KISHKINDA UNIVERSITY

Advancing Knowledge Transforming Lives

VISION AND MISSION OF THE UNIVERSITY

VISION:

To develop an ethical and a competent global workforce with an inquisitive mind.

MISSION:

M1: To equip the students with professional skills, ethical values and competency.

M2: To offer state of the art programs by collaborating with industry, academia and society.

M3: To undertake collaborative & inter disciplinary research for overall development.

M4: To develop leaders and entrepreneurs for the real and sustainable world

DEPARTMENT OF
ELECTRONICS & COMMUNICATION ENGINEERING

VISION AND MISSION

VISION:

To be a leading department in electronics and communication engineering, fostering innovation and excellence in technology, and empowering students to become visionary leaders and problem solvers in a dynamic global landscape.

MISSION:

M1: Provide a cutting-edge education that integrates theoretical knowledge with practical application.

M2: Conduct pioneering research that advances the field of electronics and communication.

M3: Collaborate with industry and academia to address real-world challenges and drive technological progress.

PROGRAMME OUTCOMES (POS):

Engineering Graduates will be able to:

1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7.Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOME (PSO'S):

PSO1: To understand the principles, processes, techniques and design aspects of electronic devices, circuits and communication systems.

PSO2: To apply, analyse and design electronic circuits, communication systems, embedded systems by using higher engineering mathematical foundations, computational principles and network modelling skills.

PSO3: To develop electronic hardware and software systems for universal requirements using sensors, embedded controllers, signal processors, analog and digitally integrated chips.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO'S):

PEO 1: To acquire strong knowledge in Basic Science, Mathematics and ability to apply this knowledge in the relevant fields of Electronics & Communication Engineering.

PEO2: To develop technical competence and uplift research ability to solve real time problems.

PEO 3: To obtain professional Excellency through lifelong learning and produce graduates with professional values.

Scheme of Syllabus

B.Tech – III & IV Semester

Electronics & Communication Engineering

(2023 Scheme)

B.Tech. in Electronics and Communication Engineering Scheme and Syllabus 2023
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2024-25)

III SEMESTER

SCHEME:

SN	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	23BB31	Biology For Engineers	CHEM	3	0	0		03	50	50	100	3
2	IPCC	23EC32	Digital Circuit Design using Verilog	EC	2	2	2		03	50	50	100	4
3	IPCC	23EC33	Signals & Systems	EC	2	2	2		03	50	50	100	4
4	PCC	23EC34	Analog Electronic Circuits	EC	2	2	0		03	50	50	100	3
5	PCCL	23ECL35	Analog Electronic Circuits Laboratory	EC	0	0	2		03	50	50	100	1
6	ESC	23EC361/ 23EC362	Network Analysis / Sensors and Instrumentation	EC	2	2	0		03	50	50	100	3
7	AEC/ SEC	23EC371/ 23EC372	Programming with C++/ Programming with Hardware Controllers	EC	If the course is a Theory: 1	0	0		01	50	50	100	1
					If a course is a laboratory: 0	0	2		02				
8	UHV	23SC38	Social Connect and Responsibility	Any Department	0	0	2		01	100	---	100	1
9	MC	23NS39	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		23PE39	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		23YO39	Yoga	Yoga Teacher									
Total										**550**	**350**	**900**	**20**

Engineering Science Course (ESC/ETC/PLC)			
23EC361	Network Analysis	23EC362	Sensors and Instrumentation
Ability Enhancement Course – III			
23EC371	Programming with C++	23EC372	Programming with Hardware Controllers

ADDITIONAL MATHEMATICS for Lateral Entry Students

SN	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	23MATDIP31	ADDITIONAL MATHEMATICS-I	MATHS	3	0	0		03	100	00	100	0

IV SEMESTER

SN	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	23MAT41	Applied Mathematics for Electrical and Electronics Engineering	MATHS	3	0	0		03	50	50	100	3
2	IPCC	23EC42	Engineering Electromagnetics	EC	2	2	2		03	50	50	100	4
3	IPCC	23EC43	Control Systems	EC	2	2	2		03	50	50	100	4
4	PCC	23EC44	Communication Systems- I	EC	2	2	0		03	50	50	100	3
5	PCCL	23ECL45	Communication Laboratory-I	EC	0	0	2		03	50	50	100	1
6	ESC	23EC461/ 23EC462	Industrial Electronics / Computer Organization and Architecture	EC	2	2	0		03	50	50	100	3
7	AEC/ SEC	23EC471/ 23EC472	OOPS Through JAVA/ Professional Skills for the Work Place	EC	1	0	0		01	50	50	100	1
8	UHV	23UH48	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	MC	23NS49	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		23PE49	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		23YO49	Yoga	Yoga Teacher									
Total										**500**	**400**	**900**	**20**

Engineering Science Course (ESC/ETC/PLC)

23EC461	Industrial Electronics	23EC462	Computer Organization and Architecture

Ability Enhancement Course / Skill Enhancement Course – IV

23EC471	OOPS Through JAVA	23EC472	Professional Skills for the Work Place

ADDITIONAL MATHEMATICS for Lateral Entry Students

SN	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	23MATDIP41	ADDITIONAL MATHEMATICS-II	MATHS	3	0	0		03	100	00	100	0

Scheme of Syllabus

B.Tech – III-Semester

Electronics & Communication Engineering

(2023 Scheme)

Semester: III
Course Name: BIOLOGY FOR ENGINEERS

Course Code	**23BB31**	CIE Marks	**50**
Teaching Hours / Week (L:T:P: S)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**

Course objectives:

1. To familiarize the students with the basic biological concepts and their engineering applications.
2. To enable the students with an understanding of bio design principles to create novel devices and structures.
3. To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
4. To motivate the students to develop interdisciplinary vision of biological engineering.

Module-1 **08 Hours**

INTRODUCTION TO BIOLOGY:
The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each), Properties and functions), vitamins and hormones.

Module-2 **08 Hours**

BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):
Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabiesand RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents / detergents), Enzymes (glucose-oxidase inbiosensors, lignolytic enzyme in bio-bleaching).

Module-3 **08 Hours**

HUMAN ORGAN SYSTEMS AND BIO DESIGNS (QUALITATIVE):
Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and conecells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pacemakers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).

Module-4 **08 Hours**

NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):
Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts). Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).

Module-5 **08 Hours**

TRENDS IN BIOENGINEERING (QUALITATIVE):

Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bioprinting techniques and materials, 3D printing ofear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Bio computing, Bio imaging and Artificial Intelligence for disease diagnosis. Self- healing Bio concrete (based on bacillusspores, calcium lactate nutrients and bio mineralization processes) and Bioremediation and Bio mining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

Course outcomes (Course Skill Set)

At the end of the course, the student will be able to:

CO-1: Elucidate the basic biological concepts via relevant industrial applications and case studies.

CO-2: Evaluate the principles of design and development, for exploring novel bioengineering projects.

CO-3: Corroborate the concepts of biomimetic for specific requirements.

CO-4: Think critically towards exploring innovative bio based solutions for socially relevant problems.

Suggested Learning Resources:

Books

- Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S.,and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MITPress, 2008.
- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N GeethaA C Udayashankar
- Lambert Academic Publishing, 2019.
- 3D Bio printing: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

Web links and Video Lectures (e-Resources):

- https: / / nptel.ac.in / courses / 121106008
- https: / / freevideolectures.com / course / 4877 / nptel-biology-engineers-other-non-biologists
- https: / / ocw.mit.edu / courses / 20-020-introduction-to-biological-engineering-design-spring-2009
- https: / / ocw.mit.edu / courses / 20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https: / / www.coursera.org / courses?query=biology
- https: / / onlinecourses.nptel.ac.in / noc19_ge31 / preview
- https: / / www.classcentral.com / subject / biology
- https: / / www.futurelearn.com / courses / biology-basic-concepts

Activity Based Learning (Suggested Activities in Class) / Practical Based learning

- Group Discussion of Case studies
- Model Making and seminar / poster presentations
- Design of novel device / equipment like Cellulose-based water filters, Filtration system

III Semester

Course Name: Digital Circuit Design Using Verilog

Course Code	**23EC32**	CIE Marks	**50**
Teaching Hours/Week (L:T:P)	**2:2:2**	SEE Marks	**50**
Total Hours of Pedagogy	**40(T)+20(P)**	Total Marks	**100**
Credits	**04**	Exam Hours	**03**

Pre-requisites:

Number systems, Arithmetic and Logical operations, Basic gates.

Course objectives:

1. To prepare learners with fundamental knowledge/ overview in the field of Digital system Design & its programming language.
2. To equip learners with a basic foundation in VLSI design fundamentals required for comprehending the operation and application of digital design and embedded systems.
3. To inculcate in second-year engineering learners an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.
4. To facilitate learners to experience task-based learning, peer learning and enable learners to inculcate self-study culture.

Module – 1 **08 Hours**

Principles of Combinational Logic: Definition of combinational logic, Problem statements to truth tables, Deriving switching equations, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps, Three and four variables Karnaugh maps, Incompletely specified Functions (Don't care Terms), Simplifying Max term Equations, Map entered variables, Multiple output functions. **Text1:**3.1, 3.1.1, 3.1.2, 3.2, 3.3, 3.4, 3.4.1, 3.4.5, 3.4.6, 3.6 & 3.8
Self-study topics:
Hazards in combinational circuits, Quine-McCluskey Minimization Technique, Quine–McCluskey using Don't CareTerms.

Module – 2 **08 Hours**

Analysis and Design of Combinational Logic: Introduction to Digital Integrated circuits, Adders and Subtractors, Cascading full adders, Look ahead carry, Decoders, Encoders, Digital Multiplexers, Demultiplexers , Binary Comparator (1 bit, 2-bit comparators only), Tri-State buffers. **Text1:**4.2, 4.3,4.3.1, 4.4,4.5,4.5.1, 4.6, 4.6.1, 4.6.2,4.7,4.10
Self-study topics:
Adders types, role of decoder in processor, ALU and Array Multipliers.

Module – 3 **06 Hours**

Overview of digital design with Verilog HDL: Typical HDL flow, Importance of HDLs. **Verilog basic concepts:** Lexical conventions, data types. **Gate level modeling:** Gate types, AND/OR gates, BUF/NOT gates, Examples like 3 bit adders, 4-bit ripple carry full adder,3 bit subtractors, multiplexers, Demultiplexers, Decoders and Encoders. **Data flow modeling using Verilog HDL:** , Examples like half adder and full adders, 4-bit ripple carry full adder,3 bit subtractors, multiplexers, Demultiplexers, Decoders, Encoders and flip flops (SR, D). **Text 2:** 1.3, 1.4, 2.1, 2.3, 3.1, 3.2, 4.1, 4.2.2, 4.2.3, 5.1, 5.1.1, 5.1.2, 5.1.4
Self-study topics:
Popularity of Verilog HDL, Components of a simulation, Half Adder & full adder using gate level modeling using xilix

Module – 4 **10 Hours**

Sequential circuits: Sequential circuit models (universal model only), Flip-flops: flip-flop logic symbols, functionand triggering, Latches, J-K Clocked flip-flops, clocked T&D flip-flop, Master- slave flip-flops, Edge triggered flip- flops, Flip Flop timing specifications. **Simple counters:** Divide by 2 and 4 counters (Asynchronous), Mod-8 synchronous counter, Johnson counter (Synchronous) Ring counter (synchronous). **Registers:** Parallel input/Parallel output, Serial input/serial output shift registers. **Text1:** 5.1, 5.2, 5.3, 5.4, 5.6, 5.6.1,6.1, Text3:1.7, 1.8, 1.9
Self-study topics:
, Up-Down Decade counter design, Difference betweenMoore and Mealy models,

Module – 5 **08 Hours**

Finite State Machines: Mealy sequential circuit design, Design of Moore sequential Circuit, Equivalent States and Reduction of State Tables. **Text1**: 6.2 ,6.2.1 ,6.2.2, 6.5 **Behavioral modeling using Verilog:** Procedural Assignments, Delay based timing control**,** Examples like half adder and full adders, 4-bit ripple carry full adder,3 bit subtractors, multiplexers, Demultiplexers, Decoders, Encoders and flip flops(SR-FF,T-FF,D-FF), Johnson counter (Synchronous), Ring counter (synchronous). **Text 2:** 6.3, 6.4, 6.5, 6.5.1, 6.5.2, 7.1,7.2,7.3.1, 7.5,7.6,7.9.
Self-study topics:
Logic synthesis with Verilog

PRACTICAL COMPONENT OF IPCC

SN	Experiments
	Part A
The following experiments can be done using Digital IC Trainer Kit	
1	To verify i. The SOP and POS expressions using universal gates. ii. De- Morgan's theorem for 2 variables.
2	Design and implement i. Half adder and Full adder ii. Half subtractor Full subtractor iii. 4-bit parallel adder using IC7483 (Optional)
3	Design and implement i. Simplified 4 variable function using basic gates by applying Boolean rules and K- map. ii. 4 variable function using IC74151 (8:1MUX).
4	Realize i. SR Flip Flop ii. D Flip Flop iii. Master and slave JK Flip Flop iv. T Flip Flop
5	i. Realize shift register using IC 7495. a. SISO b. SIPO c. PISO d. PIPO ii. Realize Mod-n synchronous counter using IC74192. iii. Realize Mod-n asynchronous counter using IC7490.
	Part B
The following experiments can be done using Xilinx/ Mentor Graphics or any other equivalent EDA tools	
1	Write a Verilog code to describe the functions of a Full Adder and Subtractors using three modeling styles
2	Write a Verilog Code to i. Design 8:3 Encoders with and without Priority. ii. Design 2:1 Multiplexer using Conditional Operator.
3	**Flip flops** i. SR-FF ii. T-FF iii. D-FF
4	**I) COUNTERS:** **Design a** **i.** Mod-n counters using Verilog code. **ii.** Johnson counter and Ring counter. **II) REGISTERS:** Parallel input/Parallel output, Serial input/serial output shift registers.

Course Outcomes:

CO-1: Use Karnaugh map and Quine-McCluskey minimization methods to simplify the given digital circuits.
CO-2: Explore the applications of combinational logic circuits such as Decoder, Encoder, Multiplexer, Adder, Subtractor etc., to realize the given Boolean function.
CO-3: Explore the applications of sequential logic circuits and their machine models to design digital circuits.
CO-4: Realize the given digital circuits using structural, data flow and behavioral Verilog HDL modeling styles with appropriate design approaches.
CO-5: Conduct Open-Ended Experiments/Mini lab projects related to applications of Digital Circuits and propose innovative solutions.

TEXT BOOKS:

S.No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Digital Logic Applications andDesign.	John M Yarbrough	Cengage Learning	2008 (reprint)
2	Verilog HDL: A Guide to DigitalDesign and Synthesis.	Samir Palnitkar	Pearson Education	2nd Edition
3	Fundamentals of Logic Design.	Charles H. Roth (Jr.)	West publications	4th Edition, 1992

REFERENCE BOOKS:

S.No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Modern Digital Electronics	R P Jain	Tata McGraw-Hill.	Third Edition
2	Digital Principle and Design.	Donald D. Givone	McGraw-Hill	2003
3	HDL Programming VHDL andVerilog	Nazeih M Botros	Dreamtech press	2009

Semester: III

Course Name: Signals & Systems

Course Code	23EC33	CIE Marks	50
Teaching Hours / Week (L:T:P)	2:2:2	SEE Marks	50
Total Hours of Pedagogy	40(T)+20(P)	Total Marks	100
Credits	04	Exam Hours	03

Pre-requisites: Basics of Mathematics-Fourier series, Partial fractions.

Course objectives:

1. **Preparation:** To prepare students with fundamental knowledge/ overview in the field of signal Processing with familiarization with concept of Signals and Systems with a qualitative insight into applications in communication.
2. **Core Competence:** To equip students with a basic foundation in Signal Processing by delivering the basics of mathematical description of continuous and discrete time signals and systems, analyzing the signals in time domain using convolution sum, classifying signals into different categories based on their properties, analyzing LTI systems in time and transform domains.
3. **Professionalism:** To inculcate students an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.
4. **Learning Environment:** To facilitate students to experience task based learning, peer learning and enable students to inculcate self-study culture, Hands on components by using modern tool.

Module-1

Introduction and Classification of signals: Definition of signal and systems with examples, Elementary signals /Functions: Exponential, sinusoidal, step, impulse and ramp functions **Basic Operations on signals:** Amplitude scaling, addition, multiplication, time scaling, time shift and time reversal. Expression of triangular, rectangular and other waveforms in terms of elementary signals **Classification of Systems and properties:** Linear-nonlinear, Time variant -invariant, causal-non causal, static-dynamic, stable-unstable, invertible-non invertible. **(Text 1, Chapter 1: 1. 1 to 1. 8)** **8 Hours**
Self-Study topics: Plotting of basic signals and operations on signals with properties.

Module-2

Time domain representation of LTI System: Impulse response, convolution sum and integral. Computation of convolution sum using graphical method for unit step and unit step, unit step and exponential, exponential and exponential, unit step and rectangular, and rectangular and rectangular signals. **LTI system Properties in terms of impulse response:** System interconnection, Memory less, Causal, Stable, Invertible and Deconvolution and step response. **(Text 1, Chapter 2: 2. 1 to 2. 9)** **8 Hours**
Self-Study topics: Applications of LTI Systems

Module-3

Continuous Time Fourier Transform: Fourier Transform of periodic / aperiodic signals, Properties of CTFT: Linearity, time shifting, conjugation and conjugate symmetry, differentiation and integration, time and frequency scaling, duality, Parseval's relation, convolution and modulation theorem **(Text 2, Chapter 4:4. 1 to 4. 5)** **8 Hours**
Self-Study topics: Verification of properties

Module-4

Discrete Time Fourier Transform: Fourier analysis of discrete time Signals and systems, DTFT, Properties of DTFT -periodicity, linearity, time and frequency shifting, conjugate symmetry, time reversal **(Text 2, Chapter 5: 5. 1 to 5. 3)** **8 Hours**
Self-Study topics: Verification of properties

Module-5

The Z-Transforms: Z transform, unilateral, Initial conditions, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform by partial fraction, Causality and stability, Transform analysis of LTI systems. **(Text 1, Chapter 6: 6. 1 to 6. 10)** **8 Hours**
Self-Study topics: Solving Z-Transforms by partial fractions

PRACTICAL COMPONENT OF IPCC

SN	Experiments
1	Generation and plotting of Continuous and Discrete Signals ex: unit step, unit ramp, sinusoidal, exponential, square, pulse, saw tooth, Sinc Signals (Any arbitrary Signals)
2	To verify different Properties of given System. a)Causal and no causal Systems b)Static and dynamic systems c)Linear and nonlinear Systems d)Time-Invariant and variant systems
3	Different mathematical Operations on Continuous and discrete time signals a)Addition of two signals b)Even and odd component Signals c) amplitude scaling and Time shifting
4	Convolution of CT and DT signals
5	To find Fourier transform of a given signal and plot its magnitude and phase spectrum
6	To find impulse response of LTI System and locate the zeros and poles, plot the zero-pole maps in Z plane
7	Transformation of signals into time and frequency domain
8	Modulation of Signals
9	Noise reduction in Communication systems
10	Synthesizing the Sound of a plucked String
11	Impulse Response and distortion removal

Course Outcomes:

CO-1: Perform mathematical operations on a given continuous / discrete type signal and Classify systems based on theirproperties.
CO-2: Develop input output relationship for a given LTI system and analyze the LTI system properties.
CO-3: Apply Fourier transform to the continuous and discrete time signals and analyze their properties.
CO-4: Analyze the discrete time signals and LTI systems applying Z transforms.
CO-5: Demonstrate the solution for a given open ended problem / Mini-lab project through simulation / emulation in the field of signal processing.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Signals and Systems	Simon Haykin	Wiley India	2nd Edition & 2008
2	Signals and Systems	Alan V. Oppenheim, Alan S, Wilsky with Hamid Nawab	PHI Publications	2nd Edition & 2011
Reference Books				
1	Fundamentals of Signals &Systems	Michael Roberts	Tata McGraw Hill Education(India), PrivateLimited	2nd edition
2	Signals and Systems	H P Hsu, R Ranjan	Schaum9s Outlines	TMH 2006

Semester: III
Course Name: Analog Electronic Circuits

Course Code	**23EC34**	CIE Marks	**50**
Teaching Hours/Week (L:T:P)	**2:2:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**03**

Pre-requisites: Semiconductor Physics, Electronic Devices

Course objectives:

This course will enable students to:

1. Explain basic Operation and characteristics of Diodes, BJT, FET parameters, connections and configurations.
2. Design various types of BJT and FET biasing for amplifier circuits
3. Understand the fundamentals of feedback structure and basic feedback topologies
4. Analyze Power amplifier circuits in different modes of operation
5. Discuss the working principle of data converters using Op-Amp
6. Design first and second order Butterworth Active filters using Op-Amp
7. Explain the working of Monostable and Astable multivibrators using IC 555 timer

Module – 1: Diode, Rectifiers, Regulators and BJT &FET Amplifiers **08 Hours**

Introduction to Electronic Devices
Diode & its applications: Introduction, PN-Junction Diode, Equivalent Circuit of Diode, Half Wave & Full Wave Rectification (With Derivation of Efficiency & Ripple Factor), Wave Shaping Circuits-Clipping, Clamping **Voltage Regulators:** Fixed Voltage Regulators and Adjustable Voltage Regulators
BJT: Introduction, BJT Construction and Operation, BJT Configuration and characteristics
FET: Introduction to FET, Construction, operation, Characteristics of MOSFET
(Text 1: 2.1,2.2,2.2.3,2.4,2.5.1,2.5.2,2.5.4,2.5.5, 3.1,3.2,3.3, 4.1,4.3 Text 3: 9.7.1,9.7.2)

Self-Study Topics:
BJT as Switch & as Amplifier

Module – 2: BJT Biasing, Small signal operation and Modeling: **08 Hours**

BJT Biasing: Biasing in BJT amplifier circuits: The Classical Discrete circuit bias (Voltage- divider bias), Biasingusing a collector to base feedback resistor.
BJT Small signal operation and Modeling: Collector current and transconductance, Base current and input resistance at the base, Emitter current and input resistance at the emitter, voltage gain, Separating the signal and the DC quantities, The hybrid Π model, The T model.
MOSFETs Biasing: Biasing in MOS amplifier circuits: Biasing by Fixing VGS, Biasing by Fixing VG and Biasing using a Drain to Gate feedback resistor.
MOSFET Small signal operation and Modeling: The DC bias point, signal current in drain terminal, voltage gain, Separating the DC Analysis and the signal analysis, small signal equivalent circuit models, Transconductance, TheT equivalent circuit model.
(Text 2: 3.5(3.5.1, 3.5.3), 3.6(3.6.1 to 3.6.7), 4.5(4.5.1, 4.5.2, 4.5.3), 4.6(4.6.1 to 4.6.7))

Self-Study Topics:
Large Signal Modeling for BJT

Module – 3 : MOSFET Amplifiers and Frequency Response: **08 Hours**

MOSFET Amplifier configuration: Basic Structure, characterizing amplifiers, CS amplifier with and withoutsource resistance RS, Source follower amplifier. **MOSFET internal capacitances and High frequency model:** The gate capacitive effect, Junction capacitances, High frequency MOSFET model. **Frequency response of the CS amplifier:** The three frequency bands, high frequency response, Low frequency response. **IC Biasing:** Current Sources, Current Mirrors and Current Steering Circuits. (Text 2: 4.7 (4.7.1 to 4.7.4, 4.7.6), 4.8(4.8.1, 4.8.2, 4.8.3), 4.9(4.9.1,4.9.2,4.9.3), 6.3(6.3.1,6.3.2))
Self-Study Topics:
Large Signal Modeling for MOSFET

Module – 4: Feedback Amplifiers and Power Amplifiers: **08 Hours**

Feedback Amplifier: General feedback structure, Properties of negative feedback, The Four Basic Feedback Topologies, The series-shunt Feedback amplifier, series-series Feedback amplifier, shunt-shunt and shunt-series Feedback amplifiers (Qualitative Analysis). **Power Amplifiers:** Introduction, Classification of output stages, Class A and Class B output stage: Transfer Characteristics, Power Dissipation, Power Conversion efficiency, Class AB output stage: Circuit operation, output resistance, Class C Output Stage: Efficiency. **(Text** 2:7.1, 7.2, 7.3, 7.4.1, 7.5.1, 7.6 (7.6.1 to 7.6.3), 12.1, 12.2 (12.2.1,12.2.3,12.2.4), 12.3 (12.3.2,12.3.3, 12.3.4), 12.4,12.6)
Self-Study Topics:
Class D Power Amplifier

Module – 5: Op-Amp Applications and IC 555 Timers: **08 Hours**

Op-Amp Applications: Instrumentation Amplifier, Peak detector, DAC-Weighted resistor and R- 2R ladder, ADC- Successive approximation type, Active Filters- First and second order low-pass and high-pass Butterworth filters, Band-pass filters, Band reject filters. **IC 555 Timers and its Operating modes:** Introduction, Monostable and Astable Multivibrators. **(Text 3:** 6.6, 8.11(8.11.1(a), 8.11.1(b), 8.11.2(a), 8.14, 7.2-7.6, 7.8, 7.9, 9.4)
Self-Study Topics:
Waveform generators using 555 Timer.

Course Outcomes:

After studying this course, students will be able to:

- **CO-1: Outline** the Construction, operation & characteristics of Junction & Field Effect devices
- **CO-2: Design and analyze** BJT and FET amplifiers with different circuit configurations and biasing conditions.
- **CO-3: Apply** the concepts of feedback topologies in the design of amplifiers and oscillators.
- **CO-4: Explore** the wide range applications of linear ICs such as ADC, DAC, filters and timers.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1.	Basic Electronics	D.P Kothari & I J Nagrath	McGraw Hill Education (India) Pvt. Limited,	2014,ISBN: 978-93-329-0158-2,
2.	"Micro Electronic Circuits Theory and Application"	Adel S. Sedra and Kenneth C. Smith,	Oxford University Press	5th Edition , 2013, ISBN-10:978-0- 19-806225-7
3.	"Op-Amps and Linear Integrated Circuits"	Ramakant A Gayakwad	Pearson Education	4th Edition, 2018. ISBN: 978-93-325-4991-3
4.	Electronic Devices and Circuits	J.Millman & C.C.Halkias	McGraw Hill Education (India) Pvt. Limited,	2nd edition, 2010
Reference Books				
1	"Electronics devices and Circuit theory"	Robert L. Boylestad and Louis Nashelsky	Pearson Education	10th/11th Edition, 2012, ISBN:978-81-317-6459-6.
2	"Integrated Electronics Analogand Digital Circuits and Systems"	J.Millman & C.C.Halkias	McGraw Hill Education (India) Pvt. Limited,	2nd edition, 2010, ISBN 0- 07-462245-5

III Semester
Name of the Laboratory: Analog Electronic Circuits Laboratory

Course Code	**23ECL35**	CIE Marks	**50**
Teaching Hours/Week (L:T:P)	**0:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**20**	Total Marks	**100**
Credits	**01**	Exam Hours	**03**

Pre-requisites: Semiconductor Physics, Electronic Devices

Course Objectives:

This laboratory course enables students to get practical experience in design, assembly, testing and evaluation of:

1. Rectifiers and Voltage Regulators
2. BJT Amplifier characteristics
3. MOSFET Characteristics and Current Mirrors
4. Op-amp and 555 Applications

List of Experiments:

SN	Part-A Experiments using Discrete components
1	Design and set up the following rectifiers with and without filters and determine ripple factor and efficiency: (a)Full Wave Rectifier (b) Bridge Rectifier
2	Conduct experiment to test diode clipping (single/double ended) and clamping circuits (positive/negative) for given specifications.
3	Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain- bandwidth product from its frequency response
4	Design and set-up the crystal oscillator and determine the frequency of oscillation.
5	Design Adder, Integrator and Differentiator circuits using Op-Amp
6	Test a comparator circuit and design a Schmitt trigger for the given UTP and LTP values andobtain the hysteresis
7	Design Astable Multivibrator using 555 Timer for given specifications
8	Design 4-bit R-2R DAC using Op-Amp
	Part-B Simulation using EDA software (p-spice, Multisim or any Equivalent tool)
1	Design and Simulate the RC-Phase shift Oscillator using Op-Amp, and Verify the frequency of Oscillations
2	Design and Simulate the Monostable Multivibrator using 555 Timer for given specifications
3	Simulate the transfer and drain characteristics of a MOSFET and calculate its drain resistance,mutual conductance and amplification factor
4	Simulate Current Mirror Circuits using MOSFET
5	Part-C Open-Ended Experiments / Mini Lab Projects
	Any Open-Ended Experiments / Mini Lab Projects

Course Outcomes:

At the end of this laboratory course, the students will be able to:

CO-1: Implement circuits of rectifiers, clipping circuits, clamping circuits for a given specifications
CO-2: Analyze the characteristics of BJT/MOSFET in the design of amplifiers and current mirrors
CO-3: Design analog circuits using OPAMPs and 555 timer for different applications
CO-4: Demonstrate the solutions for the given open-ended problem/ Mini lab projects applying Analog circuit design principles.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1.	"Basic Electronics"	D.P Kothari & I J Nagrath	McGraw Hill Education (India) Pvt. Limited,	2014,ISBN: 978-93-329-0158-2,
2	"Micro Electronic Circuits Theory and Application"	Adel S. Sedra and Kenneth C. Smith,	Oxford University Press	5th Edition , 2013, ISBN-10:978-0-19- 806225-7
3	"Op-Amps and Linear Integrated Circuits"	Ramakant A Gayakwad	Pearson Education	4th Edition,2018. ISBN: 978-93-325-4991-3

Reference Books:

"Electronics Lab Manual", Navas K A, PHI Learning Pvt. Ltd., 2018

Semester: III
Course Name: Network Analysis

Course Code	**23EC361**	CIE Marks	**50**
Teaching Hours/Week (L: T:P)	**2:2:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**03**

Pre-requisites: Students need a foundation in electrical engineering and circuit theory. Understanding concepts likeOhm's law, Kirchhoff's laws, capacitance, inductance, and impedance is essential. Proficiency in analyzing both ACand DC circuits, as well as knowledge of various circuit components like resistors, capacitors, and inductors will becrucial.

Course objectives:

By the end of this course, students will be able to:

1. **Master Foundational Concepts:** Develop a thorough understanding of fundamental principles, networkelements,and circuit laws that govern the behavior of electrical networks.
2. **Apply Network Theorems:** Effectively apply a variety of network theorems, such as Thevenin's theorem, Norton'stheorem, and Superposition theorem, to simplify complex circuits and analyze their behavior.
3. **Analyze in the Frequency Domain:** Gain proficiency in using Laplace Transformation to analyze network responsesin the frequency domain, allowing for a comprehensive understanding of system behavior over time.
4. **Predict Transient Behaviors:** Comprehend transient responses of networks and analyze their behavior during theinitial conditions, enabling accurate predictions of circuit behavior during start-up and transients.
5. **Explore Resonant Circuits:** Understand the behavior of resonant circuits, including their applications in filtersand oscillators, and how to design and analyze such circuits for specific frequency responses.
6. **Characterize Two-port Networks:** Learn how to determine and interpret two-port network parameters, such as impedance, admittance, and transmission parameters, which are crucial in understanding and designing complex interconnected systems.
7. **Hands-on Simulink Experience:** Gain practical experience through hands-on experiments using Simulink, a powerful simulation tool, to reinforce theoretical concepts and enhance analytical skills.

Module – 1 **08 Hours (RBT Levels: L1, L2 & L3)**

Basic Concepts: Introduction, Practical sources, Source transformations, Network reduction using Star–Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks,Concepts of super node and super mesh.

Module - 2 **08 Hours (RBT Levels: L1, L2 & L3)**

Network Theorems: Introduction, Superposition theorem, Reciprocity theorem, Millman‘s theorem, Thevenin‘stheorem, Norton‘s theorem, proof of thevenin’s and Norton’s theorem Maximum Power transfer theorem.

Module – 3 **08 Hours (RBT Levels: L1, L2 & L3)**

Laplace Transformation & Applications: Introduction, Laplace transform of standard input signals, properties of Laplace transform, initial and final value theorem, Solution of networks, step, ramp and impulse responses, waveform Synthesis. Transient behavior and initial conditions: Introduction, Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations.

Module – 4 **08 Hours (RBT Levels: L1, L2 & L3)**

Resonant Circuits: Introduction, Transfer functions, Series Resonance- Band width, Quality factor and half power frequencies. Parallel resonance-transfer function and frequency-response, resonance in a two branch RL-RC parallel circuits, practical parallel and series resonant circuits.

Module – 5 **08 Hours (RBT Levels: L1, L2 & L3)**

Two port network parameters: Introduction, Admittance parameters, Impedance parameters, z and y parameters by matrix partition, Hybrid parameters, transmission parameters, modeling with these parameters, relationship betweentwo- port parameters.

Course Outcomes:

CO-1: Determine currents and voltages using source transformation/ source shifting/ mesh/ nodal analysis and reducegiven network using star-delta transformation/ source transformation/ source shifting.
CO-2: Solve network problems by applying electrical laws to reduce circuit complexities and to arrive at feasible solutions.
CO-3: Apply Laplace transform to solve the given network. Calculate current and voltages for the given circuit under transient conditions.
CO-4: Evaluate for RLC elements in resonant circuits and solve the given network using specified two port network parameter like Z or Y or T or h.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Network analysis	M.E. Van Valkenberg (2000)	Prentice Hall of India	3rd edition, 2000, ISBN: 9780136110958.
2	Networks and systems	Roy Choudhury	New Age International Publications	2006, ISBN: 9788122427677
Reference Books				
1	Engineering Circuit Analysis	Hayt, Kemmerly and Durbin	TMH	7th Edition, 2010
2	Basic Engineering Circuit Analysis	J. David Irwin /R. Mark Nelms	John Wiley,	8thed, 2006.
3	Fundamentals of Electric Circuits	Charles K Alexander and Mathew N O Sadiku	Tata McGraw-Hill	3rd Ed, 2009

e-Resources:

1. https://nptel.ac.in/courses/108106098
2. https://nptel.ac.in/courses/108102042

Semester: III
Course Name: Sensors and Instrumentation

Course Code	**23EC362**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3

Course objectives:

- Understand various technologies associated in manufacturing of sensors
- Acquire knowledge about types of sensors used in modern digital systems
- Get acquainted about material properties required to make sensors
- Understand types of instrument errors and circuits for multirange Ammeters and Voltmeters.
- Describe principle of operation of digital measuring instruments and Bridges.
- Understand the operations of transducers and instrumentation amplifiers.

Module-1 **8 Hours**

Introduction to sensor based measurement systems:

General concepts and terminology, sensor classification, Primary Sensors, material for sensors, microsensor technology. (Text 1)

Module-2 **8 Hours**

Self-generating Sensors-Thermoelectric sensors, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors, electrochemical sensors. (Text 1)

Module-3 **8 Hours**

Principles of Measurement: Static Characteristics, Error in Measurement, Types of Static Error.(Text2: 1.2-1.6)

Multirange Ammeters, Multirange voltmeter.(Text2:3.2,4.4)

Digital Voltmeter: Ramp Technique, Dual slope integrating Type DVM, Direct Compensation typeand Successive Approximations type DVM (Text 2: 5.1-5.3, 5.5,5.6)

Module-4 **8 Hours**

Digital Multimeter: Digital Frequency Meter and Digital Measurement of Time, Function Generator.

Bridges: Measurement of resistance: Wheatstone's Bridge, AC Bridges - Capacitance andInductance Comparison bridge, Wien's bridge.

(Text2: refer 6.2,6.3 3 up to 6.3.2, 6.4 up to 6.4.2, 8.8, 11.2, 11.8 -11.10, 11.14).

Module-5 **8 Hours**

Transducers: Introduction, ElectricalTransducer,ResistiveTransducer,Resistive position Transducer,Resistance Wire Strain Gauges, Resistance Thermometer, Thermistor, LVDT.

(Text2:13.1-13.3,13.5, 13.6 up to 13.6.1,13.7,13.8,13.11).

Instrumentation Amplifier using Transducer Bridge, Temperature indicators using Thermometer,Analog Weight Scale(Text2:14.3.3, 14.4.1, 14.4.3).

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

CO-1: Understand the material properties required to make sensors
CO-2: Understand the principle of transducers for measuring physical parameters.
CO-3: Describe the manufacturing process of sensors
CO-4: Analyze the instrument characteristics and errors.
CO-5: Describe the principle of operation and develop circuits for multirange Ammeters, Voltmeters and Bridges to measure passive component values and frequency.

Suggested Learning Resources:

Books

1. "Sensors and Signal Conditioning", Ramon Pallas Areny, JohnG. Webster,2nd edition, John Wileyand
2. H.S.Kalsi, "Electronic Instrumentation", Mc Graw Hill,3rd Edition,2012,ISBN:9780070702066.

Reference Books

1. DavidA. Bell,"Electronic Instrumentation & Measurements", Oxford University Press PHI 2ndEdition, 2006,ISBN 81-203-2360-2.
2. D.HelfrickandW.D. Cooper, "Modern Electronic Instrumentation and Measuring Techniques", Pearson, 1stEdition, 2015, ISBN: 9789332556065.

Semester: III
Course Name: Programming with C++

Course Code	**23EC371**	CIE Marks	**50**
Teaching Hours/Week (L:T:P)	**1:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**30**	Total Marks	**100**
Credits	**01**	Exam Hours	**03**

Pre-requisites:

- Basic Knowledge of Programming Language
- Knowledge of Procedural Oriented Language like 'C'

Course objectives:

Upon completion of the course, students will be well-versed in C++ programming, object- oriented concepts, and they will possess problem-solving skills and be capable of designing efficient algorithms to address a wide range of computational challenges, making them competent software developers and programmers. This courseis targeting the following key aspects:

1. **Master C++ Programming Basics:**
   - Understand the syntax and semantics of C++ programming language.
   - Learn about variables, data types, operators, and control structures in C++.
   - Develop proficiency in writing C++ programs to solve basic computational problems.

2. **Explore Objects and Classes:**
   - Grasp the principles of object-oriented programming (OOP).
   - Create and use classes and objects to model real-world entities.
   - Implement encapsulation, abstraction, inheritance, and polymorphism.

Module – 1 **06 Hours (RBT Levels: L1,L2 & L3)**

C++ Programming Basics: Need for object-oriented programming, procedural languages, characteristics of OOPs,basic program construction, preprocessor directives, comments, data types, manipulators Type Conversion. (Text 1:1.1-1.3, 2.1- 2.5)
Teaching-Learning Process:
Chalk and talk method, PPTs, Hands-on Coding through compilation.

Module – 2 **06 Hours (RBT Levels: L1,L2 & L3)**

Structures: Structures, enumerated data types. (Text 1: 4.1-4.2) **Functions:** Passing arguments, returning values, reference arguments, overloaded functions, inline functions,variable and storage classes. (Text 1: 5.1-5.5)
Teaching-Learning Process:
Chalk and talk method, PPTs, Hands-on Coding through compilation.

Module – 3 **06 Hours (RBT Levels: L1,L2 & L3)**

Objects and Classes: Objects as data types, constructors, destructors, overloaded constructors. (Text 1: 6.1-6.3) **Arrays:** arrays as class member data types, passing arrays, arrays as objects, strings, arrays of strings. (Text 1: 7.1-7.4) **Operator Overloading:** Over loading of unary operators, binary operators, data conversion. (Text 1: 8.1-8.3)
Teaching-Learning Process:
Chalk and talk method, PPTs, Hands-on Coding through compilation.

Module – 4 **06 Hours (RBT Levels: L1,L2 & L3)**

Inheritance: Inheritance, derived class and base class, overriding member functions, scope resolution, levels of inheritance, multiple inheritances. (Text 1: 9.1-9.2, 9.4-9.5) Pointers: Pointers, Pointers to objects, virtual functions,friend functions, Static functions, files and streams, input/output operations. (Text 1: 10.1-10.3)
Teaching-Learning Process:
Chalk and talk method, PPTs, Visual Aids, Hands-on Coding through compilation.

Module – 5 **06 Hours (RBT Levels: L1,L2 & L3)**

Streams & Files: stream class, advantages of streams, stream class hierocracy. File systems : Disc file IO with streams, formatted file IO, character IO, Binary IO, closing of files, (Text 1: 12.1,12.2) **Exception Handling:** Why do we need exception, exception syntax, simple exception handling examples, multiple exceptions. (Text 1: 14.3)
Teaching-Learning Process:
Chalk and talk method, PPTs, Visual Aids, Hands-on Coding through compilation.

Course Outcomes:

CO-1: Analyze the concepts of object-oriented programming and demonstrate various different data types, operators and control statements in a C++ program to solve problem.
Co-2: Understand the concept of structures & functions in C++ program.
Co-3: Create classes & Objects to develop C++ Program.
Co-4: Discuss & illustrate the concepts of inheritance & pointers to design C++ Program.
Co-5: Analyze and explore various Stream classes, I/O operations and exception handling.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks:				
1	Object oriented programming in C++	Robert Lafore	Galgotia Publications	3rd edition 2003
Reference Books:				
1	Object Oriented Programming with C++	E Balaguruswamy	Tata McGraw Hill	3rd Edition 2006
2	C++ Primer	Lippman& J. Lajoie	, Addison Wesley	3rd Edition 2000
3	The Complete Reference C++, Herbert Schildt	Herbert Schildt	Tata McGraw Hill	4th Edition 2003

E-Resources:

1. https://www.tutorialspoint.com/cplusplus/index.htm
MOOCs: https://onlinecourses.nptel.ac.in/noc19_cs38/preview - NPTEL Course on Programming in C++ by Prof.ParthaPratim Das, IIT Kharagpur.

List of Practical Experiments for Hands-on Practice:

SN	Experiments
1	Write a C++ program to find largest, smallest & second largest of three numbers using inline functions MAX& Min.
2	Write a C++ program to calculate the volume of different geometric shapes like cube, cylinder and sphere usingfunction overloading concept.
3	Define a STUDENT class with USN, Name & Marks in 3 tests of a subject. Declare an array of 10 STUDENT objects. Using appropriate functions, find the average of the two better marks for each student. Print the USN,Name & the average marks of all the students.
4	Write a C++ program to create class called MATRIX using two-dimensional array of integers, by overloading the operator == which checks the compatibility of two matrices to be added and subtracted. Perform the additionand subtraction by overloading + and – operators respectively. Display the results by overloading the operator <<. If (m1 == m2) then m3 = m1 + m2 and m4 = m1 – m2 elsedisplay error
5	Demonstrate simple inheritance concept by creating a base class FATHER with data members: *First Name, Surname, DOB & bank Balance* and creating a derived class SON, which inherits: Surname & Bank Balance feature from base class but provides its own feature: First Name & DOB. Create & initialize F1 & S1 objectswith appropriate constructors & display the FATHER & SON details.
6	Write a C++ program to define class name FATHER & SON that holds the income respectively. Calculate &display total income of a family using Friend function.
7	Write a C++ program to accept the student detail such as name & 3 different marks by get_data() method & display the name & average of marks using display() method. Define a friend function for calculating theaverage marks using the method mark_avg().
8	Write a C++ program to explain virtual function (Polymorphism) by creating a base class polygon which has virtual function areas two classes rectangle & triangle derived from polygon & they have area to calculate &return the area of rectangle & triangle respectively.
9	Design, develop and execute a program in C++ based on the following requirements: An EMPLOYEE classcontaining data members & members functions: i) Data members: employee number (an integer), Employee_ Name (a string of characters), Basic_ Salary (in integer), All_ Allowances (an integer), Net_Salary (an integer). (ii) Member functions: To read the data of an employee, to calculate Net_Salary& to print the values of all the data members. (All_Allowances = 123% of Basic, Income Tax (IT) =30% of gross salary (=basic_ Salary_ All_Allowances_IT).
10	Write a C++ program with different class related through multiple inheritance& demonstrate the use of differentaccess specified by means of members variables & members functions.
11	Write a C++ program to create three objects for a class named count object with data members such as roll_no & Name. Create a members function set_data ( ) for setting the data values & display ( ) member function todisplay which object has invoked it using „this“ pointer.
12	Write a C++ program to implement exception handling with minimum 5 exceptions classes including two builtin exceptions.

III Semester

Name of the Course: Programming with Hardware Controllers

Course Code	**23EC372**	CIE Marks	**50**
Teaching Hours/Week (L:T:P)	**0:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**20**	Total Marks	**100**
Credits	**01**	Exam Hours	**02**

Pre-requisites: Basic Electronics and fundamentals of C programming.

List of Experiments:

Part A: Basic Arduino Programming	
SN	Experiments
1	Getting Started with Arduino: Arduino platform, Prototyping environment
2	Arduino IDE: Arduino Development Environment, setting up the Arduino board with Electronic componentsand connections.
3	Arduino First Program: Creating sketches, using Libraries, using example codes,Debugging Using the Serial Monitor.
4	Arduino Interfaces- Different Sensors & Actuators
Part B: Basic Raspberry Pi Programming	
1	Getting Started with Raspberry Pi Basic functionality of the Raspberry Pi board and its Processor, setting and configuring the board
2	Introduction to Linux: Overview of Linux and its terminal Commands for operating Raspberry Pi
3	Programming the Raspberry Pi: Python - Introducing to Python programming language & Python Programming Environment
4	Exploring Electronics with the Raspberry Pi: Sensors & Actuator Interfacing
Part C: Open Ended Experiments/Mini-Project (Only for CIE, not for SEE)	
A Mini-project using Arduino/Raspberry Pi	

Course Outcomes:

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

CO-1: Create sketches, libraries inside the Arduino Development Environment.
CO-2: Wire Raspberry Pi and create a fully functional computer.
CO-3: Use Python-based IDE, trace and debug Python code on Raspberry Pi.
CO-4: Interface suitable sensors and actuators with Arduino/Raspberry Pi to measure and control physical world.
CO-5: Implement the solution using Arduino /raspberry pi for a given open ended problem.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Arduino Cookbook	Michael Margolis,	O'Reilly Media	1st edition.
2	Raspberry Pi Cookbook for Python Programmers	Tim Cox	Packt Publishing Ltd.	2nd Revised edition, 2016
Reference Books				
1	Arduino for beginners : Essential Skills Every Maker Needs	John Baichtal	Pearson Education, Inc	1st edition,2013
2	Raspberry Pi User Guide	Eben Ubton and Gareth Halfacree	John Wiley Publications	4th Edition.2016

Semester: III
Course Name: SOCIAL CONNECT & RESPONSIBILITY

Course Code	**23SC38**	CIE Marks	**100**
Teaching Hours / Week (L:T:P: S)	**0:0:3:1**	SEE Marks	**--**
Total Hours of Pedagogy	**40 hour Practical Session +15 hour Planning**	Total Marks	**100**
Examination nature (No SEE – Only CIE)	**For CIE Assessment - Activities Report Evaluation by College NSS Officer / HOD / Sports Dept. / Any Dept.**		
Credits	**01 – Credit**		

Course objectives:

The course will enable the students to:

1. Provide a formal platform for students to communicate and connect to the surrounding.
2. Create a responsible connection with the society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

Contents:

- The course is mainly activity-based that will offer a set of activities for the student that enables them to connectwithfellow human beings, nature, society, and the world at large.
- The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, andsemester-long activities conducted by faculty mentors.

In the following a set of activities planned for the course have been listed:

Contents
Part I: **Plantation and adoption of a tree:** Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes.
Part II : **Heritage walk and crafts corner:** Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowingthe city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - Objectives, Visit, Case Study, Report, Outcomes.
Part III : **Organic farming and waste management:** Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the cam- Objectives, Visit, Case Study, Report,Outcomes.

Part IV:
Water conservation:
Knowing the present practices in the surrounding villages and implementation in the campus, documentary orphotoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.

Part V:
Food walk:
City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, casestudy, report, outcomes.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1: Communicate and connect to the surrounding.
CO2: Create a responsible connection with the society.
CO3: Involve in the community in general in which they work.
CO4: Notice the needs and problems of the community and involve them in problem –solving.
CO5: Develop among themselves a sense of social & civic responsibility & utilize their knowledge in findingpractical solutions to individual and community problems.
CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

Activities:

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experienceof Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fineart.

PEDAGOGY:

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solutionas the course project, with your group. Social immersionwith NGOs / social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

DURATION:

A total of 40 - 50 hours engagement per semester is required for the 3rd semester of the B.E. / B.Tech. program. Thestudents will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic, and poetry) Faculty mentors has to design the evaluation systemas perVTU guidelines of scheme & syllabus.

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE):

After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor / s to indicate what he has observed and learned in the social connect period. The reportshouldbe signed by the mentor. The report shall be evaluated on the basis of the following criteria and / or other relevant criteriapertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connectInformation / Data collected during the social connect Analysis of the information / data and report writing Considering all above points allotting the marks as mentioned below

Excellent: 80 to 100
Good: 60 to 79

Satisfactory: 40 to 59 Unsatisfactory and fail: <39

Special Note:

NO SEE – Semester End Exam – Completely Practical and activities based evaluation

Pedagogy – Guidelines:

It may differ depending on local resources available for the study as well as environment and climatic differences, locationand time of execution.

SN	Topic	Group size	Location	Activity Execution	Reporting	Evaluation Of the Topic
1.	Plantation and adoption of a tree:	May be individual or team	Farmers land / parks / Villages / roadside / community area / College campus etc.	Site Selection / Proper Consultation / Continuous Monitoring / Information Board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubricsOf scheme and syllabus by Faculty
2.	Heritage walk and crafts corner:	May be individual or team	Temples / monumental places / Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc.	Site Selection / Proper Consultation / Continuous Monitoring / Information Board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubricsOf scheme and syllabus by Faculty
3.	Organic farming and waste management:	May be individual or team	Farmers land / parks / Villages visits / roadside / community area / College campus etc.	Group Selection / Proper Consultation / Continuous Monitoring / Information Board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubricsOf scheme and syllabus by Faculty
4.	Water conservation: & conservation techniques	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc.	Site Selection / Proper Consultation / Continuous Monitoring / Information Board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubricsOf scheme and syllabus by Faculty
5.	Food walk: Practices in society	May be individual or team	Villages / City Areas / Grama panchayat / public associations / Government Schemes officers / campus etc.	Group Selection / Proper Consultation A/ Continuous Monitoring / Information Board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubricsOf scheme and syllabus by Faculty

Plan of Action (Execution of Activities):

SN	Practice Session Description
1	Lecture session in field to start activities
2	Students Presentation on Ideas
3	Commencement of activity and its progress
4	Execution of Activity
5	Execution of Activity
6	Execution of Activity
7	Execution of Activity
8	Case study based Assessment, Individual performance
9	Sector / Team wise study and its consolidation
10	Video based seminar for 10 minutes by each student At the end of semester with Report.

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progressandits completion.
- At last consolidated report of all activities, compiled report should be submitted as per the instructions andscheme.

Semester: III

Course Name: PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I

Course Code	**23PE39**	CIE	**100 Marks**
Credits: L:T:P	**0:0:1**		
Total Hours	**30 P**		

Course Outcomes:

At the end of the course, the student will be able to

CO-1: Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
CO-2: Familiarization of health-related Exercises, Sports for overall growth and development
CO-3: Create a foundation for the professionals in Physical Education and Sports
CO-4: Participate in the competition at regional / state / national / international levels.
CO-5: Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

Module I: Orientation **05 Hours**

a. Lifestyle
b. Fitness
c. Food & Nutrition
d. Health & Wellness
e. Pre-Fitness test.

Module II: General Fitness & Components of Fitness **15 Hours**

a. Warming up (Free Hand exercises)
b. Strength – Push-up / Pull-ups
c. Speed – 30 Mtr Dash
d. Agility – Shuttle Run
e. Flexibility – Sit and Reach
f. Cardiovascular Endurance – Harvard step Test

Module III: Recreational Activities **10 Hours**

a. Postural deformities.
b. Stress management.
c. Aerobics.
d. Traditional Games.

Semester: IV

Course Name: PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II

Course Code	**23PE49**	CIE	**100 Marks**
Credits: L:T:P	**0:0:1**		
Total Hours	**30 P**		

Course Outcomes:

At the end of the course, the student will be able to

CO-1: Understand the ethics and moral values in sports and athletics

CO-2: Perform in the selected sports or athletics of student's choice.

CO-3: Understand the roles and responsibilities of organization and administration of sports and games.

Module IV: Ethics and Moral Values **5 Hours**

Ethics in Sports Moral Values in Sports and Games

Module V: Specific Games (Any one to be selected by the student) **20 Hours**

Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.Throwball – Service, Receive, Spin attack, Net Drop & Jump throw. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash. Athletics (Track / Field Events) – Any event as per availability of Ground.

Module VI: Role of Organization and Administration **05 Hours**

Semester III – VI Semester
Course Name: YOGA FOR A BETTER LIFE

Course Code	**23YO39**	CIE Marks	100 / Sem.
Teaching Hours / Week (L:T:P: S)		SEE Marks	---
Total Hours of Pedagogy per semester	**24 - 28 hours (Theory + practical)**	Total Marks	100 / Sem.
Examination nature (SEE):	**Objective type Theory / Practical / Viva-Voce**		

Course objectives:

1. To enable the student to have good health.
2. To practice mental hygiene.
3. To possess emotional stability.
4. To integrate moral values.
5. To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcoholabuse).If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- **Physical**
  1. Improved body flexibility and balance
  2. Improved cardiovascular endurance (stronger heart)
  3. Improved digestion
  4. Improved abdominal strength
  5. Enhanced overall muscular strength
  6. Relaxation of muscular strains
  7. Weight control
  8. Increased energy levels
  9. Enhanced immune system
- **Mental**
  1. Relief of stress resulting from the control of emotions
  2. Prevention and relief from stress-related disorders
  3. Intellectual enhancement, leading to improved decision-making skills
- **Spiritual**
  1. Life with meaning, purpose, and direction
  2. Inner peace and tranquility
  3. Contentment

Semester III
Course Name: YOGA SYLLABUS

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, importance of prayer Yogic practices for common man to promote positive health

Rules to be followed during yogic practices by practitioner Yoga its misconceptions,

Difference between yogic and non-yogic practices

Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar 12 count, 2 rounds.

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionarymeasures and benefits of each asana

Different types of Asanas

a. Sitting: 1. Padmasana, 2. Vajrasana
b. Standing: 1. Vrikshana, 2. Trikonasana
c. Prone line: 1. Bhujangasana, 2. Shalabhasana
d. Supine line: 1. Utthitadvipadasana, 2. Ardhahalasanae.
e.

SEMESTER IV

Patanjali's Ashtanga Yoga, its need and importance. Yama:
Ahimsa, Satya, Asteya, Brahmacarya, Aparigraha
Niyama: Shoucha, Santosh, Tapa, Svaadhyaya, Eshvarapranidhan, Suryanamaskar12 Count- 4 Rounds of Practice

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionarymeasures and benefits of each asana

Different types of Asanas

a. Sitting: 1. Sukhasana, 2. Paschimottanasana
b. Standing: 1. Ardhakati Chakrasana, 2. Parshva Chakrasana
c. Prone line: 1. Dhanurasana,
d. Supine line: 1. Halasana, 2. Karna Peedasana

Meaning, importance and benefits of Kapalabhati. 40 strokes / min 3 rounds
Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measuresandbenefits of each Pranayama
Pranayama: 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana, 4. Chandra Bhedana 5.Nadishodhana

SEMESTER V

Patanjali'sAshtanga Yoga its need and importance. Ashtanga Yoga

1. Asana
2. Pranayama
3. Pratyahara

Asana its meaning by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

a. Sitting: 1. Ardha Ushtrasana, 2.Vakrasana, 3.Yogamudra in Padmasana
b. Standing: 1. UrdhvaHastothanasana, 2.Hastapadasana, 3.ParivrittaTrikonasana, 4.Utkatasana
c. Prone line: 1. Padangushtha Dhanurasana, 2.Poorna Bhujangasana / Rajakapotasana
d. Supine line: 1. Sarvangasana, 2.Chakraasana, 3.Navasana / Noukasana, 4.Pavanamuktasana

Revision of practice 60 strokes / min 3 rounds

Meaning by name, technique, precautionary measures and benefits of each Pranayama

1. Ujjayi2. Sheetali 3. Sheektari

SEMESTER VI

Ashtanga Yoga 1. Dharana 2. Dhyana (Meditation) 3. Samadhi

Asana by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

a. Sitting: 1. Bakasana, 2.Hanumanasana, 3.Ekapada Rajakapotasana, 4.Yogamudra in Vajrasana
b. Standing: 1. Vatayanasana, 2.Garudasana, 3.
c. Balancing: 1. Veerabhadrasana, 2.Sheershasana
d. Supine line: 1. Sarvangasana, 2.Setubandha Sarvangasana, 3.Shavasanaa (Relaxation posture).

Revision of Kapalabhati practice 80 strokes / min - 3 rounds

Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama 1. Bhastrika 2. BhramariMeaning, Need, importance of Shatkriya. Different types. Meaning by name, technique, precautionary measures and benefits ofeach Kriya 1. Jalaneti & sutraneti 2. Nouli (only for men) 3. Sheetkarma Kapalabhati

COURSE OUTCOMES (COURSE SKILL SET):

At the end of the course, the student will be able to:

CO-1: Understand the meaning, aim and objectives of Yoga.
CO-2: Perform Suryanamaskar and able to Teach its benefits.
CO-3: Understand and teach different Asanas by name, its importance, methods and benefits.
CO-4: Instruct Kapalabhati and its need and importance.
CO-5: Teach different types of Pranayama by its name, precautions, procedure and uses
CO-6: Coach different types of Kriyas , method to follow and usefulness.

Suggested Learning Resources:

Books:

1. Yogapravesha in Kannada by Ajitkumar
2. Light on Yoga by BKS Iyengar
3. Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly
4. Yoga Instructor Course hand book published by SVYASA University, Bengaluru
5. Yoga for Children –step by step – by Yamini Muthanna

Web links and Video Lectures (e-Resources): Refer links

https: //youtu.be/KB-TYlgd1wE
https: //youtu.be/aa-TG0Wg1Ls

Semester: 3rd to 6th

Course Name: NATIONAL SERVICE SCHEME (NSS)

Course Code	**23NS39**	CIE Marks	**100**
Teaching Hours / Week(L:T:P: S)	**0:0:3:1**	SEE Marks	**-**
Total Hours of Pedagogy	**40 hour Practical Session +15 hour Planning**	Total Marks	**100**
Examination nature (SEE)	Activities Report Evaluation by College NSS Officer at the end of every semester(3rd to 6th Semester)		
Credits	NCMC – Non Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)		

Course objectives:

National Service Scheme (NSS) will enable the students to:

1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem –solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmonyingeneral.

General Instructions - Pedagogy:

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted sothatthe activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documentingstudents' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

National Service Scheme (NSS) – Contents:

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocationaleducation.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, SwatchBharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.,
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

NOTE:

- Student / s in individual or in a group should select any one activity in the beginning of each semester till end ofthat respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.

SEMESTER WISE FROM 3RD TO 6TH SEMESTER DISTRIBUTION OF ACTIVITIES

Semester	Topics / Activities to be Covered
3rd Sem.	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4th Sem.	4. Water conservation techniques – Role of different stakeholders– Implementation.5 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education.
5th Sem.	7. Developing Sustainable Water management system for rural areas and implementationapproaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill developmentprograms etc., 9. Spreading public awareness under rural outreach programs.(minimum5 programs). 10. Social connect and responsibilities.
6th Sem.	11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

SN	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers Land / Villages / Roadside / Community Area / College Campus Etc.,	Site selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govt. organization, 5 R's.	May be individual or team	Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc.,,	Site selection / proper consultation / Continuous monitoring / Informationboard	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women Empowerment Groups / Consulting NGOs & Govt. Teams / College Campus Etc.,	Group selection / pro per consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc.,	site selection / proper consultation / Continuous monitoring / Informationboard	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc.,	Group selection / pro per consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
6.	Helping local schools to achieve good results and enhance their enrolment in Higher / technical / vocational education.	May be individual or team	Local Government / Private / Aided Schools / Government Schemes Officers / Etc.,	School selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

7.	Developing Sustainable Water management systemfor rural areas and implementation approaches.	May be individual or team	Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc.,	site selection / proper consultation /Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.,	May be individual or team	Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc.,	Group selection / pro per consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
9.	Spreading public awareness under rural outreach programs (minimum5 programs) / Social connect and responsibilities.	May be individual or team	Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc.,	Group selection / pro per consultation / Continuous monitoring / Informationboard	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
10.	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc.,	Place selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
11.	Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).	May be individual or team	Villages / City Areas / Grama Panchayat / Public Associations / Government Schemes Officers / Campus Etc.,	Place selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages / City Areas / Grama Panchayat / Public Associations / Government/ Schemes Officers / Campus Etc.,	Place selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities for Each Semester)

SN	Practice Session Description
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

- In every semester from 3rd semester to 6th semester, Each student should do activities according to the schemeandsyllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activityprogress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should besubmitted as per the instructions.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1: Understand the importance of his / her responsibilities towards society.
CO2: Analyse the environmental and societal problems / issues and will be able to design solutions for the same. CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development. CO4: Implement government or self-driven projects effectively in the field.
CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and socialharmony in general.

SUGGESTED LEARNING RESOURCES:

Books:

NSS Course Manual, Published by NSS Cell, VTU Belagavi. Government of Karnataka, NSS cell, activities reports and its manual.Government of India, NSS cell, Activities reports and its manual.

Semester: III
Course Name: ADDITIONAL MATHEMATICS-I

(For Lateral Entry Students)

Course Code	**23MATDIP31**	CIE Marks	**100**
Teaching Hours/Week (L:T:P)	**3:0:0**	SEE Marks	**-**
Total Hours of Pedagogy	**30**	Total Marks	**100**
Credits	**00**	Exam Hours	**-**

Pre-requisites:

1. Algebraic formulae
2. Differentiation
3. Integration
4. Trigonometric formulae

Module – 1 **08 Hours**

Linear Algebra
Introduction-Rank of matrix by elementary row operations- Echelon form. Consistency of system of linear equations, Solution of linear equations-Gauss elimination method. Eigen values and Eigen vectors of a squarematrix. Problems.
Self-Study: Gauss Jordon Method

Module - 2 **08 Hours**

Differential Calculus:
Review of successive differentiation-Illustrative examples. Maclaurin's series expansions-Illustrative examples.Partial Differentiation: Euler's theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobian of order two-problems.
Self-Study: Taylor's series expansion.

Module – 3 **08 Hours**

Vector Differentiation:
Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar andVector point functions. Gradient, Divergence and Curl- Simple problems. Solenoidal and irrotational vector fields- Problems.
Self-Study: Angle between two surfaces[RBT Levels: L1, L2,L3]

Module – 4 **08 Hours**

Integral Calculus:
Review of elementary integral calculus. Reduction formulae for $Sin^n x$, Co(with proof) and $Sin^m x\ Cos^n x$ (without proof) and evaluation of these with standard limits- Examples. Double and triple integrals-Simple problems.
Self-Study: Change of Order of Integration.

Module – 5 **08 Hours**

Ordinary Differential Equations:
Introduction-Solutions of first order and first degree differential equation: exact, Equation reducible to exact.Linear differential equations and Bernoulli's equation.
Self-Study: Homogeneous differential equations

Course outcomes:

CO-1: Upon Completion of this course, student will be able to,
CO-2: Make use of matrix theory for solving system of linear equations and compute eigen values and Eigen vectors.
CO-3: Learn the notion of partial differentiation to calculate the rate of change of multivariate functions and solve problems related to composite functions and Jacobians
CO-4: Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational vectors
CO-5: Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and the volumes.
CO-6: Solve first order linear differential equations analytically using standard methods.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S.Grewal	Khanna Publishers	43rd Ed.2015
2	Advanced Engineering Mathematics	E. Kreyszig	John Willy & Sons	10th Ed. (Reprint). 2016
3	Additional Mathematics-1	Dr. Pandurangappa	Sanguine Technical Publishers	4th Ed., 2019.
Reference Books				
1	Higher Engineering Mathematics	B.V. Ramana	Tata McGraw-Hill	11th Edition.2010

Scheme of Syllabus
B.Tech – IV Semester
Electronics & Communication Engineering
(2023 Scheme)

B.Tech in Electronics and Communication Engineering Scheme of Syllabus 2023

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

IV SEMESTER

SN	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	23MAT41	Applied Mathematics for Electrical and Electronics Engineering	MATHS	3	0	0		03	50	50	100	3
2	IPCC	23EC42	Engineering Electromagnetics	EC	2	2	2		03	50	50	100	4
3	IPCC	23EC43	Control Systems	EC	2	2	2		03	50	50	100	4
4	PCC	23EC44	Communication Systems- I	EC	2	2	0		03	50	50	100	3
5	PCCL	23ECL45	Communication Laboratory-I	EC	0	0	2		03	50	50	100	1
6	ESC	23EC461/ 23EC462	Industrial Electronics / Computer Organization and Architecture	EC	2	2	0		03	50	50	100	3
7	AEC/ SEC	23EC471/ 23EC472	OOPS Through JAVA/ Professional Skills for the Work Place	EC	1	0	0		01	50	50	100	1
8	UHV	23UH48	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	MC	23NS49	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		23PE49	Physical Education (PE) (Sports And Athletics)	Physical Education Director									
		23YO49	Yoga	Yoga Teacher									
Total										**500**	**400**	**900**	**20**

Engineering Science Course (ESC/ETC/PLC)			
23EC461	Industrial Electronics	23EC462	Computer Organization and Architecture
Ability Enhancement Course / Skill Enhancement Course – IV			
23EC471	OOPS Through JAVA	23EC472	Professional Skills for the Work Place

ADDITIONAL MATHEMATICS for Lateral Entry Students

SN	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	23MATDIP31	ADDITIONAL MATHEMATICS-I	MATHS	3	0	0		03	100	00	100	0

SEMESTER-IV

Course Name: Applied Mathematics for Electronics and Electrical Engineering

Course Code:	**23MAT41**	CIE Marks	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**3**

Pre-requisites: Knowledge of trigonometry, calculus, Basic concepts of Probability, Addition and MultiplicationTheorem, signals and systems properties.

Course objectives: This course will enable students

1. To find the association between attributes and the correlation between two variables
2. Aims to provide essential concepts of elementary probability theory.
3. Testing of hypothesis using t-distribution and chi-square distribution.
4. To differentiate a vector variable and Scalar variable and to find angle between surfaces, unit normal vector, directional derivative.
5. To study differentiation of complex variables and to construct analytic function

Module – 1: Curve Fitting, Correlation and regressions 09 Hours

Principles of least squares, Curve fitting by the method of least squares: fitting a straight line in the in the form $y = ax + b$, fitting a Parabola in the form of $y = ax^2 + bx + c$ and fitting a geometric curve in the form $y = ax^b$. Correlation, Co-efficient of correlation, lines of regression. Angle between regression lines, rank correlation coefficient.

Self- Study: Fitting of curves in the form $y = ae^{bx}$, $y = ab^x$.

Applications: To fit the given data into different curves, Signal approximation, Noise analysis, predictive maintenance.

Module – 2: Probability **08 Hours**

Probability distributions: Review of probability theory. Random variables (discrete and continuous), probability mass density function. Mean and variance of Binomial and Poisson distribution (with proof) andNormal distribution (without proof)-Problems.

Joint probability distribution: Joint probability distribution for two discrete random variables, expectation, standard deviation, covariance and correlation.

Self-study: Baye's theorem.

Applications: Control Engineering, operation research, testing and quality control, Noise analysis, System Reliability, Load forecasting.

(RBT Levels: L1, L2 and L3

Module – 3: Sampling Theory **08 Hours**

Introduction to sampling Theory, type-1, type-II errors, Test of hypothesis - Student's t-distribution and Chi-square distribution as a test of goodness of fit.

Self-study: Point estimation and interval estimation

Applications: Communication systems and quality control, Signal processing, data compression in communication, Power systems.

(RBT Levels: L1, L2 and L3)

Module – 4: Vector Calculus **07 Hours**

Review of Vector Algebra, Scalar and Vector Point Functions, Gradient of a scalar field, Divergence and Curlof Vector Field. Solenoidal and irrotational vectors, Vector Identities, Physical Interpretation of Divergenceand Curl.

Self- Study: Work done, Velocity and Acceleration

Applications: Electromagnetism, Fluid Dynamics, Control systems

(RBT Levels: L1, L2 and L3)

Module – 5: Complex Variables **08 Hours**

Analytic function, Cauchy-Riemann equations in Cartesian and polar form(with proof), Harmonic functions, determination of analytic function when real part or imaginary part is given using Milne-Thompsons method, related problems,

Self- Study:

geometrical representation of w=f(z) by linear transformations, conformer transformations of $w=z^2$ and $w=z+1/z$. Conformal transformation of $w=e^z$

Applications: Applications to flow problems, Signal analysis, Antenna theory, Thermal analysis.

(RBT Levels: L1, L2 and L3)

Course Out comes:

At the end of the course students will be able to:

CO-1: Apply the correlation and regression analysis to fit a suitable mathematical model for the statistical data.

CO-2: Will be able to apply binomial, poisons and normal distributions.

CO-3: Will be able to test the goodness of fit of the data using t-distribution and chi-square.

CO-4: Apply vector calculus to solve problems of Electromagnetic Field, Fluid Dynamics, etc

CO5: Will be able to analyze and study flow problems.

Suggested Learning Resources:

S.No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Higher Engineering Mathematics	B. S. Grewal	Khanna Publications, 44 th Ed.,	2021
2	References from Grewal Textbook **Module-1** Curve fitting introduction Pg. no.: 812(24.1), Fitting a parabola- Pg. no.: 825(24.8) **Module-2** Probability Introduction pg. no. 857(26.1), Random Variables pg. no.: 871(26.7), Poissons distribution pg.no. 882(26.15) Binomial Distribution pg. no.: 879(26.14) **Module-3** Introduction pg. 897(27.1), Testing of Hypothesis pg. 898(27.3), Students t-distribution pg. 905(27.14), Chi-square distribution pg.911 (27.17). **Module-4** Vector calculus- Introduction pg. 315(8.1), Scalar and Vector Point Functions pg. 322(8.4), Module-5: C-R equations pg.673 (20.3), Harmonic functions pg. 677(20.5), Analytic functions pg. 674(20.4).			
3	Advanced EngineeringMathematics	E. Kreyszig	John Wiley & Sons,	10 th Ed., 2018
4	Signals & Systems	Simon Haykin, Berry Van Veen	Wiley	2 nd Edition
5	Engineering Mathematics	N P Bali, Dr. Manish Goyal	Laxmi Publications	Volume II
6	Signals & Systems	Nagoor Kani	McGraw Hill	1st Edition
7	Signals & Systems	H.P. Hsu, R Ranjan	Schaum's outline series, TMH	Printed in 2005

e-Resources:

https://www.youtube.com/playlist?list=PLC210462711083C4
https://youtube.com/playlist?list=PLDhVjW4Yw3zhxehR_lhusOeyfywv03bok&si=KclTDlRcG74g80HM

Semester: IV
Course Name: Engineering Electromagnetics

Course Code	**23EC42**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:2:2**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40(T)+20(P)**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Pre-requisites: Fundamental physics, Vector calculus, Integral and differential calculus.

Course objectives: This Theory course enables students to

- **Understand Electromagnetic Fundamentals:** Develop a comprehensive understanding of the fundamental conceptsand principles of electromagnetism, including electric and magnetic fields, charge distributions, and Maxwell's equations.
- **Analyze Static Electric and Magnetic Fields:** Apply mathematical techniques and fundamental principles toanalyze static electric and magnetic fields. Understand the behavior of electric and magnetic fields in different materials and configurations.
- **Study Time-Varying Fields and Maxwell's Equations:** Analyze time-varying electric and magnetic fields andtheir relationship to Maxwell's equations. Understand the role of displacement current and the propagation of electromagnetic waves.
- **Investigate Electromagnetic Waves:** Study the characteristics, properties, and behavior of electromagnetic waves in different media. Analyze the generation, transmission, and reception of electromagnetic waves.
- **Develop Problem-Solving and Analytical Skills:** Develop problem-solving skills by applying mathematical and analytical techniques to solve complex electromagnetic problems. Enhance critical thinking and analyticalabilities through analysis and interpretation of electromagnetic phenomena.
- **Research and Analytical Abilities:** Cultivate research skills by studying and reviewing scientific literature related to electromagnetic theory. Develop the ability to analyze and critically evaluate research findings in thefield.
- **Enhance Communication and Presentation Skills:** Improve written and oral communication skills through technical report writing and presentation of electromagnetic theory concepts, experiments, and research findings.

Module – 1 **10 Hours (RBT Levels: L1, L2 & L3)**

Prerequisites: Review of Vector Algebra, Vector Calculus, Coordinate Systems and Coordinate transformations.
(Only for CIE) (Text 2: 1.1-1.8, 2.1-2.4, 3.1-3.4)

Coulomb's Law and Electric Field Intensity: Experimental law of Coulomb (Vector form), Electric field intensity, Field due to finite charge distributions, Field due to infinite line charge and infinite Sheet of charge, Numerical Problems.
(Text 1: 2.1-2.5)
Gauss's law and its Applications: Electric flux density, Gauss law (Statement and Proof), Applications of Gauss law. Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), divergence theorem. Numerical Problems **(Text 1: 3.2 to 3.7)**

Teaching-Learning Process:

Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving, Conceptual Demonstrationthrough Simulation tools (HFSS/MATLAB)
Self-study topics: Difference between Circuit theory and Electromagnetic field theory

Module – 2 **08 Hours (RBT Levels: L1, L2 & L3)**

Energy, Potential and Conductors: Energy expended or work done in moving a point charge in an electric field,Definition of potential difference and potential, The potential difference due to point charge and system of charges, Potential gradient, Numerical Problems. **(Text 1: 4.1 to 4.4 and 4.6)** Current and Current density, Continuity of current equation. **(Text 1: 5.1, 5.2)** **Poisson's and Laplace's Equations:** Derivation of Poisson's and Laplace's Equations, Numerical problems on Laplace equation, Capacitance calculation for different configurations using Laplace's equation, Uniqueness theorem. **(Text 1: 7.1to 7.3)**
Teaching-Learning Process:
Chalk and talk method, Power Point Presentation, YouTube videos, Problem solving. **Self-study topics:** Energy density, Applications of Poisson's equation

Module – 3 **08 Hours (RBT Levels: L1, L2 & L3)**

Steady Magnetic Fields: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Concept of Scalar and Vector Magnetic Potentials, Numerical problems. **(Text 1: 8.1to 8.6)** **Magnetic Forces:** Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions, Numerical problems. **(Text 1: 9.1 to 9.3)**
Teaching-Learning Process:
Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving. **Self-Study topics:** Magnetic Materials/Circuits, Mutual Inductance. Magnetic Energy Storing issues.

Module – 4 **07 Hours (RBT Levels: L1, L2 & L3)**

Time Varying Fields and Maxwell's equations: Faraday' law of Electromagnetic Induction - Integral form and Point form, Continuity equation, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems. **(Text 1: 10.1 to 10.4)**
Teaching-Learning Process:
Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving. **Self- Study topics:** History of Maxwell's equations, Hertz experiments, EM radiation phenomena.

Module – 5 **07 Hours (RBT Levels: L1, L2 & L3)**

Uniform Plane Waves: Plane wave, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Solution of wave equation for perfect dielectric, Relation between E and H, Wave propagation in freespace, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media (γ, α, β, η)and good conductors, Skin effect or Depth of penetration, Poynting's theorem and wave power, Numerical problems.**(Text 1: 12.1to 12.4)**
Teaching-Learning Process:
Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem Solving, Demonstration throughSimulation tools (HFSS/MATLAB). **Self-Study topics:** Polarization of electromagnetic waves, phase velocity, and group velocity, Electromagnetic Interference (EMI).

PRACTICAL COMPONENT OF IPCC

SN	Experiments
PART A: Simulation based Experiments using MATLAB/Python/HFSS or any other Suitable software.	
1	Simulate experiments that involve vector calculus Divergence, and vector operators (Gradient, CURL, dot product and cross product).
2	Verify Coulomb's law by measuring the force between two charged objects at different distances and comparing it with the inverse square relationship.
3	Calculate and visualize the electric field of a point charge and also with multiple point charges to observe howtheir electric fields combine.
4	Demonstrate Gauss's law by calculating the electric flux through a closed Gaussian surface for different charge distributions.
5	Simulate the application of Laplace's equation to calculate the capacitance of a parallel plate capacitor.
6	Simulate the magnetic field produced by a current-carrying straight wire using and investigate the spatialdistribution of the magnetic field strength and direction around the wire to visualize its magnetic field lines.
7	Simulate Faraday's law by changing the magnetic field within a loop and observing the induced EMF andcurrent.
8	Simulate the behavior of uniform plane waves in different mediums and observe changes in their speed anddirection.
PART B: Demonstration Experiments (Not for SEE)	
1	**Charging by Friction:** Rub a comb against your hair to charge it, then observe how the charged comb attractssmall pieces of paper **Charging by Induction:** Use a charged balloon to induce a charge on aluminum can, causing it to be attractedto the balloon. **Static Electricity with Balloons:** Inflate a balloon and rub it against your clothes to generate static electricity.Use it to attract small pieces of paper or make your hair stand up.
2	**Magnetic Fields with Compass:** Place a bar magnet under a piece of paper and sprinkle iron filings on top.Observe how the filings arrange themselves along the magnetic field lines.
3	**Simple Motors:** Create a simple motor using a battery, a coil of wire, and a magnet. When the coil is placedbetween the magnet poles and connected to the battery, it will rotate.
4	**Oersted's Experiment:** Pass an electric current through a wire placed above a compass needle. Observe howthe current generates a magnetic field that deflects the needle.
5	**Faraday's Electromagnetic Induction:** Move a magnet in and out of a coil of wire and observe the induced current. You can also use a coil to light up a bulb.
6	**Homemade Electromagnet:** Wrap a coil of wire around a nail, connect the ends to a battery, and observehow the nail becomes magnetic.
7	**Simple Capacitor:** Create a simple capacitor using two metal plates and an insulator between them. Chargeit using a battery and observe the spark when discharged.
	PART C: Open Ended/Mini Lab Experiments (Not for SEE)
1	**Any Open-Ended Experiments**

Course Outcomes:

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

CO-1: Solve problems on Electric force, electric field intensity due to point, linear, volume charges by applying Coulombs Law and Gauss's Law.
CO-2: Determine Energy and Potential for various charge distributions and apply continuity equation of current to calculate flow of current, total charge, charge density etc for Conductors.
CO-3: Apply Poisson's and Laplace equations for solving boundary value problems associated with electrostatics and magneto-statics.
CO-4: Analyze the applications of magneto-statics by applying Biot-Savart law, Ampere's circuital law and derive the concepts of magnetic forces and materials to characterize the magnetic circuits.
CO-5: Analyze Maxwell's equations for Static fields, time varying fields, EM waves in free space, conductors and Evaluate power associated with EM waves using Poynting theorem.
CO-6: Conduct Open-Ended Experiments/Mini lab projects related to applications of electromagnetic systems and propose innovative solutions.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Engineering Electromagnetics	William H. Hayt, John A. Buck, M. Jaleel Akhtar	Tata McGraw- Hill	8th Edition, 2014.
2	Elements of Electromagnetics	Matthew N. O. Sadiku	Oxford niv.Press	4th Edition
Reference Books				
1	Electromagnetic Waves andRadiating Systems	E.C. Jordan and K. G. Balmain	PHI	2nd Edition, 2000
2	Engineering Electromagnetics	Nathan Ida,	Springer (India) Pvt. Ltd., New Delhi	2nd Edition, 2005
3	Electromagnetics- Schaum'sOutline series	Joseph A. Ediminister	Tata McGraw-Hill	Revised 2nd Edition, 2014
4	Electromagnetic Theory Practical Book for Engineering Students	Dr. Rishu Bhati	Bharath Publications	--

e-Resources/ Web Links

1 https://nptel.ac.in/courses/108/106/108106073/
2 https://nptel.ac.in/courses/117/103/117103065/
3 https://archive.nptel.ac.in/courses/108/106/108106138/
4 https://www.ee.iitb.ac.in/course/~vel/
5 https://nt7-mhe-complex-assets.mheducation.com/nt7-mhe-complex-assets/Upload-20190715/InspireScience6-8CA/CT05/index.html
6 https://phet.colorado.edu/en/simulations/faraday

Semester: IV
Course Name: Control Systems

Course Code	**23EC43**	CIE Marks	**50**
Teaching Hours/Week (L: T:P)	**2:2:2**	SEE Marks	**50**
Total Hours of Pedagogy	**40(T)+20(P)**	Total Marks	**100**
Credits	**04**	Exam Hours	**03**

Pre-requisites: Basic engineering Mathematics, Introduction to Electrical circuits, Linear Algebra and differential equations

Course objectives:

This Theory course enables students to

1. Understand the foundational principles of control systems, including their types, components, and applications.
2. Analyze the time response characteristics of feedback control systems and assess their performance metrics.
3. Apply stability analysis techniques to determine the stability of control systems, including root locus and frequency domain methods.
4. Comprehend the basics of digital control systems and their advantages over analog counterparts.
5. Utilize Simulink and MATLAB to simulate and implement control system designs, solidifying practical skillsforreal-world applications.

Module – 1 **08 Hours (RBT Levels: L1, L2 & L3)**

Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems – Mechanical Systems, Electrical Systems, Analogous Systems. Computational approaches for Transfer function- Block diagram algebra and Signal Flow graphs or use of simulation tools etc.
Teaching-Learning Process:
Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving.

Module – 2 **08 Hours (RBT Levels: L1, L2 & L3)**

Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errorsand error constants. Introduction to PI, PD and PID Controllers (excluding design).
Teaching-Learning Process:
Chalk and talk method, Power Point Presentation, YouTube videos, Problem solving, Demonstration through Simulation tools (MATLAB/SIMULINK).

Module – 3 **08 Hours (RBT Levels: L1, L2 & L3)**

Stability analysis: Introduction, Concepts of stability, Necessary conditions for Stability, Routh stability criterion, special cases of Routh stability. Application of Routh's criterion. Relative stability analysis & Determining rangevalues of K. Marginal K and frequency of sustained oscillations, advantages and limitations of Routh's array
Teaching-Learning Process:
Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving.

Module – 4 **08 Hours (RBT Levels: L1, L2 & L3)**

Root locus and Frequency domain analysis for stability: Introduction, Basic concepts of Root-Locus, Angle and magnitude condition, rules for construction of root loci, advantages of Root locus method. Introduction to Bode plots, advantages and limitations of frequency domain approach, Correlation between time andfrequency response, bode plot of standard factors, calculation of G.M and P.M from bode plot. Polar and Nyquist plot: Introduction, basic concepts of polar and Nyquist plots.
Teaching-Learning Process:
Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem solving, Demonstration through Simulation tools (MATLAB/SIMULINK).

Module – 5	**08 Hours (RBT Levels: L1, L2 & L3)**
Introduction to Digital Control System: Introduction, Spectrum Analysis of Sampling process, Signal reconstruction, Difference equations. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems.	
Teaching-Learning Process:	
Chalk and talk method, PowerPoint Presentation, YouTube videos, Problem Solving, Demonstration through Simulation tools (MATLAB/SIMULINK).	

PRACTICAL COMPONENT OF IPCC

SN	Experiments
PART A: Simulation based Experiments using MATLAB/Simulink/Python or any other Suitable software.	
1	Determination of time response specification of a second order Under damped System, for differentdamping factors.
2	Determination of frequency response of a second order System
3	Using suitable simulation package, draw Root locus & Bode plot of the given transfer function.
4	Using suitable simulation package, obtain the time response from state model of a system.
5	Generate Step, Ramp and impulse functions for 1st order systems
6	Generate Step, Ramp and impulse functions for 2nd order systems
PART B: Demonstration Experiments	
1	Implementation of PI, PD Controllers.
2	Implement a PID Controller and hence realize an Error Detector.
3	Demonstrate the effect of PI, PD and PID controller on the system response.
	PART C: Open Ended/Mini Lab Experiments (Not for SEE)
1	Any Open-Ended Experiments

Course Outcomes:

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

CO-1: Develop the mathematical model of mechanical and electrical systems.
CO-2: Develop transfer function for a given control system using suitable computational tool.
CO-3: Determine the time domain specification s for first and second order systems.
CO-4: Determine the stability y of a system in the time domain and frequency domain
CO-5: Conduct Open-Ended Experiments/Mini lab projects related to applications of Control systems and propose suitable solutions.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Control Systems Engineering	J Nagrath, M. Gopal	New age international Publishers	5th edition, 2005
Reference Books				
1	Modern Control Engineering	K. Ogata	Pearson Education Asia/ PHI	4th Edition, 2002.
2	Automatic Control Systems	Benjamin C. Kuo	John Wiley India Pvt. Ltd.	8th Edition, 2008.
3	Feedback and Control System	Joseph J Distefano III et al.	Schaum's Outlines, TMH	2nd Edition 2007.
e-Resources/ Web Links				
1	https://nptel.ac.in/courses/108106098			

Semester: IV
Course Name: Communication Systems- I

Course Code	**23EC44**	CIE Marks	**50**
Teaching Hours/Week (L:T:P)	**2:2:0**	SEE Marks	**50**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**03**	Exam Hours	**03**

Pre-requisites: Signals and Systems, Probability theory, Random Processes.

Course objectives:

This Course enables students to target the following attributes:

1. Preparation: To prepare students with basic knowledge of communication theory principles
2. Core Competence: To equip students with a basic foundation in Communication Engineering fundamentals required for the Design, Analysis and Development of various analog communication subsystems.
3. Professionalism: To inculcate ethical and professional attitude by providing an academic environment inclusiveofeffective communication, teamwork, Industrial Visits and ability to relate engineering issues to a broader socialcontext, and life-long learning needed for a successful professional career.
4. Learning Environment: To facilitate students to experience task-based learning, peer learning, experimental learning and enable students to inculcate self-study culture.

Module – 1 **08 Hours**

Introduction to Communication System: Introduction, Elements of a Communication System, Need for Modulation, Electromagnetic Spectrum and Typical Applications, Terminologies in Communication Systems, Basics of Signal Representation and Analysis.
Amplitude Modulation (AM) Systems: Introduction, Time and Frequency domain representation, AM Generation-Switching Modulator, AM Detection- Envelop detector, significance of RC time constant in envelop detector, virtues limitations, and modifications of amplitude modulation, Comparison of AM Modulation techniques-
Standard AM, DSBSC, SSB and VSB, Frequency translation, Frequency division Multiplexing, Quadrature carrier Multiplexing. **(Text-1: 3.1,3.2,3.4,3.7,3.8 & Text-2: 1.1-1.6)**

Self-study topics:

Basic tools for Communication-Fourier Transforms, Trigonometric relations, Dirac Delta function.

Module - 2 **08 Hours**

Angle Modulation: Basic Definitions- Description of phase modulation (PM) and Frequency modulation (FM), Properties of Angle modulated waves, Relationship between FM and PM. Frequency Modulation (FM): Narrow band FM, Wideband FM, transmission bandwidth of FM signals using Carson's Rule.
Generation of FM Signals: Direct and Indirect method.
Demodulation of FM Signals: Balanced frequency discriminator and Phase locked loop. FM stereo Multiplexing,Super heterodyne Receiver. **(Text-1: 4.1-4.6 &Text-2: Chapter 4)**

Self-study topics:

EM Spectrum for FM Broadcasting system [Text-3], Survey on various FM stations around the state.

Module – 3 **08 Hours**

Noise in Analog Modulation: Introduction, shot noise, thermal noise, white noise, Narrow band noise. Representation of noise in-terms of in phase and quadrature components, representation of noise in-terms of envelopand phase components. **Noise in AM Receivers:** Signal to Noise Ratios, AM receiver Model, Noise in AM receivers, and Noise in DSBSC receivers. **Noise in FM Receivers:** FM receiver Model, Noise in FM reception, FM threshold effect, pre- emphasis and de- emphasis in FM. **(Text-1: 5.10,6.1-6.6)**

Self-study topics:
Gaussian Distribution, AWGN, Noise Figure, Power Spectral Density.

Module – 4 **08 Hours**

Analog to Digital Transition: Introduction, Why Digitize Analog Sources? The Low pass Sampling Process, Practical aspects of sampling and signal recovery, Types of Sampling (Natural, Flat top/Sample and Hold, Impulse), Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Theme Example— PPM in Impulse Radio.**(Text-1: 7.1-7.7)**
Self-study topics:
Bandwidth requirements for TDM, T1 Carrier Systems- A Case Study (Text 3: 6.3), Importance of Interleaving.

Module – 5 **08 Hours**

Analog to Digital Transition (Cont..): The Quantization Random Process, Quantization Noise, Types of Quantization, Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering Multiplexing; Delta Modulation, Application examples- (a) Video + MPEG and (b) Vocoders. **Line Codes (RZ & NRZ):** Unipolar, Polar, Bipolar, Manchester Coding/Signaling. Other baseband signaling- HDB3, BnZs **(Text-1: 7.8-7.11 & Text-3: 6.8,7.1,7.2)**
Self-study topics:
Digital Multiplexing.

Course Outcomes:

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

CO-1: Apply mathematical tools/transformations to analyze the performance of amplitude modulation schemes(StandardAM, DSBSC, SSB & VSB).

CO-2: Analyze FM modulated/demodulated signals from the learning recourses and realize the design principles of FM in audio broadcasting.

CO-3: Characterize the influence of channel noise on the modulated signals and analog receivers.

CO-4: Relate the design principles of analog to digital transformations in context to digital signal processing/multimedia applications.

CO-5: Design and Conduct experiment by way of simulation or emulation on analog communication subsystems targeting to specific radio applications.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Communication Systems	Simon Haykins & M Moher	John Willey India Pvt. Ltd.	5th Edition & 2010
2	Electronic Communication Systems	George Kennedy, Bernard Davis & S R M Prasanna	McGraw Hill Education (India) Private Limited	5th Edition & 2015
3	Modern Digital and Analog Communication Systems	B P Lathi & Zhi Ding	Oxford University Press	4th Edition & 2010
Reference Books				
1	Principles of Communication Systems	H Taub & D L Schilling	TMH	3rd Edition & 2011
2	An Introduction to Analog and Digital Communication	Simon Haykins	John Willey India Pvt. Ltd.	2008
e-Resources/ Web Links				
1	https://archive.nptel.ac.in/courses/108/104/108104091/ -NPTEL MOOC Lecture Material (Videos, Transcripts, Book)-Principles of Communication Systems-I by Prof. Aditha K Jagannathan, Dept. of E&CE, IIT Kanpur.			

Semester: IV
Name of the Laboratory: Communication Laboratory-I

Course Code	**23ECL45**	CIE Marks	**50**
Teaching Hours/Week (L:T:P)	**0:0:2**	SEE Marks	**50**
Total Hours of Pedagogy	**20**	Total Marks	**100**
Credits	**01**	Exam Hours	**03**

Pre-requisites: Signals and Systems, Analog and Digital circuit fundamentals, Probability theory and RandomProcesses.

Course Objectives:

This laboratory course enables students to

1. Design Circuits for analog signal processing like filters, mixers etc.
2. Realize the electronic circuits to perform analog and pulse modulations and demodulations.
3. Design the circuit to sample an analog signal. Also verify the sampling theorem and relate the signal and its spectrumbefore and after sampling.
4. Comprehend the critical design issues, advantages, disadvantages, and limitations of analog communication systems.
5. Demonstrate their practical learning skills in both hand-on and simulation-based experimentation (Blend of both hardware and software) on various communication system applications which involve signal transmission/ recovery, modulation process, multiplexing, analog to digital signal transformations, line coding etc.

List of Experiments:

Part A: Design of Experiments using Discrete Components	
SN	**Experiments**
1	Design of active second order Butterworth Low pass and high pass filters.
2	Amplitude Modulation and Demodulation of Standard AM
3	FM Signal generation (IC8038/IC2206 can be used)
4	Pulse amplitude modulation and demodulation
5	Design and test BJT/FET Mixer
Part B: Design based /Simulation based Experiments using MATLAB/SCILAB/SIMULINK/LABVIEW etc.	
1	Illustration of (a) AM modulation and demodulation and display the signal and its spectrum. (b) DSB- SC modulation and demodulation and display the signal and its spectrum.
2	Illustration of FM modulation and demodulation and display the signal and its spectrum
3	Illustration of Pulse code modulation and demodulation
4	Illustration of Delta Modulation and the effects of step size selection in the design of DMEncoder
5	Illustrate the process of sampling and reconstruction of low pass signals. Display the signalsand its spectrums of both analog and sampled signals.
6	Simulate Line codes and Generate NRZ, RZ Unipolar and Polar signaling waveforms.
Part C: Demo/Kit based/ Open Ended Experiments (Only for CIE, not for SEE)	
1	Demonstrate Time Division Multiplexing and De-multiplexing of two band limited signals.
2	Design of active Butterworth Band pass filter using Op-amp.
3	Pulse width Modulation
4	Phase Locked Loop Synthesis
5	Any Open ended Experiments/Mini Lab Projects

Course Outcomes:

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

CO-1: Design and Validate 2nd order active filters as per the given design Specifications (Cut-off frequency, Roll off factor, Gain, Bandwidth etc) and stability requirements.

CO-2: Demonstrate the AM and FM modulation/Demodulation for a given specification through discrete circuit implementation and Measure its performance parameters (Modulation Index, Carrier frequency, Bandwidth etc).

CO-3: Design and Test the Pulse Amplitude Modulation/demodulation using discrete circuits and Comment on sampling criteria/Conditions.

CO-4: Test BJT/FET Mixer and realize the need of mixer and local oscillator in super heterodyne receivers.

CO-5: Simulate/Emulate assorted communication system applications that involve signal transmission/ recovery, modulation process, multiplexing, analog to digital signal transformations, line coding etc.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Communication Systems	Simon Haykins & M Moher	John Willey India Pvt. Ltd.	5th Edition & 2010
2	Modern Digital and Analog Communication Systems	B P Lathi & Zhi Ding	Oxford University Press	4th Edition & 2010
3	Principles of Electronics Communication Systems	Louis E Frenzel	TMH	2016
	Reference Books			
1	An Introduction to Analog and Digital Communication	Simon Haykins	John Willey India Pvt.Ltd.	2008
2	Principles of Communication Systems	H Taub & D L Schilling	TMH	2011

e-Resources/Web Links:

1. https://archive.nptel.ac.in/courses/108/104/108104091/ -NPTEL MOOC Lecture Material (Videos, Transcripts,Book)-Principles of Communication Systems-I by Prof. Aditha K Jagannathan, Dept. of E&CE, IIT Kanpur.
2. https://www.etti.unibw.de/labalive/ -labAlive Virtual Communications Lab

Semester: IV
Course Name: Industrial Electronics

Course Code	**23EC461**	CIE Marks	50
Teaching Hours/Week (L: T:P)	2:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours	Total Marks	100
Credits	03	Exam Hours	03

Course objectives: This course will enable student to

- Explain broad types of industrial power devices, there structure, and its characteristics.
- Design and analyse the broad categories of power electronic circuits.
- Explain various types of MEMs devices, principle of operation and construction.
- Familiarize with soft core processors and computer architecture.
- Apply protective methods for devices and circuits.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teachingmethods may be adopted to develop the outcomes.
2. Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skillssuchas the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with theirowncreative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helpsimprove the students' understanding.

Module-1 **8 Hours**

Industrial Power Devices: General purpose power diodes, fast recovery power diodes, schottky power diodes, silicon carbide power diodes **(Text book 1: 2.5, 2.6)**, Power MOSFETs, Steady state characteristics, switching characteristics, silicon carbide MOSFETs, COOLMOS, Junction field effect transistors, operation and characteristics of JFETs, Silicon Carbide JFET structures, Bipolar Junction Transistors, Steady state characteristics, switching characteristics, silicon carbide BJTs, IGBT, silicon carbide IGBTs **(Text book 1: 4.3, 4.4, 4.6, 4.7)**, Thyristor, Thyristor characteristics, two transistor model **(Text book 1: 9.2, 9.3, 9.4)**.

Module-2 **8 Hours**

Power Electronics Circuits: Controlled Rectifiers – Single phase full converter with R and RL load, Singlephase dual converters, and Three phase full converter with RL load **(Text book 1: 10.2, 10.3, 10.4)**.

Switching mode regulators – Buck Regulator, Boost regulator, Buck – Boost regulator, comparison ofregulators **(Text book 1: 5.9.1, 5.9.2, 5.9.3, 5.10)**

Inverters – Principle of operation, Single phase bridge inverter, Three phase inverter with 180 and 120 degreeconduction, Current source inverter **(Text book 1: 6.3, 6.4, 6.5, 6.9)**.

AC voltage controllers – Single phase full wave controller with resistive load, single phase full wave controller with inductive load **(Text book 1: 11.3, 11.4)**.

Module-3	8 Hours
MEMS Devices: Sensing and Measuring Principles, Capacitive Sensing, Resistive Sensing, Piezoelectric Sensing, Thermal Transducers, Optical Sensors, Magnetic Sensors, MEMS Actuation Principles, ElectrostaticActuation, Thermal Actuation, Piezoelectric Actuation, Magnetic Actuation, MEMS Devices Inertial Sensors, Pressure Sensors, Radio Frequency MEMS: Capacitive Switches and Phase Shifters, Microfluidic Components, Optical Devices. **(Text book 2: 13.1, 13.3, 13.4)**	

Module-4	8 Hours
Soft Core Processors - Processor Core Options, Processor Definition Process, Software Development Aspects,Utilization of Soft-Core Processors, Custom Instructions, Soft-Core Processor on an ASIC vs. FPGA, Design Issues, Applications for Soft-Core Processors **(Text book 2: 22.2, 22.3, 22.4, 22.5, 22.6, 22.7, 22.8, 22.9).** **Computer Architecture -** Hardware Organization, Computer Software, Programming Languages, Operating Systems, Information Representation in Digital Computers, Computer Programming Model, CPU Registers, Immediate Operands, Memory, Organization, Memory Addressing, Computer Instruction, Types, Interrupts and Exceptions, Evaluating Instruction Set Architectures, Computer System Design, Hierarchical Memory Systems, Memory Characteristics, Semiconductor Memory Technologies, Memory System Organization, Cache Memory, Virtual Memory Management, Interfaces to Input/Output Devices, Microcontroller Architectures Multiple Processor Architectures **(Text book 2: 23.2, 23.3, 23.4, 23.5, 23.6, 23.7, 23.8, 23.9, 23.10)**	

Module-5	8 hours
Protections of Devices and Circuits: Cooling and Heat sinks, Thermal Modeling of Power Switching Devices,Electrical Equivalent Thermal model, Mathematical Thermal Equivalent Circuit, Coupling of Electrical and Thermal Components, Snubber circuits, Reverse Recovery Transients, Supply and Load side transients, Voltage protection by Selenium Diodes and Metaloxide Varistors, Current protection, Fusing, Fault current with AC source, Fault current with DC source, Electromagnetic Interference, sources of EMI, Minimizing EMI Generation, EMI shielding, EMI standards **(Text book 1: 17.2, 17.3, 17.4, 17.5, 17.6, 17.7, 17.8, 17.9)**.	

Course outcome (Course Skill Set):

At the end of the course, the student will be able to:

CO-1: Explain different types of industrial power devices such as MOSFET, BJT, IGBT etc, there structure, and its operating characteristics.

CO-2: Design and analyse the power electronic circuits such as switch mode regulators, inverters, controlled rectifiers and ac voltage controllers.

CO-3: Explain various types of MEMs devices used for sensing pressure, temperature, current,voltage, humidity, vibration etc..

CO-4: Familiarize with soft core processors such as ASIC and FPGA.

CO-5: Familiarize with computer hardware, software, architecture, instruction set, memory organization, multiprocessor architecture.

CO-6: Apply protective methods for devices various industrial power devices based on thermal requirements and develop protective methods for the circuits against various electrical parameters.

Suggested Learning Resources:

Books

1. Power Electronics: Devices, Circuits, and Applications, Muhammad H. Rashid, Pearson, 4th International edition.
2. Fundamentals of Industrial Electronics , Bogdan M. Wilamowski, J. David Irwin, CRC Press, 2011,
3. Thomas E. Kissell, Industrial Electronics: Applications for Programmable Controllers, Instrumentation and Process Control, and Electrical Machines and Motor Controls, 3rd edition, 2003, Prentice Hall.
4. Ned Mohan, T.M. Undeland and W.P. Robbins, "Power Electronics: Converters, Applications and Design",WileyIndia Ltd, 2008.

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/108/102/108102145/
- https://nptel.ac.in/courses/117105082
- https://www.youtube.com/channel/UCKg8GNii0Q-ieXE56AXosGg/featured
- https://www.ieee-ies.org/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quiz and Seminars

Semester: IV
Course Name: Computer Organization and Architecture

Course Code	**23EC462**	**CIE Marks**	**50**
Teaching Hours/Week (L: T:P)	**2:2:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 hours**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course objectives: This course will enable students to:

1. Explain the basic sub systems of a computer, their organization, structure andoperation.
2. Illustrate the concept of programs as sequences of machine instructions.
3. Demonstrate different ways of communicating with I/O devices
4. Describe memory hierarchy and concept of virtual memory.
5. Illustrate organization of simple pipelined processor and other computing systems.

Module – 1 **08 Hours (RBT Levels: L1, L2 & L3)**

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance – Processor Clock, Basic Performance Equation (upto 1.6.2 of Chap 1 of Text). **Machine Instructions and Programs:** Numbers, Arithmetic Operations and Characters, IEEE standard for Floating point Numbers, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing (upto 2.4.6 of Chap 2 and 6.7.1 of Chap 6 of Text)
Teaching-Learning Process:
Chalk and talk method, PPTs, Problem Solving.

Module - 2 **08 Hours (RBT Levels: L1, L2 & L3)**

Addressing Modes: Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions (from 2.4.7 of Chap 2, except 2.9.3, 2.11 & 2.12 of Text)
Teaching-Learning Process:
Chalk and talk method, PPTs, Hands-on Coding through compilation.

Module – 3 **08 Hours (RBT Levels: L1, L2 & L3)**

Input / Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct
Memory Access (upto 4.2.4 and 4.4 except 4.4.1 of Chap 4 of Text).
Teaching-Learning Process:
Chalk and talk method, PPTs.

Module – 4 **08 Hours (RBT Levels: L1, L2 & L3)**

Memory System: Basic Concepts, Semiconductor RAM Memories-Internal organization of memory chips, Static memories, Asynchronous DRAMS, Read Only Memories, Cash Memories, Virtual Memories, Secondary Storage-Magnetic Hard Disks (5.1, 5.2, 5.2.1, 5.2.2, 5.2.3, 5.3, 5.5 (except 5.5.1 to 5.5.4), 5.7 (except 5.7.1), 5.9, 5.9.1 of Chap 5 of Text).
Teaching-Learning Process:
Chalk and talk method, PPTs, Visual Aids.

Module – 5 **08 Hours (RBT Levels: L1, L2 & L3)**

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Microprogrammed Control (upto 7.5 except 7.5.1 to 7.5.6 of Chap 7 of Text). Case Study on Intel Core i-7 architecture.
Teaching-Learning Process:
Chalk and talk method, PPTs.

Course Outcomes:

CO-1: Demonstrate the understanding of the basic organization of a computer system.
CO-2: Explore the architectures of various microprocessors, instruction sets and assembly programing.
CO-3: Analyze different ways of accessing an input / output device including interrupts.
CO-4: Illustrate the organization of different types of semiconductor and other secondary storage memories.
CO-5: Illustrate simple processor organization based on hardwired control and micro programmed control.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks:				
1	Computer Organization	Carl Hamacher, Zvonko Vranesic, Safwat Zaky	Tata McGraw Hill	5th Edition, 2002.
Reference Books:				
1	Computer Organization and Design – The Hardware / Software Interface ARM Edition	David A. Patterson, John L. Hennessy	Elsevier	4th Edition, 2009.
2	Computer Organization & Architecture	William Stallings	PHI	7th Edition, 2006.
3	Computer Systems Design and Architecture	Vincent P. Heuring & Harry F. Jordan	Pearson Education	2nd Edition, 2004.

E-Resources: https://onlinecourses.nptel.ac.in/noc22_cs88/preview
https://archive.nptel.ac.in/courses/106/105/106105163/

Semester IV

Course: OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Course Code	**23EC471**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	2:0:0	SEE Marks	50
Total Hours of Pedagogy	30 hours	Total Marks	100
Credits	01	Exam Hours	03

Prerequisites: Programming for Problem Solving.

Course Objectives:

1. Introduces Object Oriented Programming Concepts Using The Java Language
2. Introduces The Principles Of Inheritance And Polymorphism; And Demonstrates How TheyRelate ToThe Design Of Abstract Classes.
3. Introduces The Implementation Of Packages And Interfaces.
4. Introduces Exception Handling, Event Handling and Multithreading.
5. Introduces The Design Of Graphical User Interface Using Applets And Swings.

UNIT - I: **6 Hours**

Object Oriented Thinking and Java Basics: History of Java, Java Buzzwords, Data Types, Variables, Scope and Life Time ofVariables, Arrays, Operators, Expressions, Control Statements, Type Conversion andCasting, SimpleJava Program.

UNIT - II: **6 hours**

Classes and Objects: Concepts of Classes, Objects, Constructors, Methods, Access Control, This Keyword, Garbage Collection, Overloading Methods and Constructors, Method Binding, Inheritance, Overriding andExceptions, Parameter Passing, Recursion, Nested and Inner Classes, Exploring String Class

UNIT - III: **6 hours**

Inheritance: Hierarchical Abstractions, Base Class Object, Subclass, Subtype, Substitutability, Forms of Inheritance- Specialization, Specification, Construction, Extension, Limitation, Combination, Benefits of Inheritance, Costs of Inheritance. Member Access Rules, Super Uses, Using Final with Inheritance, Polymorphism- Method Overriding, Abstract Classes, The Object Class.

UNIT - IV: **6 hours**

Packages and Interfaces: Defining, Creating and Accessing a Package, Understanding Class path, Importing Packages, Differences between Classes and Interfaces, defining an Interface, Implementing Interface, Applying Interfaces, Variables in Interface and Extending Interfaces, Exploring Java.IO.

UNIT - V: **6 hours**

Exception Handling: Concepts of Exception Handling, Benefits of Exception Handling, Termination or Resumptive Models, Exception Hierarchy, Usage of Try, Catch, Throw, Throws and Finally, Built in Exceptions, Creating Own Exception Sub Classes.

Course Outcomes:

CO-1: Develop Applications for Range of Problems Using Object-Oriented Programming Techniques

CO-2: Error handling in the Java Programming

CO-3: Event handling Mechanism

TEXT BOOKS:

1. Java the Complete Reference, 7th Edition, Herbert Schildt, TMH.
2. Understanding OOP with Java Updated Edition, T. Budd, Pearson Education.

REFERENCE BOOKS:

1. An Introduction to Programming and OO Design using Java, J. Nino and F.A. Hosch, JohnWiley &Sons.
2. An Introduction to OOP, Third Edition, T. Budd, Pearson Education.
3. Introduction to Java Programming, Y. Daniel Liang, Pearson Education.
4. An Introduction to Java Programming and Object-Oriented Application Development, R.A.Johnson- Thomson.
5. Core Java 2, Vol 1, Fundamentals, Cay. S. Horstmann and Gary Cornell, EighthEdition,PearsonEducation.
6. Core Java 2, Vol 2, Advanced Features, Cay. S. Horstmann and Gary Cornell, eighth Edition,PearsonEducation

Semester: IV
PROFESSIONAL SKILLS FOR THE WORK PLACE

Course Code	**23PSW472**	CIE Marks	**50**
Teaching Hours / Week (L:T:P)	**2:0:0**	SEE Marks	**50**
Total Hours of Pedagogy	**30**	Total Marks	**100**
Credits	**01**	Exam Hours	**01**

Pre-requisites:

1. Basic Conversational English
2. Fundamentals of Mathematics
3. Basic Knowledge of Reasoning

Module – 1 **06 Hours**

Communication Skills
Basic Tools of Communication, Listening Skills, Body Language, Voice, Verbal Language, Conversations in Professional Setting

Module – 2 **06 Hours**

Presentation Skills
Zero Presentation, Individual Presentations, Feedback, Types of Introductions, Captivating the Audience,Interaction Methods, Signing off.

Module – 3 **06 Hours**

Verbal & Numerical Ability
Vocabulary is Fun, Root Words, Sentence Structures, Bouncing, Similar and Opposite Words, Common Errors,Number System, Factors and Multiples.

Module – 4 **06 Hours**

English Language
Phonetic and Non-phonetic Languages, sounds in English, IPA, Syllables, Word Stress, Stress patterns in Indianlanguages vs English, Pausing and Rhythm in English, Sentence Structures, Bouncing, Common Errors.

Module – 5 **06 Hours**

Verbal Ability and Verbal Reasoning
Similar and Opposite words, Number and Alphabet Series, Human Relations, Direction Tests, Coding Decoding,Clocks and Calendars

Course Outcomes:

CO-1: Demonstrate communicative ability in a professional environment
CO-2: Articulate one's ideas and demonstrate them to an audience
CO-3: Transform one's English Vocabulary and Language Structure
CO-4: Interpret international phonetic symbols, stress patterns, and enhance English speech
CO-5: Identify patterns, determine the problem-solving process & validate solutions

Suggested Learning Resources:

SN	Title of the Book	Name of the Author / s	Name of the Publisher	Edition and Year
Textbooks				
1	Reasoning N' Reasoning - Verbal& Non-verbal Reasoning	Dr. Ravi Chopra	Galgotia	1994
2	Magical Book on Quicker Math	M. Tyra	BSC	I Edition, 2018
3	Communicate With Confidence	Diana Booher	Mc-Graw-Hill	Nov 2011
Reference Books				
1	Cambridge Advanced Learner's Dictionary	Cambridge University Press	CBS	IV Edition, 2013
2	A Modern Approach to Verbal and Non-verbal Reasoning	R S Agarwal	S Chand	II Edition, 2018
3	Word Power Made Easy	Norman Lewis	Goyal Publishers	IV Edition, 2014
4	Speak With Confidence	Diana Booher	Mc-Graw-Hill	I Edition, 2002

Semester: IV
Course Name: UNIVERSAL HUMAN VALUES (UHV)

Course Code	**23UH48**	CIE Marks	**50**
Teaching Hours / Week (L: T:P: S)	**1:0:0:1**	SEE Marks	**50**
Total Hours of Pedagogy	**15-hour Theory Session +15 hour Self study**	Total Marks	**100**
Credits	**01**	Exam Hours	**01 Hour**
Examination type (SEE)	**SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is MCQ (multiple choice questions).**		

Course objectives:

This course is intended to:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustfuland mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. This course is intended to provide a much-needed orientation input in value education to the young enquiringminds.

Module-1 **03 hours**

Introduction to Value Education:
Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the BasicHuman Aspirations

Module-2 **03 hours**

Harmony in the Human Being :
Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body Programme to ensure self-regulation and Health

Module-3 **03 hours**

Harmony in the Family and Society :
Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to- Human Relationship, UnderstandingHarmony in the Society, Vision for the Universal Human Order

Module-4 **03 hours**

Harmony in the Nature / Existence:
Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Module-5 **03 hours**

Implications of the Holistic Understanding – a Look at Professional Ethics:
Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Course Outcome (Course Skill Set)

At the end of the course, students are expected to become more aware of themselves, and their surroundings (family,society, nature);

CO-1: They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

CO-2: They would have better critical ability.

CO-3: They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).

CO-4: It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Expected to positively impact common graduate attributes like:

- Ethical human conduct
- Socially responsible behaviour
- Holistic vision of life
- Environmentally responsible work
- Having Competence and Capabilities for Maintaining Health and Hygiene

Appreciation and aspiration for excellence (merit) and gratitude for all
Suggested Learning Resources:

Books for READING:

Text Book and Teachers Manual

- The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria,2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034- 47-1
- The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, G

Reference Books:

- Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- The Story of Stuff (Book).
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
- Small is Beautiful - E. F Schumacher.
- Slow is Beautiful - Cecile Andrews

Semester: IV

Course Name: ADDITIONAL MATHEMATICS-II

(For Lateral Entry Students)

Course Code	**23MATDIP41**	CIE Marks	**100**
Teaching Hours/Week (L:T:P)	**3:0:0**	SEE Marks	**-**
Total Hours of Pedagogy	**40**	Total Marks	**100**
Credits	**0**	Exam Hours	**-**

Pre-requisites:

1. Differentiation
2. Integration
3. Trigonometric formulae
4. Differential equations

Module-1 **08 Hours**

Higher Order ODE's

Linear Differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators. [Particular integral restricted to $\phi(x) = e^{ax}$, $Sinax$, $Cosax$ for $f(D)y = \phi(x)$

Self-Study: Finding particular Integral for $\phi(x) = x^m$

Module – 2 **08 Hours**

Partial Differential Equations (PDE's):

Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE bydirect integration. Homogeneous PDE involving derivative with respect to one independent variable only.

Self-Study: Method of separation of variables

Module – 3 **08 Hours**

Laplace Transform:

Definition, Laplace transforms of elementary functions. Laplace transform of $e(t)$, $t^n f(t)$ (without proof). Laplace transform of Periodic functions (statement only) and Unit-step function- problems.

Inverse Laplace Transform: Definition, Inverse Laplace Transform of standard functions. Inverse transform byPartial Fraction Method. Apply the concepts of Laplace Transforms to find the solution of linear differentialequations.

Self-Study: Convolution Theorem.

Module – 4 **08 Hours**

Numerical Methods:

Solution of algebraic and transcendental equations by Newton-Raphson method and Secant method. Interpolation: Newton's Forward and Backward Interpolation formulae, Newton's divided difference formula,Lagrange's Interpolation formula without proof problems.

Numerical Integration: Simpson's 1/3rd and 3/8th rule (without proof) - problems.

Self-Study: Weddle's Rule

Module – 5 **08 Hours**

Probability:
Introduction, sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes' theorem. Problems.
Self-Study: Applications of Bayes' theorem

Course outcomes:

CO-1: Upon completion of this course, student will be able to,

CO-2: Demonstrate various physical models through higher order differential equations and solve such linear ordinarydifferential equations.

CO-3: Construct a variety of partial differential equations and solution by various methods.

CO-4: Use Laplace Transform and inverse Laplace Transform in solving differential /integral equation arising innetwork analysis, control systems and other fields of engineering

CO-5: Apply the knowledge of numerical methods in the modeling of various physical and engineering phenomena.

CO-6: Use the concepts of probability in different probability distribution.

Suggested Learning Resources:

SN	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S.Grewal	Khanna Publishers	43rd Ed.2015
2	Advanced Engineering Mathematics	E. Kreyszig	Jhon willy & Sons	10th Ed. (Reprint) 2016
3	Additional Mathematics-2	Dr. Pandurangappa	Sanguine Technical Publishers	4Th Ed., 2019.
Reference Books				
1	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw-Hill	11th Edition.2010