage currents, patient isolation, fail-safes

Medical device standards: IEC 60601, ISO certifications, regulatory landscape Future trends: AI in diagnostic tools, smart wearables, and real-time analytics

Meditronics Experiments

1. **Heart Rate Monitoring using PPG Sensor**

   Objective: Measure heart rate using a photoplethysmograph sensor (IR LED + photodiode).

   Components: IR LED, photodiode (or pulse sensor), Arduino Uno, 16x2 LCD (optional).

Bengaluru City University Bengaluru

ಬೆಂಗಳೂರು ನಗರ ವಿಶ್ವವಿದ್ಯಾಲಯ BENGALURU CITY UNIVERSITY
ಜ್ಞಾನ ಭಾರತಿ ಆವರಣ
BE BOUNDLESS

Central College Campus, Bengaluru-560 001.

Question Paper Pattern for B.Sc. Electronics (Theory), As per SEP-2024 Scheme

Subject: ELECTRONICS

Paper Title:

Instructions: Answer ALL the questions from Part–A, any FIVE questions from Part–B and any FOUR questions from Part–C.

Note: It is required to answer all the questions of Part–A in any one page and to be answered only once. *In this Part, answering the same question multiple times will not be considered for Evaluation.*

PART – A

I. Answer **ALL** the subdivisions **(Multiple Choice Questions)** 20×1 = 20

PART – B

II. Answer any **FIVE** questions. (5/8) 8×5 = 40

PART – C

III. Answer any **FOUR** questions (4/6) 4×5 = 20

Part	Type	Questions	Marks Each	Total Marks
A	Multiple Choice Questions	20	1	20
B	Descriptive Questions in (Single/Multiple Questions)	5/8	8	40
C	Problems /Analysis	4/6	5	20

- Cumulative Internal Assessment (CIA) Marks Allotted for Theory 20 Marks

Sl. No.	Particulars	IA marks
1	Internal Tests (Minimum of Two)	10
2	Assignments /Seminar / Case Study / Project work / Reports on - visits to industries/exhibitions/science center's / active participation in Electronics competitions, etc.	10
	Theory IA Marks	20

Dr. Naveen Kumar SK
Chairman
BoS in Electronics (UG)
Bengaluru City University
Bengaluru-01

Bengaluru City University Bengaluru

ಬೆಂಗಳೂರು ನಗರ ವಿಶ್ವವಿದ್ಯಾಲಯ
BENGALURU CITY UNIVERSITY
ಆಗು ಏ ಅಪರಿಮಿತ
BE BOUNDLESS

Central College Campus, Bengaluru-560 001.

Question Paper Pattern for B.Sc. Electronics (Practical), As per SEP-2024 Scheme

Subject: ELECTRONICS

Paper Title:

- Scheme for Practical Examination Marks allotted 40 Marks
- In each Semester/Paper minimum **Eight** Experiments to be performed.

Sl. No.	Particulars	Marks
1	Write Up: Circuit Diagram, Tabular Column, Formulae.	12
2	Conduction: Tabulation, Performance, Result.	18
3	Viva-Voce	05
4	Record Book	05
	Total Marks	40

- Cumulative Internal Assessment (CIA) Marks Allotted for Practical 10 Marks

Sl. No.	Particulars	IA marks
1	Practical Tests	05
2	Report on datasheet of electronic devices / Seminar on electronics experiments/ Active participation in practical classes	05
	Practical IA Marks	10

Dr. Naveen Kumar SK
Chairman
BoS in Electronics (UG)
Bengaluru City University
Bengaluru-01

Bengaluru City University Bengaluru

ಬೆಂಗಳೂರು ನಗರ ವಿಶ್ವವಿದ್ಯಾಲಯ
BENGALURU CITY UNIVERSITY
ಜ್ಞಾನ ಭೀ ಅಭಿವೃದ್ಧಿ
BE BOUNDLESS

Central College Campus, Bengaluru-560 001.

Suggested Final Year Electronics Subjects Core Paper Titles

Sl. No.	Semester	Course Code	Course Title	Teaching Hours/Week			Examination				Total Credits
				L	T	P	Examination Hours	CIA Marks	SEE Marks	Total	
1	V	DSC-ELECT5	Mobile Communication	4	0	0	3	20	80	100	3
2		DSC-ELECP5	Mobile Communication Lab - V	0	0	4	4	10	40	50	2
3		DSC-ELECT6	PIC Microcontroller	4	0	0	3	20	80	100	3
4		DSC-ELECP6	PIC Microcontroller Lab - VI	0	0	4	4	10	40	50	2
1	VI	DSC-ELECT7	IoT and Robotics	4	0	0	3	20	80	100	3
2		DSC-ELECP7	IoT and Robotics Lab-VII	0	0	4	4	10	40	50	2
3		DSC-ELECT8	Artificial Intelligence and Machine Learning	4	0	0	3	20	80	100	3
4		DSC-ELECP8	Project Lab - VIII	0	0	4	4	10	40	50	2

Dr. Naveen Kumar SK
Chairman
BoS in Electronics (UG)
Bengaluru City University
Bengaluru-01

BENGALURU CITY UNIVERSITY (BCU)

Jnana Jyothi Central College Campus,

Dr. B.R. Ambedkar Veedhi, Bengaluru - 560 001.