NAGARJUNA
COLLEGE OF ENGINEERING & TECHNOLOGY

An Autonomous College under VTU

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

VISION

To transform the students as leaders in Electronics & Communication Engineering to achieve professional excellence in the challenging future

MISSION

M1: Creating an environment for the students to have strong academic fundamentals and enable them to be life-long learners.

M2: Providing modern tools to the students in the field of electronics & communication to meet the real-world challenges.

M3: Developing communication skills, Technical skills, leadership qualities, and teamwork.

M4: Inculcating Ethics and Human values for solving societal problems.

M5: Imparting engineering knowledge through innovative research projects and to enhance their employability and entrepreneurship skills.

III & IV Semester
Scheme and Syllabus
With effect from Academic Year 2023-2024

Program Educational Objectives (PEOs)

PEO-1: Develop Proficiency as an Electronics and communication engineering with an ability to solve technical and real-world problems for sustainable societal growth.

PEO-2: Prepare the graduates to possess the ability to design project-based learning and collaborative learning.

PEO-3: To communicate effectively and manage resources skilfully as member and leader of the profession.

PEO- 4: To prepare graduates for higher studies and research profession blended with ethical and humanitarian values.

PEO-5: To acquire the expertise and understanding needed for employment and entrepreneurship.

Program Outcomes and Program Specific Outcomes as defined by the Program

Program Outcome:

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 analyze 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 modeling 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.

Program Specific Outcome (PSO):

PSO1: Able to identify, analyse & solve the technical, societal and environmental problems by applying the knowledge of Electronics and Communication Engineering.

PSO2: Ability to design, develop and implement software and hardware modules using significant knowledge through modern tools in Electronics and Communication Engineering.

PSO3: Able to pursue higher studies, involve in research activities, be employable or entrepreneur and pursue lifelong professional development in Electronics and Communication Engineering

Nagarjuna College of Engineering and Technology

B.E. in Electronics and Communication EngineeringScheme of Teaching and Examinations 2022

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

(Effective from the academic year 2023-24)

III SEMESTER

Sl. No	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 inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	22MATE31	Mathematics for Electronics and Communication Engineering	TD- Maths PSB - Maths	3	0	0		03	50	50	100	**3**
2	IPCC	22ECI32	Analysis and Design of Digital Circuits	TD: ECE PSB: ECE	3	0	2		03	50	50	100	**4**
3	IPCC	22ECI33	Basic Signal Processing	TD: ECE PSB: ECE	3	0	2		03	50	50	100	**4**
4	PCC	22ECT34	Analog Electronic Circuits	TD: ECE PSB: ECE	3	0	0		03	50	50	100	**3**
5	PCCL	22ECL35	Analog Electronics Laboratory	TD: ECE PSB: ECE	0	0	2		03	50	50	100	**1**
6	ESC	22ECT36X	ESC/ETC/PLC	TD: ECE PSB: ECE	3	0	0		03	50	50	100	**3**
7	UHV	22UHV37	Social Connect and Responsibility	Any Department	0	0	2		01	100	---	100	**1**
8	AEC/SEC	22EC38X	Ability Enhancement Course/Skill Enhancement Course - III	ECE	If the course is a Theory				01	50	50	100	**1**
					1	0	0						
					If a course is a laboratory				02				
					0	0	2						
9	MC	22NS39	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	**0**
		22PE39	Physical Education (PE) (Sports and Athletics)	PED									
		22YO39	Yoga	Yoga Teacher									
									Total	**550**	**350**	**900**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation. K: This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

Engineering Science Course (ESC/ETC/PLC)

22ECT36A	Object Oriented Programming using C++	22ECT36C	Computer Organization and Architecture
22ECT36B	Sensors and Instrumentation	22ECT36D	Network Analysis

Ability Enhancement Course – III

22EC38A	LICs Lab using PSPICE	22EC38C	Digital Engineering Course (NASSCOM)
22EC38B	Simulink Programming Basics	22EC38D	IOT for Smart Infrastructure

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 may please be referred.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Nagarjuna College of Engineering and Technology

B.E. in Electronics and Communication EngineeringScheme of Teaching and Examinations 2022

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

(Effective from the academic year 2023-24)

IV SEMESTER

Sl.No	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	PCC	22ECT41	Analog Communication	ECE	3	0	0	-	03	50	50	100	**3**
2	IPCC	22ECI42	Digital Design using Verilog	ECE	3	0	2	-	03	50	50	100	**4**
3	IPCC	22ECT43	Engineering Electromagnetics	ECE	4	0	0	-	03	50	50	100	**4**
4	PCCL	22ECL44	Analog Communication lab	ECE	0	0	2	-	03	50	50	100	**1**
5	ESC	22ECT45X	ESC/ETC/PLC	ECE	3	0	0	-	03	50	50	100	**3**
6	AEC/SEC	22EC46X	Ability Enhancement Course/SkillEnhancement Course- IV	TD and PSB: Concerned department	If the course is Theory				01	50	50	100	**1**
					1	0	0	-					
					If the course is a lab				02				
					0	0	2	-					
7	BSC	22BET47	Biology For Engineers	TD / PSB: BT, CHE,	3	0	0	-	03	50	50	100	**3**
8	UHV	22UHV48	Universal human values course	Any Department	1	0	0	-	01	50	50	100	**1**
9	MC	22NS49	National Service Scheme (NSS)	NSS coordinator	0	0	2	-	-	100	-	100	**0**
		22PE49	Physical Education (PE) (Sports and Athletics)	Physical Education Director				-	-				
		22YO49	Yoga	Yoga Teacher				-	-				
									Total	**500**	**400**	**900**	**20**

Ability Enhancement Course / Skill Enhancement Course - IV			
22EC46A	Electronic Devices	22EC46C	LabVIEW Programming
22EC46B	PCB Design	22EC46D	Risk Management in IOT Implementation
Engineering Science Course (ESC/ETC/PLC)			
22ECT45A	8051 Microcontroller	22ECT45C	Operating Systems
22ECT45B	Java Programming	22ESC45D	Advanced Matrix Theory and Linear Algebra for Engineers

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses is mandatory for the award of degree.

III Semester

Mathematics for Electronics and Communication Engineering.			
Course Code	**22MATE31**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S)	**2:2:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 hours**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course objectives:

The goal of the course **Mathematics for Electronics and communication Engineering** is to,

1. Learn to use the Fourier series to represent periodical physical phenomena in engineering analysis and to enable the student to express non-periodic functions to periodic functions using the Fourier series and Fourier transforms.
2. Analyze signals in terms of Fourier transforms and Z-Transform
3. Have an insight into solving ordinary differential equations by using Laplace transform techniques.
4. To find the association between attributes and the correlation between two variables

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher 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 so that the delivered lessons shall develop students theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises (post-lecture activity).

Module-1

Fourier series and practical harmonic analysis:

Periodic functions, Dirichlet's condition. Fourier series expansion of functions with period 2π and with arbitrary period: periodic rectangular wave, Half-wave rectifier, rectangular pulse, Saw tooth wave. Half-range Fourier series. Triangle and half range expansions, Practical harmonic analysis, and variation of periodic current. **8 Hours.**

[Text 1: 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.11]

[RBT Levels: L1, L2 and L3]

Self-Study: Complex form Fourier series**.**

Applications: Signal filtering, noise removal, compression of audio signals and speech recognition.

Module-2

Infinite Fourier Transforms:

Infinite Fourier transforms, Fourier cosine and sine transforms, Inverse Fourier transforms, Inverse Fourier cosine and sine transforms, discrete Fourier transform (DFT), Fast Fourier transform (FFT). **8 Hours.**

[Text 1: 22.1, 22.2, 22.4] [Text 2: 11.9]

[RBT Levels: L1, L2 and L3]

Self-Study: Properties of Fourier transforms.

Applications: Signal processing, image processing, modulation and demodulation of signals.

Module-3

Z -Transforms:

Definition, Z-transforms of basic sequences and standard functions. Properties: Linearity, scaling, first and second shifting properties, multiplication by n. Initial and final value theorem. Inverse Z- transforms. Application to difference equations. **8 Hours.**

[Text 1: 23.1, 23.2, 23.3, 23.4, 23.5, 23.6, 23.7, 23.8, 23.9, 23.15, 23.16, 31.1, 31.2]

[RBT Levels: L1, L2 and L3]

Self-Study:

Applications: Digital signal processing, analyze and process digital data.

Module-4

Laplace Transform:

Existence and Uniqueness of Laplace transform, transform of elementary functions. Properties–Linearity, Scaling, t-shift property, s-domain shift, differentiation in the s-domain, division by t. Laplace transform of periodic functions (square wave, saw-tooth wave, triangular wave, full & half wave rectifier), Heaviside Unit step function and Unit impulse function.

Inverse Laplace Transforms: Definition, properties, evaluation using different methods, convolution theorem (without proof), problems, and applications to solve ordinary differential equations. **8 Hours.**

[Text 1: 21.1, 21.2, 21.3, 21.4, 21.5, 21.7, 21.9, 21.10,21.12, 21.13, 21.14, 21.15, 21.17, 21.18**]**

[RBT Levels: L1, L2 and L3]

Self-Study: Verification of convolution theorem. Solution of simultaneous first-order differential equations.

Applications: Signals and systems, Control systems, LR, CR and LCR circuits.

Module-5

Curve fitting, Correlation and Regressions:

Principles of least squares, Curve fitting by the method of least squares in the form $y = a + bx$, $y = a + bx + cx^2$ and $y = ax^b$. Correlation, Coefficient of correlation, Lines of regression, Angle between regression lines, standard error of estimate, rank correlation. **8 Hours.**

[Text 1: 24.1, 24.4, 24.5, 24.6, 25.12, 25.13, 25.14, 25.16]

[RBT Levels: L1, L2 and L3] Self-Study: **Fitting of the curves y = ab^x and y = ae^{bx}.**

Applications: Data visualization, Lighting control, comparison and estimation.

Teaching-Learning Process for all modules	**Chalk and Talk/PowerPoint presentation/YouTube videos.**

Course Outcomes(Course Skill Set):

After successfully completing the course, the students will be able to:

1. Demonstrate the Fourier series to study the behavior of periodic functions and theirapplications in system communications, digital signal processing, and field theory.
2. Use Fourier transforms to analyze problems involving continuous-time signals
3. Apply Z-Transform techniques to solve difference equations
4. Understand the concept of Laplace transform and to solve initial value problems.
5. Make use of correlation and regression analysis to fit a suitable mathematical model for statistical data

Evaluation Details:

Evaluation Type		Component	Max Marks	Marks Reduced to	Min. Marks	Evaluation Details
Theory Component	Internal Assessment Tests (IAT)	IAT-1	25	25	20	Average of two IATs, Scaled down to 25 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	25	25		Any two Assessment methods as per 22OB4.2 of regulations. Average of two CCEs, scaled down to 25 marks
		CCE-2	25			
	Total CIE -Theory			**50**	**20**	
SEE			100	**50**	**18**	Conducted for 100 marks And scaled down to 50.
CIE + SEE				**100**	**40**	

Suggested Learning Resources:

Text Books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016.

Reference Books:

1. **B.V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed.
2. **Srimanta Pal & Subodh C.** Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Reprint, 2016.
3. **N.P Bali and Manish Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022..
4. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw – Hill Book Co. Newyork, 6th Ed., 2017.
5. **Gupta C.B, Sing S.R and Mukesh Kumar:** "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education(India) Pvt. Ltd 2015.
6. **H.K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S.Chand Publication 3rd Ed., 2014.
7. **James Stewart: "**Calculus" Cengage publications, 7th edition, 4th Reprint 2019.

E-Resources:

- http://.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program

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

- Quizzes
- Assignments
- Seminars

CO- PO Mapping :

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C201.1	3	3	1									
C201.2	3	3	2									
C201.3	3	3										
C201.4	3	3										
C201.5	2	3	1									

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped

SEMESTER III

Analysis and Design of Digital Circuits			
Course Code	**22ECI32 (IC)**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (3:0:2:0)	**Credits (3:0:1:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 hours Theory + 13 Lab slots**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course objectives:

This course will enable students to:

1. Understand the concepts of simplifying Boolean expression using K-map techniques and Quine-McCluskey minimization techniques.
2. Gain knowledge of designing combinational logic circuits.
3. Analyze the operation of different types of sequential logic circuits.
4. Analyze and design the functioning of different types of counters and Shift registers.
5. Construct the state diagrams, state table and state equations for Mealy and Moore state models.

Module-1

Introduction to Combinational Logic circits:

Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps- up to 4 variables, Quine-McCluskey Minimization Technique, Quine-McCluskey using Don't Care Terms.

08 Hours

Module-2

Analysis of combinational logic circuits:

General approach to Combinational Logic Design, Full adder & Subtractor, Parallel adder and subtractor, carry look ahead adder, Magnitude Comparator, Decoders, Encoders and Multiplexers as minterm/maxterm Generator.

08 Hours

Module-3

Memory circuits and its applications:

Basic Bistable Element, Latches, SR Latch, Application of SR Latch, A Switch Debouncer, The SR Latch, The gated SR Latch, The gated D Latch, The Master Slave Flip-Flops (Pulse-Triggered Flip-Flops), The Master-Slave SR Flip-Flops, The Master-Slave JK Flip-Flop, Edge Triggered D Flip-Flops.

08 Hours

Module-4

Design of Sequential Circuits:

Characteristic Equations, Registers, Counters - Binary Ripple Counters, Synchronous Binary counters, Counters based on Shift Registers, Design of Asynchronous counters, Design of a Synchronous Mod-N Counter using clocked JK, D and T Flip-Flops.

08 Hours

Module-5

Applications of Sequential Circuits:

Introduction, Mealy and Moore Models, State Machine Notation, Synchronous Sequential Circuit Analysis, construction of state diagram. Design of Binary Multiplier, Design of Binary Divider. Programmable Logic Devices: PLA, PAL, FPGA.

08 Hours

	PRACTICAL COMPONENTS
Sl. No	**Experiments**
1	Verify the following the logical operations sing K-Map: a) The sum-of product expression using universal gates. b) The product-of-sum expression using universal gates.
2	Design and implement (a) Full Adder using basic logic gates. (b) Full Subtractor using basic logic gates.
3	Design and implement 4-bitParallelAdder/ Subtractor using IC 7483.
4	Design and implement BCD to Excess-3 code conversion and vice-versa using IC 7483.
5	Realize (i) Adder & Subtractor using IC 74153.
6	Realize 4-variable function using IC 74151(8:1MUX)
7	Verify the following flip-flops using NAND Gates. (a) Clocked SR Flip-Flop (b) JK Flip-Flop (c) D-Flip-Flop (d) T-Flip-Flop
8	Realize the following shift registers using IC7474 (a)SISO (b) SIPO (c) PISO (d) PIPO
9	Realize the following shift registers using IC7474 (a) Ring Counter (b) Johnson Counter (c)Mod-N Counter using IC7490.

Course Outcomes

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

1. Interpret the simplification Boolean functions using K-map and Quine-McCluskey minimization technique.
2. Analyze the different combinational logic circuits.
3. Implement the concepts of Flip Flops (SR, D, T and JK).
4. Design the Registers, Asynchronous and Synchronous counters, Counter using Flip-Flops.
5. Realize the appropriate Mealy and Moore Finite State Machine.

IPCC / Integrated Courses :						
Evaluation Type		**Component**	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
Theory Component	Internal Assessment Tests(IAT)	IAT-1	25	15	10	Average of two IATs, Scaled down to 15 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	10	10		Any two Assessment methods as per 22OB4.2of regulations , Averageof two CCEs, scaled down to 10 marks
		CCE-2	10			
	Total CIE - Theory			**25**	**10**	Scale down marks of IAT and CCE to 25
Laboratory Component	Practical's and Lab Records	-	15	25	10	Conduction of experiments and preparation of Lab records, etc
	Lab Test	50	10			One test to be conductedafter the completion of all lab experiments.
	Total CIE – Practical's			**25**	**10**	
Total CIE (Theory + Lab)				**50**	**20**	
SEE			100	**50**	**18**	Conducted for 100 marks and scaled down to 50.
CIE + SEE				**100**	**40**	

Suggested Learning Resources:

Text Books:

1. John M Yarbrough: "Digital Logic Applications and Design", 3rd Edition, Cengage Learning, New Delhi, Reprint, 2012, ISBN-13: 978-81-315-0058-3, ISBN-10: 81315-0058-6.
2. Donald D Givone "Digital Principles and Design", 1st Edition, Tata McGraw Hill, New Delhi, Reprint, 2005, ISBN: 0-07-052906-X.

Reference Books:

1. Charles H Roth, Kinney LL, John EB "Fundamentals of Logic Design", Enhanced Seventh Edition, Cengage Learning; 2020, ISBN-10 :1337620351, ISBN-13 : 978-1337620352
2. M. Morris Mano, Charles R. Kime, and Tom Martin. "Logic and computer design fundamentals. "Fifth Edition, Pearson, 2015, ISBN-10 : 0133760634, ISBN-13 : 978-0133760637

E-Resources:

1. http://nptel.ac.in/courses/117106086/
2. http://www.asic-world.com/digital/tutorial.html
3. https://www.wiziq.com/tutorials/digital-electronics
4. https://alison.com/course/design-and-analysis-of-digital-circuits
5. https://www.codingninjas.com/studio/library/moore-and-mealy-machine

CO-PO MAPPING:

POS / COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C202.1	2	3	2	1	-	-	-	-	-	-	-	2	2	2	1
C202.2	2	3	2	2	-	-	-	-	-	-	-	2	3	2	2
C202.3	1	2	3	1	-	-	-	-	-	-	-	1	2	3	3
C202.4	1	2	3	2	3	-	-	-	3	2	1	1	1	2	1
C202.5	1	2	3	2	3	-	-	-	3	2	1	1	2	1	1

SEMESTER – III

BASIC SIGNAL PROCESSING			
Course Code	**22ECI33**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (3:0:2:0)	**Credits (3:0:1:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 hours Theory + 13 Lab slots**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course objectives:

The goal of the course Basic Signal Processing is:

1. Understand the mathematical description of continuous and discrete time signals and systems.
2. Analyze the signals in time domain using convolution sum and Integral.
3. Classify signals into different categories based on their properties and Analyze Linear Time Invariant (LTI) systems in time and transform domains.
4. Understand the frequency domain sampling and reconstruction of discrete time signals.
5. Study the properties and the development of efficient algorithms for the computation of DFT.

Teaching-Learning Process (General Instructions)

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 maybe adopted so that the delivered lessons shall develop students theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   a) As an introduction to new topics (pre-lecture activity).
   b) As a revision of topics (post-lecture activity).
   c) As additional examples (post-lecture activity).
   d) As an additional material of challenging topics (pre-and post-lecture activity).
   e) As a model solution of some exercises (post-lecture activity).

Module-1

Introduction and Classification of signals: Definition of signal and systems, communication and control system as examples Classification of signals.

Basic Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shift and time reversal.

Elementary signals/Functions: Exponential, sinusoidal, step, impulse and ramp functions. Expression of triangular, rectangular and other waveforms in terms of elementary signals.

[Text 1:21.1, 21.2, 21.3, 21.4, 21.5, 21.7, 21.9, 21.10,21.12, 21.14, 21.15, 21.17]

08 Hours

Module-2

System Classification and properties: Linear-nonlinear, Time variant-invariant, causal-noncausal,

static-dynamic, sta
ble-unstable, invertible.

Time domain representation of LTI System: Impulse response, convolution sum, convolution integral. Computation of convolution sum and convolution integral using graphical method for unit step and unit step.

[Text 1: 9.3, 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.11]

08 Hours

Module-3

Time domain representation of LTI System: Computation of convolution sum and convolution integral unit step and exponential, exponential and exponential, unit step and rectangular, and rectangular and rectangular.

LTI system Properties in terms of impulse response: System interconnection, Memory less, Causal, Stable, Invertible and Deconvolution and step response

[Text 1: 22.1, 22.2, 22.4, 22.5, 23.1, 23.2, 23.3, 23.5, 23.6, 23.7, 23.15, 23.16, 31.1, 31.2]

08 Hours

Module-4

Discrete Fourier Transforms (DFT): Frequency domain sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform, DFT as a linear transformation

Properties of the DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and Circular Convolution, Additional DFT properties.

[Text 1: 22.1, 22.2, 22.4, 22.5, 23.1, 23.2, 23.3, 23.5, 23.6, 23.7, 23.15, 23.16, 31.1, 31.2]

08 Hours

Module-5

Linear filtering methods based on the DFT: Use of DFT in Linear Filtering, Filtering of Long data Sequences

The Z-Transforms: Z-transform, 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: 35.1, 35.2, 35.3, 35.4, 35.5]

08 Hours

Practical Component

Matlab Simulation Experiments

1. Write the Matlab code to generate the following elementary signals: (i) Exponential Signal (ii) Unit step (iii) Unit impulse
2. Write the Matlab code to perform the following basic operations on the signals: (i) Amplitude scaling (ii) Addition of two signals (iii) Time shift (iv) Time reversal
3. Write the Matlab code to check the system is Linear or nonlinear.
4. Write the Matlab code to perform convolution sum and convolution integral of the signal.
5. Write the Matlab code to DFT and IDFT of the signal.
6. Write the Matlab code to verify the property of DFT: (i) Periodicity (ii) Linearity (iii) Symmetry

Teaching-Learning Process for all modules	**Chalk and Talk/PowerPoint presentation/YouTube videos.**

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Analyze the different types of signals and systems.
2. Represent continuous and discrete systems in time and frequency domain using different transforms Test whether the system is stable.
3. Determine response of LTI systems using time domain and DFT techniques.
4. Compute DFT of real and complex discrete time signals.
5. Computation of DFT for linear filtering approach and Z –transform for the signals

Assessment Details (both CIE and SSE)

IPCC / Integrated Courses :						
Evaluation Type		**Component**	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
Theory Component	Internal Assessment Tests(IAT)	IAT-1	25	15	10	Average of two IATs, Scaled down to 15 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	10	10		Any two Assessment methods as per 22OB4.2of regulations , Averageof two CCEs, scaled down to 10 marks
		CCE-2	10			
	Total CIE - Theory			**25**	**10**	Scale down marks of IAT and CCE to 25
Laboratory Component	Practical's and Lab Records	-	15	25	10	Conduction of experiments and preparation of Lab records, etc
	Lab Test	50	10			One test to be conducted after the completion of all lab experiments.
	Total CIE – Practical's			**25**	**10**	
Total CIE (Theory + Lab)				**50**	**20**	
SEE			100	**50**	**18**	Conducted for 100 marks and scaled down to 50.
CIE + SEE				**100**	**40**	

Suggested Learning Resources:

Text Books:

1. Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, Wiley India. ISBN 9971-51-239-4.
2. Proakis & Monalakis, "Digital signal processing – Principles Algorithms & Applications", 4th Edition, Pearson education, New Delhi, 2007. ISBN: 81-317-1000-9. 2.

Reference Books:

1. D.GaneshRao and Vineeth P Gejji, "Digital Signal Processing" Cengage India Private Limited, 2017, ISBN: 9386858231.
2. Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
3. Ganesh Rao and SatishTunga, "Signals and Systems", Pearson/Sanguine.

E-Resources:

- NPTEL :: Electrical Engineering - Networks Signals and Systems
- NPTEL :: Electrical Engineering - Digital Signal Processing
- NPTEL :: Electrical Engineering - Digital Signal Processing
- NPTEL :: Electrical Engineering - Digital Signal Processing

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

- Quizzes
- Assignments
- Seminars

CO- PO Mapping:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C203.1	3	3	2	2	3	--	--	--	--	--	--	--	3	3	2
C203.2	3	3	3	3	3	--	--	--	--	--	--	--	3	3	3
C203.3	3	2	3	3	3	--	--	--	--	--	--	--	3	2	3
C203.4	3	3	3	3	1	--	--	--	--	--	--	--	3	3	2
C203.5	3	3	3	3	3	--	--	--	--	--	--	--	3	3	3

SEMESTER – III

Analog Electronic Circuits			
Course Code	**22ECT34**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (3:0:0:0)	**Credits (3:0:0:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 hours**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course objectives:

1. Design and analyses the BJT circuits as an amplifier and voltage regulation.
2. Design of MOSFET Amplifiers and analyze the basic amplifier configurations.
3. Design of operational amplifiers circuits as Comparators, DAC and filters and understand the concept of positive and negative feedback.
4. Analyze Power amplifier circuits in different modes of operation.
5. Understand the thyristor operation and the different types of thyristors.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various cou rse 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 skills
   such as 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 theirown creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

BJT models: Introduction, Biasing in BJT, Configuration of BJT (Only Common-Emitter Biased Amplifier).

Small signal operation and Models: Two transistor model (Pi-Model only), Collector current and trans conductance, Input and output parameters (Base-Emitter voltage and current), input resistance, voltage gain. Darlington Connections (DC-Model analysis). (Text1: 7.1, 7.5, 7.9, 8.2, 8.3, 8.4, 8.5, 8.6, 9.6, 9.7) **08 Hours**

Module-2

Linear Op-amp Circuits: 2-input Summing Amplifier and D/A Converter, Nonlinear Op-amp Circuits: Comparator with and without zero references.

Oscillator (Using BJT only): Generation of Sinusoidal Oscillation using tank circuit, RC Phase Shift Oscillator, Crystal Oscillator.

The 555 timer: Monostable Operation, Astable Operation. (Text-1: 18.6, 20.1, 20.2, 21.1, 21.3, 21.5, 21.6, 21.7, 21.8) **08 Hours**

Module-3

Negative Feedback Op-amp: General feedback structure, Properties of negative feedback, The Four Basic Feedback Topologies: series-shunt, series-series, shunt-shunt and shunt-series amplifiers (Qualitative Analysis without practical circuits)

Active Filters: High and low Pass Filters, Bandpass Filters, Bandstop Filters, First order low pass butterworth filter.(Text 3: 3.1, 3.2, 3.3, 7.2, 7.3, 7.5, 7.8, 7.9) **08 Hours**

Module-4

Thyristors: The four layer Diode, SCR, IGBTs, Other Thyristors.

Power Amplifiers: Amplifier terms, classifications, Class A Operation, Class B operation, Class B push pull emitter follower, Class C Operation.(Text 1: 13.1, 13.2, 13.4, 13.6, 13.7, 10.1, 10.3, 10.4, 10.8)

08 Hours

Module-5

MOSFET Amplifier configuration: Biasing in MOS amplifier circuits: Fixing VGS, Fixing VG, Drain to Gate feedback resistor. Basic configurations, characterizing amplifiers, CS amplifier with and without source resistance, The Common Gate Amplifier, Source follower. (Text 2: 4.5.1,4.5.2, 4.5.3, 4.7.1-4.7.6) **08 Hours**

Teaching-Learning Process for all modules	**Chalk and Talk/PowerPoint presentation/YouTube videos.**

Course Outcomes: By the end of the course the students are able to:

1. Analyze the characteristics of BJTs for switching and amplifier circuits.
2. Design and interpret the applications of BJT with different circuit configurations and biasing conditions.
3. Distinguish the different feedback structures and filters.
4. Illustrate the different power electronics components and its functions.
5. Design and analyze the biasing circuits of MOSFETs.

Assessment Details (both CIE and SEE)

Theory Courses : 3 Credits or 2 Credits

Evaluation Type		Component	Max Marks	Marks reduced to	Min. Marks	Evaluation Details
Theory Component	Internal Assessment Tests(IAT)	IAT-1	25	25	20	Average of two IATs, Scaled down to 25 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	25	25		Any two Assessment methods as per 22OB4.2of regulations. Average of two CCEs, scaled down to 25 marks
		CCE-2	25			
	Total CIE - Theory			**50**	**20**	Scale down marks of IAT and CCE to 25
SEE			100	**50**	**18**	Conducted for 100 marks and scaled down to 50.
CIE + SEE				**100**	**40**	

Suggested Learning Resources:

Text Books:

1. Albert Malvino, David J Bates, Electronic Principles, 7th Edition, McGraw Hill Education, 2017, ISBN: 978-0-07 063424-4.

2. Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 5th Edition, Oxford, 2015.ISBN: 978-0-19-808913-1**.**

3. Op-amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition, Pearson Education, 2018. ISBN: 978-93-325-4991-3.

Reference Books:

1. Integrated Electronics: Analog and Digital Circuits and Systems, Jacob Millman, Christos C. Halkias, McGraw-Hill, 2015.

2. Electronic Devices and Circuit, Boylestad & Nashelsky, Eleventh Edition, Pearson, January 2015.

3. Analog Electronic Circuits, U B Mahadeva swamy, PEARSON, ISBN 978-81-317-3234-2, Sixth Edition.

E-Resources:

1. Integrated Electronics: Analog and Digital Circuits and Systems, Jacob Millman, Christos C. Halkias, **McGraw-Hill, 2015.**
2. Electronic Devices and Circuit, Boylestad & Nashelsky, Eleventh Edition, Pearson, January 2015.
3. https://www.tutorialspoint.com/amplifiers/amplifiers_negative_feedback.html
4. https://www.electronics-tutorials.ws/amplifier/transistor-biasing.html
5. https://circuitdigest.com/electronic-circuits/half-wave-and-full-wave-precision-rectifier-circuit-using-op-amp
6. https://www.electronicshub.org/scr-turn-off-methods/

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

- Quizzes
- Assignments
- Mini-project

CO- PO Mapping:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C204.1	3	3	2	2	1	--	--	--	2	1	1	1	3	1	1
C204.2	3	3	2	2	1	--	--	--	2	1	1	1	3	1	1
C204.3	3	3	2	1	1	--	--	--	2	1	1	1	3	2	1
C204.4	3	2	1	1	1	--	--	--	2	1	1	1	3	2	1
C204.5	3	2	1	1	1	--	--	--	2	1	1	1	3	2	1

SEMESTER - III

Analog Electronics Lab			
Course Code	**22ECL35**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (0:0:2:0)	**Credits (0:0:1:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**13 lab slots**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course objectives:

This laboratory course enables students to:

1. Understand the electronic circuit schematic and its working
2. Realize and test amplifier and oscillator circuits for the given specifications
3. Realize the op-amp circuits for the applications such as implement mathematical functions and precision rectifiers.
4. Study clippers, clampers and rectifier circuits.
5. Use suitable ICs based on the specifications and functions.

Sl. No.	Experiments
1	Design and test diode clipping clampers - positive and negative circuits
2	Design and test Bridge rectifier
3	Design and set up the BJT common emitter voltage amplifier with and without feedback anddetermine the gain- bandwidth product, input and output impedances.
4	Design and set-up BJT RC oscillator
5	Design and set up the circuits using op-amp: i) Adder ii) Comparator
6	Design and set up the circuits using op-amp: i) Integrator ii) Differentiator
7	To design Second order active LPF and HPF.
8	Design and set-up BJT Crystal Oscillator.
9	Test the Half wave precision rectifiers using op-amp.
10	Design and test Monostable & Astable Multivibrator using 555 Timer

Course outcomes (Course Skill Set):

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

1. Design and analyze the Clipping, clamping and rectifier circuits.
2. Design and analyze the BJT oscillator circuits.
3. Design and test Op-amp circuits to realize the mathematical computations.
4. Design and test the Opamp circuits to realize the precision rectifiers.
5. Design and test timer circuits

Assessment Details:

Lab Courses : 1 Credit				
Evaluation Type	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
CIE (Lab)	50		20	The split-up of CIE marks for record/ journal and test are in the ratio 60:40.
SEE	100	50	18	All laboratory experiments are to be included for practical examination
CIE + SEE	**100**		**40**	

Suggested Learning Resources:

1. Fundamentals of Electronic Devices and Circuits Lab Manual, David A Bell, 5th Edition, 2009, Oxford University Press.

2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition, Pearson Education, 2018. ISBN: 978-93-325-4991-3.

3. Fundamentals of Logic Design, Charles H Roth Jr., Larry L Kinney, Cengage Learning, 7th Edition.

CO- PO Mapping:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C205.1	3	3	3	3	2	-	-	-	3	1	1	1	3	2	1
C205.2	3	3	3	3	2	-	-	-	3	1	1	1	3	2	1
C205.3	3	2	3	3	1	-	-	-	3	1	1	1	3	2	1
C205.4	3	2	3	3	1	-	-	-	3	1	1	1	3	1	1
C205.5	3	2	3	3	1	-	-	-	3	1	1	1	3	1	1

SEMESTER – III

OBJECT ORIENTED PROGRAMMING USING C++			
Course Code	**22ECT36A**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P:S) (3:0:0:0)	**Credits (3:0:0:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 hours**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course objectives:

This course will enable the students to:

1. Understand the features of Encapsulation, Inheritance and Polymorphism.
2. Study the concept of constructor and destructor using classes and objects.
3. Apply the different types of inheritance using base class and derived class.
4. Analyze the concept of function overloading, operator overloading and virtual functions.
5. Develop the formatted and unformatted I/O operation using stream classes.

Module-1

Introduction: Origin of C++, features of OOP, Comparison of Object Oriented Language with C,Sample C++ program, Different data types, operators, expressions, implicit conversion, Type cast operator and statements, arrays and strings, pointers and user defined types, reference variable, memory management operator, name space, control structure, Function, default argument, inline functions, function, recursive functions**.**

08Hours

Module-2

Classes and Objects: Classes, structures and classes are related. Friend functions, inline functions, function over loading, Constructors, Different types of constructor, Destructors, Static data members, when constructor and destructors are executed, scope resolution operator. Nested classes, local classes, passing objects to functions, returning objects, this pointer.

08Hours

Module-3

Inheritance: Base Class, Inheritance, Types of inheritance and protected members, protected base class inheritance, inheriting multiple base classes, Constructors, Destructors and inheritance, Passing parameters to base class constructors, Granting access, Virtual base classes.

08 Hours

Module-4

Virtual functions, Polymorphism and Operator overloading: Operator over loading basics, creating a member operator function, Operator overloading using friend functions such as +, - , pre-increment, post increment, etc., overloading << and >> Virtual function, calling a Virtual function through a base class reference, Virtual attribute is inherited; Virtual functions are hierarchical, pure virtual functions, Abstract classes,Using virtual functions, Early and late binding**.**

08Hours

Module-5

Streams and Working with files: C++ streams and stream classes, formatted and unformatted I/O operations, Output with manipulators, Classes for file stream operations, opening and closing a file, EOF, Multi threading.

08Hours

Course Outcomes:

On completion of this course the students will be able to

1. Explain the features of Object Oriented Programming.
2. Illustrate classes and objects using public and private members of the class.
3. Analyze the different types of inheritance to solve complex problems.
4. Implement mechanism of virtual function, polymorphism and operator overloading.
5. Develop an I/O operations and file streams using opening and closing file.

Assessment Details (both CIE and SEE)

Theory Courses : 3 Credits or 2 Credits						
Evaluation Type		**Component**	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
Theory Component	Internal Assessment Tests(IAT)	IAT-1	25	25	20	Average of two IATs, Scaled down to 25 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	25	25		Any two Assessment methods as per 22OB4.2 of regulations. Average of two CCEs, scaled down to 25 marks
		CCE-2	25			
	Total CIE - Theory			**50**	**20**	Scale down marks of IAT and CCE to 25
SEE			100	**50**	**18**	Conducted for 100 marks and scaled down to 50.
CIE + SEE				**100**	**40**	

Text Books:

1. Herbert Schildt: "The Complete Reference C++", 4th Edition, Tata McGraw Hill, 2003, ISBN 13: 9780070532465
2. Object Oriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013. ISBN-978-1-25-902993-6

Reference Books:

1. Stanley B. Lippmann, JoCCE Lajore: "C++ Primer", 4th Edition, Pearson Education, 2005, ISBN-10: 0-321-71411-3.
2. Paul J Deitel, Harvey M Deitel: "C++ for Programmers", Pearson Education, 2009,ISBN-10: 0137059663

E-Resources:

1. http://www.tutorialspoint.com/cplusplus/cpp_tutorial.pdf
2. http://www.ddegjust.ac.in/studymaterial/mca-3/ms-17.pdf

CO-PO Mapping:

POS COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
C206a.1	3	2	1	1	1	--	--	--	--	--	--	--	2	2	1
C206a.2	3	3	2	1	2	--	--	--	--	--	--	--	3	2	2
C206a.3	3	3	3	1	2	--	--	--	--	--	--	--	2	1	1
C206a.4	3	2	1	2	1	--	--	--	--	--	--	--	2	2	1
C206a.5	2	3	2	1	2	--	--	--	--	--	--	--	2	1	1

SEMESTER – III

SENSOR AND INSTRUMENTATION			
Course Code	**22ECT36B**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (3:0:0:0)	**Credits (3:0:0:0)**	**SSE Marks**	**50**
Total Hours of Pedagogy	**40 hours**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course objectives:

The goal of the course sensor and instrumentation is:

1. To understand the basic concepts of transducers.
2. To identify the mathematical model of the transducer and its response to various inputs.
3. Explain the construction and working principle of resistive type transducers.
4. To evaluate the knowledge on capacitive type and inductive type transducers.
5. Illustrate the construction and working principle of sensors and their real-time applications.

Teaching-Learning Process (General Instructions)

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 maybe adopted so that the delivered lessons shall develop students theoreticaland applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments andquizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   a) As an introduction to new topics (pre-lecture activity).
   b) As a revision of topics (post-lecture activity).
   c) As additional examples (post-lecture activity).
   d) As an additional material of challenging topics (pre-and post-lecture activity).
   e) As a model solution of some exercises (post-lecture activity).

Module-1

Sensor and Transducer: Definition, Classification & selection of sensors, General block diagram of measure measurement systems – Methods of measurements – Classification and selection of transducers – Error analysis – Statistical methods – Odds and uncertainty, classification of instruments, applications of measurement systems. **08 Hours**

Module-2

Static characteristics: Accuracy, precision, resolution, sensitivity, linearity – Dynamic characteristics – Mathematical model of transducer – Zero, first and second order transducers – Response for impulse, step, ramp, and sinusoidal inputs **08 Hours**

Module-3

Measurement of Temperature Sensors: Principle of operation , Construction details , Characteristics and application of resistance potentiometer– Strain gauge – Resistance thermometer – Thermistor - RTD – Hot-wire anemometer – Humidity sensor –Induction potentiometer – Variable reluctance transducers – LVDT. **08 Hours**

Module-4

Optical, Pressure and smart sensors Capacitive transducer and types – Capacitor microphone – Frequency response – Piezoelectric transducer– Hall effect transducer – Magneto resistive – Digital transducers – Fiber optic sensors - LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Thick and thin film sensors (Biosensor and chemical sensor)

08 Hours

Module-5

Signal Conditioning and DAQ Systems - Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi-channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring

08 Hours

Teaching-learning process for all modules	**Chalk and Talk/PowerPoint presentation/YouTube videos.**

Course Outcomes:

After successfully completing the course, the students will be able

1. Identify the sensors for the measurement of various physical parameters.
2. Apply the mathematical model of the transducer and its response for various inputs.
3. Evaluate an appropriate resistive type transducer for the measurement of various physical parameters.
4. Demonstrate capacitive and inductive type transducers for the measurement of various physical parameters.
5. Illustrate about the sample and hold circuits and DAQ system.

Assessment Details (both CIE and SEE)

Theory Courses : 3 Credits or 2 Credits

Evaluation Type		Component	Max Marks	Marks reduced to	Min. Marks	Evaluation Details
Theory Component	Internal Assessment Tests(IAT)	IAT-1	25	25	20	Average of two IATs, Scaled down to 25 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	25	25		Any two Assessment methods as per 22OB4.2 of regulations. Average of two CCEs, scaled down to 25 marks
		CCE-2	25			
	Total CIE - Theory			**50**	**20**	Scale down marks of IAT and CCE to 25
SEE			100	**50**	**18**	Conducted for 100 marks and scaled down to 50.
CIE + SEE				**100**	**40**	

Suggested Learning Resources:

Text Books:

1. "A Course in Electrical and Electronics Measurements and Instrumentation", Sawhney A K, Dhanpat Rai and Sons, New Delhi, 2013
2. "Sensors and Transducers", Patranabis D, Prentice Hall of India, Second Edition, 2010
3. "Transducers and Instrumentation", Murthy D V S, Prentice Hall of India, New Delhi, Second Edition, 2010.

Reference Books:

1. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.
2. A.D. Helfrick and W.D. cooper, Modern Electronic Instrumentation & Measurement Techniques, PHI – 2001
3. Hermann K.P. Neubert, "Instrument Transducers" 2nd Edition 2012, Oxford University Press.

E-Resources:

- **https://onlinecourses.nptel.ac.in/noc21_ee32**
- **https://onlinecourses.nptel.ac.in/noc23_ee105**
- **https://archive.nptel.ac.in/courses/108/105/108105064/**
- **https://onlinecourses.nptel.ac.in/noc23_ee95/**

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

- Quizzes
- Assignments
- Seminars

CO- PO Mapping:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C206b.1	3	2	3	2	2	2	--	--	--	--	--	1	2	1	3
C206b.2	3	3	2	2	1	2	--	--	--	--	--	2	2	1	3
C206b.3	3	3	3	2	2	2	--	--	--	--	--	1	2	1	3
C206b.4	3	2	2	2	2	2	--	--	--	--	--	1	2	1	3
C206b.5	3	2	3	2	2	2	--	--	--	--	--	1	2	1	3

SEMESTER – III

Computer Organization and Architecture			
Course Code	**22ECT36C**	**CIE Marks**	**50**
Teaching Hours/Week(L:T:P:S) (3:0:0:0)	**Credits (3:0:0:0)**	**SSE 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. Understand the basic sub systems of a computer, their organization, structure and operation.
2. Explain 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.

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 teaching methods may be adopted to develop the outcomes.
2. Encourage collaborative (Group) Learning in the class.
3. Ask at least three HOTS(Higher order Thinking)questions in the class, which promotes critical thinking.
4. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
5. Topics will be introduced in a multiple representation.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world-and when that's possible, it helps improve the students' understanding.
8. Adopt Flipped class technique by sharing the materials/Sample Videos prior to the class and have discussions on the topic in the succeeding classes.

Module-1

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance -Processor Clock, Basic Performance Equation.

Machine Instructions and Programs: Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations**.**

[Text1:1.1,1.2,1.3,1.4,1.5,1.6,1.6.1,1.6.2,2.1,2.2,2.3]

08 Hours

Module-2

Machine Instructions : Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions.

[Text1:2.4,2.5,2.6,2.7,2.8,2.9,2.10]

08 Hours

Module-3

Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests ,Exceptions, Direct Memory Access, Buses,Interface Circuits and Standard I/O Interfaces.

[Text1:4.1,4.2,4.2.1,4.2.2,4.2.3,4.2.4,4.2.5,4.4,4.5,4.6,4.7]

08 Hours

Module-4

Memory System: Basic Concepts, Semiconductor RAM Memories-Internal organization of memory chips, Static memories, Asynchronous DRAMS, Synchronous DRAMS, Read Only Memories, Speed, Size and Cost,Cash Memories, Mapping Functions, Replacement Algorithm, Virtual Memories, Secondary Storage-Magnetic Hard Disks.

[Text1:5.1,5.2,5.2.1,5.2.2,5.2.3,5.2.4,5.3,5.4,5.5,5.5.1,5.5.2,5.7,5.9,5.9.1]

08 Hours

Module-5

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Micro programmed Control, Pipelining, Basic concepts, Role of Cache memory, Pipeline Performance.

[Text1: 7.1,7.2,7.3,7.4,7.5,8.1,8.1.1,8.1.2]

08 Hours

Teaching-Learning Process for all modules	**Chalk and Talk/Power Point presentation/YouTube videos.**

Course Outcomes:

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

1. Interpret the basic organization of a computer system.
2. Describe the addressing modes, instruction formats and program control statement.
3. Identify different ways of accessing an input/ output device including interrupts.
4. Explain the organization of different types of semiconductor and other secondary storage memories.
5. Illustrate simple processor organization based on hard wired control and micro-programmed control.

Assessment Details(both CIE and SEE)

Theory Courses : 3 Credits or 2 Credits

Evaluation Type		Component	Max Marks	Marks reduced to	Min. Marks	Evaluation Details
Theory Component	Internal Assessment Tests(IAT)	IAT-1	25	25	20	Average of two IATs, Scaled down to 25 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	25	25		Any two Assessment methods as per 22OB4.2 of regulations. Average of two CCEs, scaled down to 25 marks
		CCE-2	25			
	Total CIE - Theory			**50**	**20**	Scale down marks of IAT and CCE to 25
SEE			100	**50**	**18**	Conducted for 100 marks and scaled down to 50.

CIE + SEE		**100**	**40**	

Suggested Learning Resources:

Text Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition,Tata McGrawHill,2002.

ReferenceBooks:

2. David A. Patterson, John L. Hennessy: Computer Organization and Design-The Hardware/ Software Interface ARM Edition, 4th Edition, Elsevier,2009.
3. William Stallings: Computer Organization &Architecture, 7th Edition, PHI, 2006.
4. Andrew S. Tanenbaum, Todd Austin, "Structured Computer Organization", 6th Edition, Pearson, 2013
5. Vincent P. Heuring & Harry F. Jordan: Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004.

E-Resources:

https://nptel.ac.in/courses/106105163
https://nptel.ac.in/courses/106106166
https://nptel.ac.in/courses/106103180
https://onlinecourses.nptel.ac.in/noc23_cs67

Activity-BasedLearning(SuggestedActivitiesinClass)/Practical-Based Learning

- Quizzes
- Assignments
- Seminars

CO-PO Mapping:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C206c.1	3	3	2	2	--	1	--	--	1	--	--	1	3	3	2
C206c.2	3	3	2	2	--	1	--	--	1	--	--	1	3	3	2
C206c.3	3	3	2	2	--	1	--	--	1	--	--	1	3	3	2
C206c.4	3	3	2	2	--	1	--	--	1	--	--	1	3	3	2
C206c.5	3	3	2	2	--	1	--	--	1	--	--	1	3	3	2

SEMESTER – III

NETWORK ANALYSIS			
Course Code	**22ECT36D**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P:S) (3:0:0:0)	**Credits (3:0:0:0)**	**SSE Marks**	**50**
Total Hours of Pedagogy	**40 hours**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course objectives:

The goal of the course Transform Calculus, Fourier series and Numerical techniques is:

1. Describe basic network concepts emphasizing source transformation source shifting, mesh and nodal techniques to solve for resistance/impedance, voltage, current and power.
2. Explain network Thevenin‘s, Millman‘s, Superposition, 0063Maximum Power transfer and Norton‘s Theorems and apply them in solving the problems related to Electrical Circuits.
3. Describe Series and Parallel Combination of Passive Components as resonating circuits, related parameters and to analyze frequency response.
4. Analyze the behaviour of networks subjected to transient conditions. Use applications of Laplace transform to solve network problems.
5. Study two port network parameters like Z, Y, T and h and their inter-relationships.

Teaching-Learning Process(General Instructions)

These are sample Strategies, which teacherscanusetoacceleratetheattainmentofthevariouscourseoutcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods maybe adopted so that the delivered lessons shall develop students theoretical and applied mathematical skills.
2. StatetheneedforMathematicswithEngineeringStudiesandProvidereal-lifeexamples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   a) As an introduction to new topics (pre-lecture activity).
   b) As a revision of topics (post-lecture activity).
   c) As additional examples (post-lecture activity).
   d) As an additional material of challenging topics(pre-and post-lecture activity).
   e) As a model solution of some exercises (post-lecture activity).

Module-1

Basic Concepts: Introduction, Practical sources, Source transformations, Star – Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC networks, Concepts of super node and super mesh. **08 Hours**

Module-2

Network Theorems: Superposition Theorem, Thevenin‘s and Norton‘s theorems, Maximum Power transfer theorem, Millman‘s theorem. **08 Hours**

Module-3
Resonant Circuits: Series and Parallel Resonance, Frequency Response of Series and Parallel circuits, Q-Factor, Bandwidth. **08 Hours**
Module-4
Transient behaviour and initial conditions: Behaviour of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for DC excitations, Applications of Laplace Transforms in circuit analysis. **08 Hours**
Module-5
Two port network parameters: Introduction, open circuit impedance parameter, short circuit admittance parameter, hybrid parameters, transmission parameter, relationship between parameters. **08 Hours**

Teaching-Learning Process for all modules	**Chalk and Talk/Power Point presentation/YouTube videos.**

Course Outcomes:

After successfully completing the course, the students will be able

1. Analyze currents and voltages in a circuit using network simplification techniques.
2. Determine the complex circuits using network theorems.
3. Simplify the series and parallel resonance circuits.
4. Apply simple DC circuits concepts to transient conditions and to the Laplace's Transforms.
5. Solve the given network using specified two port network parameters like Z or Y or T or h and Evaluate frequency response related parameters through the RLC elements, in resonant circuits.

Assessment Details (both CIE and SEE)

Theory Courses : 3 Credits or 2 Credits

Evaluation Type		Component	Max Marks	Marks reduced to	Min. Marks	Evaluation Details
Theory Component	Internal Assessment Tests(IAT)	IAT-1	25	25	20	Average of two IATs, Scaled down to 25 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	25	25		Any two Assessment methods as per 22OB4.2of regulations. Average of two CCEs, scaled down to 25 marks
		CCE-2	25			
	Total CIE - Theory			**50**	**20**	Scale down marks of IAT and CCE to 25
SEE			100	**50**	**18**	Conducted for 100 marks and scaled down to 50.
CIE + SEE				**100**	**40**	

Suggested Learning Resources:

Text Books:

1. M.E. Van Valkenberg (2000), "Network analysis", Prentice Hall of India, 3rd edition, 2000, ISBN: 9780136110958.
2. Roy Choudhury, "Networks and systems", 2nd edition, New Age International Publications,

2006, ISBN: 9788122427677.

Reference Books:

1. Hayt, Kemmerly and Durbin —Engineering Circuit Analysis", TMH 7th Edition, 2010.
2. J. David Irwin /R. Mark Nelms, "Basic Engineering Circuit Analysis", John Wiley, 8th edition, 2006.

E-Resources:

- https://archive.nptel.ac.in/courses/108/105/108105159/
- https://nptel.ac.in/courses/108105159
- https://onlinecourses.nptel.ac.in/noc22_ee07/

Activity-BasedLearning(SuggestedActivitiesinClass)/Practical-Based Learning

- Quizzes
- Assignments
- Seminars

CO-PO Mapping:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C206d.1	3	1	3	2	2	-	-	-	-	-	-	-	2	-	-
C206d.2	3	3	3	2	2	-	-	-	-	-	-	-	1	2	-
C206d.3	3	2	3	2	1	-	-	-	-	-	-	-	-	1	2
C206d.4	3	3	3	2	1	-	-	-	-	-	-	-	1	-	-
C206d.5	2	2	3	3	1	-	-	-	-	-	-	-	-	-	2

SEMESTER – III

Social Connect and Responsibility			
Course Code	**22UHV37**	**CIE Marks**	**100**
Teaching Hours/Week (L: T: P: S) (0:0:2:0)	**Credits (0:0:1:0)**	**SSE Marks**	**00**
Total Hours of Pedagogy	**15 hours**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**--**

Course objectives:
The Course will

1. Enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & the government and build solutions to alleviate these complex social problems through immersion, design & technology.
2. Provide a formal platform for students to communicate and connect to their surroundings.
3. Enable to create of a responsible connection with society.

Teaching-Learning Process (General Instructions)

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

Module-1

Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a group of B.Tech. students. They will also make an excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.

03 Hours

Module-2

Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photoblog and documentary on evolution and practice of various craft forms.

03 Hours

Module-3

Organic farming and waste management: usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus.

03 Hours

Module-4

Water Conservation: knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.

03 Hours

Module-5

Food Walk City's culinary practices, food lore, and indigenous materials of the region used in cooking.

03 Hours

Teaching-Learning Process for all modules	**Chalk and Talk/PowerPoint presentation/YouTube videos.**

Course Outcomes:

The students are expected to have the ability to :

1. Understand social responsibility.
2. Practice sustainability and creativity.
3. Showcase planning and organizational skills
4. Conservation and saving of potable water
5. To taste the local cuisine and rate the nutrient values of that cuisine.

Assessment Details:

Weightage	**CIE – 100%**	• Implementation strategies of the project (NSS work). • The last report should be signed by NSS Officer, the HOD and principal. • At last report should be evaluated by the NSS officer of the institute. • Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.
Field Visit, Plan, Discussion	10 Marks	
Commencement of activities and its progress	20 Marks	
Case study based Assessment Individual performance with report	20 Marks	
Sector wise study & its consolidation 5*5 = 25	25 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report. **Activities 1 to 5, 5*5 = 25**	25 Marks	
Total marks for the course in each semester	**100 Marks**	
For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.		
Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general through activities.		

Activities

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

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 solution as the course project, with your group. Social immersion with 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.

A total of 14-20 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. program. The students will be divided into 10 groups of 35 each. Each group will be handled by two **faculty mentors**. Faculty mentors will design the activities (particularly Jamming sessions open mic ,and poetry)

CO- PO Mapping:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C207.1	--	--	--	--	--	--	--	--	--	--	--	2	--	2	--
C207.2	--	--	--	--	--	--	--	--	--	1	--	2	--	2	--
C207.3	--	--	--	--	--	--	--	--	--	2	--	2	--	2	--
C207.4	--	--	--	--	--	--	--	--	--	2	--	2	--	2	--
C207.5	--	--	--	--	--	--	--	--	--	2	--	2	--	2	--

SEMESTER III

LICs Lab using PSPICE			
Course Code	**22EC38A**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (0:0:2:0)	**Credits (0:0:1:0)**	**SSE Marks**	**50**
Total Hours of Pedagogy	**10 hours**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course objectives:

1. Demonstrate various circuits using PSPICE and verify functionality.
2. To be exposed to the operation and application of electronic devices and their circuits.
3. To analyze circuit characteristics with signal analysis using Op-amp ICs.
4. Familiarize with Modern tools
5. Acquire knowledge on different types of description in PSPICE.

Teaching-Learning Process (General Instructions)

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

S. No.	Experiments
1	To realize using op-amp an Inverting Amplifier and Non-Inverting Amplifier
2	To realize using op-amps i) Summing Amplifier ii) Difference amplifier
3	To realize using op-amps an Instrumentation Amplifier
4	To realize using op-amps i) Differentiator ii) Integrator
5	To realize using op-amps a Full wave Precision Rectifier
6	To realize using op-amps i) Inverting and Non-Inverting Zero Crossing Detectors ii) Positive and Negative Voltage level detectors
7	To realize using op-amp an Inverting Schmitt Trigger
8	To realize using op-amp an Astable Multivibrator
9	To design and implement using op-amps i) Butterworth I & II order Low Pass Filter ii) Butterworth I & II order High Pass Filter
10	To design and implement 4 - bit R-2R Digital to Analog Converter

Course outcome (Course Skill Set)

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

1. Demonstrate various circuits using PSPICE and verify functionality.
2. Design and test of analog circuits using OPAMPs
3. Design and implement basic circuits using IC (OPAMP and 555 timers).
4. Use the modern engineering tool such as PSPICE necessary for engineering practice.

Lab Courses: 1 Credit				
Evaluation Type	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
CIE (Lab)	**50**		**20**	The split-up of CIE marks for record/ journal and test are in the ratio 60:40.
SEE	**100**	**50**	**18**	All laboratory experiments are to be included for practical examination
CIE + SEE		**100**	**40**	

Assessment Details (both CIE and SEE)

Suggested Learning Resources:

E-Resources:

- https://nptel.ac.in/courses/117105147
- https://nptel.ac.in/courses/106105165

CO- PO Mapping:

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C208a.1	3	2	1	1	-	-	-	-	-	-	-	2	1	3	-
C208a.2	1	-	-	-	3	-	-	-	-	-	-	2	1	-	-
C208a.3	1	2	3	-	1	-	-	-	-	-	-	2	1	3	-
C208a.4	1	2	2	2	-	-	-	-	-	-	-	1	1	3	-
C208a.5	1	1	1	-	2	-	-	-	-	-	-	1	1	3	-

SEMESTER III

Simulink Programming Basics			
Course Code	**22EC38B**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (0:0:2:0)	**Credits (0:0:1:0)**	**SSE Marks**	**50**
Total Hours of Pedagogy	**10 hours**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course objectives:

1. Teach students how to create dynamic system models in Simulink, including continuous and discrete systems, and simulate their behavior.
2. Enable students to design and implement control systems using Simulink, including PID controllers, state-space controllers, and other advanced control techniques.
3. Teach students how to integrate Simulink models with MATLAB scripts and functions for enhanced functionality and data analysis.
4. Real-Time Simulation and Hardware-in-the-Loop (HIL): Explore real-time simulation concepts and how to use Simulink for Hardware-in-the-Loop testing, bridging the gap between virtual simulations and physical systems.
5. These objectives cover the basics of Simulink, modeling, simulation, control system design, and advanced applications, providing students with a comprehensive skill set for using Simulink effectively.

1. Generation of following Basic Waveforms
    - Unit Step Function
    - Ramp Function
    - Pulse Function
    - Sum and Difference of Step Functions
2. Trigonometric Functions
    - Sine, Cosine and Tangent Functions
    - Cosecant Function
    - Secant Function
    - Cotangent Function
    - Applications of Trigonometric Functions
3. Differential Equations
    - Differential Equations
    - Solving differential equations
    - Spring mass damper system
    - Solving the system
    - Special cases
    - Laplace transforms
4. Spring-Mass-Damper Systems and Stability
    - Transfer function estimation (Special cases)
5. Simple Harmonic Oscillator and Control System Design
    - Simple Harmonic Oscillator
        - Control System Design
        - Transfer function
        - Feedback to the controller
6. PID Design for a Direct Current (DC) Machine
    - Modelling a Direct Current (DC) Machine

- PID Design for a DC Motor
- Speed control of a DC motor
- Transfer function

7. Linearization and Nonlinear Control
    - Linearization
    - Nonlinear equation solving
    - Nonlinear Control
        - Transfer function
        - Feedback system

Course outcome (Course Skill Set)

1. Students are able to understand the generation of waveforms
2. Students are able to understand the trigonometric function using simulink
3. Students are able to solve differential equation
4. Students will be able to analyze the stability of spring-mass-damper systems and estimate their transfer functions
5. Students will understand the behavior of simple harmonic oscillators and the principles of control system design

Assessment Details (both CIE and SEE)

Lab Courses : 1 Credit				
Evaluation Type	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
CIE (Lab)	**50**		**20**	The split-up of CIE marks for record/ journal and test are in the ratio 60:40.
SEE	**100**	**50**	**18**	All laboratory experiments are to be included for practical examination
CIE + SEE		**100**	**40**	

Suggested Learning Resources:
E-Resources: https://onlinecourses.nptel.ac.in/noc19_ee45/preview

CO- PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C208b.1	3	2	1	1	-	-	-	-	-	-	-	2	1	1	-
C208b.2	1	-	-	-	3	-	-	-	-	-	-	2	1	1	-
C208b.3	1	2	3	-	1	-	-	-	-	-	-	2	1	1	-
C208b.4	1	2	2	2	-	-	-	-	-	-	-	1	1	1	-
C208b.5	1	1	1	-	2	-	-	-	-	-	-	1	1	1	-

SEMESTER III

IOT and Embedded Systems			
Course Code	**22EC38D**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (0:0:2:0)	**Credits (0:0:1:0)**	**SSE Marks**	**50**
Total Hours of Pedagogy	**13 hours**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course objectives:

1. To understand fundamentals of IoT and embedded system basic design strategy and process modeling.
2. Apply the knowledge of programming in different operations of embedded system.
3. Enable students to design and implement interfacing of Peripherals of LED, Push button
4. To introduce students a set of advanced topics in embedded IoT and lead them to understand research in network.
5. To understand fundamentals of IoT and cloud platform

Teaching-Learning Process (General Instructions)

1. Interfacing Onboard RGB LED and Switches.
2. Configuring the PUSH Button using Interrupt method.
3. Interfacing the Analog to Digital Converter to read the data from the sensors.
4. Configure the Pulse width Modulation to control the intensity of LED and Speed of DC Motor.
5. Interfacing the 7- Segment Display with microcontroller.
6. Configuration of UART protocol to print the data on the serial monitor
7. Configuration of UART protocol to print the data on the serial monitor and to receive the data from the keyboard.
8. Communication b/w two Microcontrollers using UART protocol.
9. Configure the IIC protocol for device-to-device communications.
10. Designing a web server page to the web page and controlling led.
11. Control on-board LED using IoT Platform.
12. Interfacing IR sensor and Servo motor with MCU and sending sensor data's to cloud
13. Store sensor data in the Cloud using IoT Technology.

Course outcome (Course Skill Set)

1. Students are able to understand the fundamental concepts of IOT and embedded systems
2. Students are able to understand the interfacing of LED, Push button and DC motor
3. Students will be able to analyze the UART protocol, IOT and Cloud platform
4. Students are able to analyze the IOT & cloud plat form for real time applications
5. Students will understand interfacing IR sensor and store the sensor data in Cloud platform

Assessment Details (both IAT and CCE)

Lab Courses: 1 Credit				
Evaluation Type	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
CIE (Lab)	**50**		**20**	The split-up of CIE marks for record/ journal and test are in the ratio 60:40.
SEE	**100**	**50**	**18**	All laboratory experiments are to be included for practical examination
CIE + SEE		**100**	**40**	

Suggested Learning Resources:

1) John H. Davies "MSP430 Microcontroller Basics" Elsevier. 2008, ISBN 9789380501857

2) John Catsoulis “Designing Embedded Hardware”, Shroff Publishers and Distributors. 2nd edition, 2012, ISBN-10: 9788184042597

E-Resources:

1) https://onlinecourses.nptel.ac.in/noc20_ee98/
2) https://www.ti.com/microcontrollers-mcus-processors/msp430 microcontrollers/overview.html

CO- PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C208d.1	3	2	1	1	-	-	-	-	-	-	-	2	1	2	2
C208d.2	1	2	-	-	3	-	-	-	-	-	-	2	1	2	2
C208d.3	1	2	3	-	1	-	-	-	-	-	-	2	1	2	2
C208d.4	1	2	2	2	-	-	-	-	-	-	-	1	1	2	2
C208d.5	1	1	1	-	2	-	-	-	-	-	-	1	1	2	2

SEMESTER - IV

Analog Communication			
Course Code	**22ECT41**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (3:0:0:0)	**Credits (3:0:0:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 hours Theory**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**03**

Course objectives:

This course will enable students to:

1. Understand and analyze concepts of Analog Modulation with frequency spectrum.
2. Study the generation and demodulation with linear and nonlinear concepts used in angle modulation.
3. Evolve the concept of SNR in the presence of channel induced noise and study Demodulation ofanalog modulated signals.
4. Understand and study the concepts of radio receivers.
5. Evolve the concept of sampling and pulse modulation systems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher 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 skills such as 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 withtheir own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

AMPLITUDE MODULATION: Introduction, Amplitude Modulation: Time & Frequency Domain description, switching modulator, Envelop detector.

DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION: Time and Frequency Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.

SINGLE SIDE–BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION: SSB Modulation, VSB Modulation, Frequency Translation.

08 Hours

Module-2

ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM,Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems.

08 Hours

Module-3

NOISE: Shot Noise, Thermal noise, White Noise.

NOISE IN ANALOG MODULATION: Introduction, Receiver Model, Noise in DSB-SC receivers. Noise in AM receivers, FM threshold effect, Pre-emphasis and De-emphasis in FM

08 Hours

Module-4

Radio Receiver: - Receiver Types - Tuned radio frequency receiver, super heterodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver. Comparison with AM Receiver, Amplitude limiting.

08 Hours

Module-5

SAMPLING AND PULSE MODULATION: Introduction to digitize analog sources, The Low pass Sampling Process-Pulse Amplitude Modulation. Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves.

08 Hours

Teaching-Learning Process for all modules	**Chalk and Talk, PowerPoint presentation, flip teaching, YouTube videos**

Course Outcomes

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

1. Understand the amplitude modulation techniques and perform time and frequency domain transformations.
2. Identify the schemes for frequency modulation and demodulation of analog signals and compare the performance.
3. Characterize the influence of channel noise on analog modulated signals.
4. Analyze the radio receiver operation and its characteristics
5. Illustrate the sampling, pulse modulation techniques and multiplexer concept.

Assessment Details (both CIE and SEE)

Theory Courses : 3 Credits or 2 Credits

Evaluation Type		**Component**	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
Theory Component	Internal Assessment Tests(IAT)	IAT-1	25	25	20	Average of two IATs, Scaled down to 25 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	25	25		Any two Assessment methods as per 22OB4.2 of regulations. Average of two CCEs, scaled down to 25 marks
		CCE-2	25			

	Total CIE - Theory		**50**	**20**	Scale down marks of IAT and CCE to 25
SEE		100	**50**	**18**	Conducted for 100 marks and scaled down to 50.
CIE + SEE			**100**	**40**	

Suggested Learning Resources:

Text Books:

1. Simon Haykins & Moher, Communication Systems, 5th Edition, John Wiley, India Pvt. Ltd, 2010,
   ISBN 978 -81–265– 151-7.

Reference Books:

1. B P Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University Press.,
   4th edition, 2010, ISBN: 97801980738002.
2. Simon Haykins, An Introduction to Analog and Digital Communication, John Wiley India Pvt. Ltd., 2008,
   ISBN 978–81–265–3653–5.
3. H Taub & D L Schilling, Principles of Communication Systems, TMH, 2011, ISBN: 978-0-07-064811-1.

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc21_ee74/preview
2. https://electronicspost.com/explain-the-generation-of-am-waves-using-square-law-modulator-and-switching modulator
3. http://www.radio-electronics.com/info/rf-technology-design/fm-reception/fmdemodulation-detection-overview.php

CO- PO Mapping :

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C209.1	3	3	2	2	1	-	-	-	2	1	1	1	3	2	1
C209.2	3	3	2	3	1	-	-	-	2	1	1	1	3	2	1
C209.3	3	2	2	2	-	-	-	-	2	1	1	1	3	2	1
C209.4	3	2	2	2	1	-	-	-	2	1	1	1	3	1	1
C209.5	3	2	2	1	1	-	-	-	2	1	1	1	3	1	1

SEMESTER – IV

Digital System Design Using Verilog			
Course Code	**22ECI42**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (3:0:2:0)	**Credits (3:0:1:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 hours Theory + 13 Lab slots**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course objectives:

This course will enable students to:

1. Understand the language constructs and programming fundamentals of Verilog HDL
2. Develop Combinational and sequential circuits in different modelling styles using Verilog HDL
3. Apply the concepts of the Verilog HDL-data flow model for the design of digital systems.
4. Analyze the Behavioral model for the design of digital systems for different circuits.
5. Analyze the Structural models for the different digital circuits and Verify the functionality of digital circuits/systems using test benches.

Teaching-Learning Process (General Instructions)

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

1. Lecture method (L) does not mean only traditional lecture method, but a different type of teachingmethods may be adopted to develop the outcomes.
2. Show Video/animation films to explain the different concepts of Linear Algebra & Signal Processing.
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 skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up withtheir own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helpsimprove the students' understanding.
9. Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the topic in the succeeding classes.
10. Give Programming Assignments.

Module-1

Introduction to Verilog: Verilog as HDL, Levels of Design Description, Concurrency, Program structure, Top-down and Bottom up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block, Verilog Data types and Operators, Types of Descriptions, simulation and synthesis, brief comparison of VHDL and Verilog.

08 Hours

Module-2

Gate Level Modeling : Modelling using basic Verilog gate Primitives, Description of and/or and buffer / not type gates, rise, fall and turn-off delays, min, max, and typical delays, fundamentals of combinational circuits

08 Hours

Module-3

Dataflow Modelling: Structure of Data flow description, Continuous assignments, Delay specification, expressions, operators, Design of Decoders, Multiplexers, Flip-flops, Registers & Counters in dataflow model.

08Hours

Module-4

Behavioral Modelling: Structure, Variable Assignment Statement, Sequential statements, Initial and always blocks, blocking and non-blocking statements, delay control, conditional statements, loops, sequential and parallel blocks, Design of Decoders, Multiplexers, Flip-flops in Behavioral model.

08 Hours

Module-5

Verilog Structural description: Highlights of Structural description, Organization of structural description, Structural description of ripple carry adder.

Components Test and Verification: Test Bench – Combinational Circuits Testing, Sequential Circuits Testing

08 Hours

Teaching-Learning Process for all modules	**Chalk and Talk, Power point presentation, flip teaching, YouTube videos**

PRACTICAL COMPONENTS

Sl. No	Experiments
	SOFTWARE EXPERIMENTS using Xilinx Tool
1	An inverter, Basic and universal gates
2	Realize using Verilog Behavioral description 8:1 mux
3	Realize using Verilog Behavioral description 3:8 decoder
4	Realize using Verilog Behavioral description: 2-bit Comparator.
5	Realize using Verilog Behavioral description Flip-flops: a) JK type b) SR type c) T type d) D type
6	Realize Counters - up/down (BCD and binary) using Verilog Behavioral description
7	Realize using Verilog Behavioral/Structural description: Full adder and 4 Bit Parallel adder

Course Outcomes

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

1. Understand the fundamental concepts of Verilog HDL , data types, operators and overview of styles of programing
2. Analyze gate level modeling using Verilog HDL
3. Apply the concepts of dataflow modeling to design the digital circuits such as multiplexer, decoder
4. Apply the concepts of behavioral description for the sequential circuits using loops and conditional statements.
5. Learn the concepts of Structural models and Verify the functionality of digital circuits using test benches

Assessment Details (both CIE and SEE)

IPCC / Integrated Courses : 4 Credits and 3 Credits Courses						
Evaluation Type		**Component**	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
Theory Component	Internal Assessment Tests(IAT)	IAT-1	25	15	10	Average of two IATs, Scaled down to 15 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	10	10		Any two Assessment methods as per 22OB4.2 of regulations , Average of two CCEs, scaled down to 10 marks
		CCE-2	10			
	Total CIE - Theory			**25**	**10**	Scale down marks of IAT and CCE to 25
Laboratory Component	Practical's and Lab Records	-	15	25	10	Conduction of experiments and preparation of Lab records, etc
	Lab Test	50	10			One test to be conducted after the completion of All lab experiments.
	Total CIE – Practical's			**25**	**10**	
Total CIE (Theory + Lab)				**50**	**20**	
SEE			100	**50**	**18**	Conducted for 100 marks And scaled down to 50.
CIE + SEE				**100**	**40**	

Suggested Learning Resources:

Text Books:

3. John M Yarbrough: "Digital Logic Applications and Design", 3rd Edition, Cengage Learning, New Delhi, Reprint, 2012, ISBN-13: 978-81-315-0058-3, ISBN-10: 81315-0058-6.
4. Samir Palnitkar-Verilog HDL: A Guide to Digital Design and Synthesis, Pearson Education, 2nd edition., 2009.
5. Nazeih M. Botros: "HDL Programming (VHDL and Verilog)", (Chapters 1-5), Dreamtech Press Publishers, New Delhi, 2018, ISBN-13: 9788177226973.
6. Michel D. Ciletti- Advanced Digital Design with Verilog HDL,2nd edition, PHI, 2009

Reference Books:

1. Charles H Roth, Kinney LL, John EB "Fundamentals of Logic Design", Enhanced Seventh Edition, Cengage Learning; 2020, ISBN-1 :1337620351, ISBN-13 : 978-1337620352
2. Charles H. Roth, Jr., Lizy Kurian John, and Byeong Kil Lee "Digital Systems Design Using Verilog" Cengage Learning, 2016

E-Resources:

6. http://nptel.ac.in/courses/117106086/
7. http://www.asic-world.com/digital/tutorial.html
8. https://www.wiziq.com/tutorials/digital-electronics
9. http://www.xilinx.com/video/hardware/basic-hdl-coding-techniques.html
10. http://www.academia.edu/1492361/VHDL_BASICS_WITH_EXAMPLES
11. http://www.referencedesigner.com/tutorials/verilog/verilog_01.php

CO- PO Mapping :

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C210.1	2	3	2	1	-	-	-	-	-	-	-	2	2	2	1
C210.2	2	3	2	2	-	-	-	-	-	-	-	2	3	2	2
C210.3	1	2	3	1	-	-	-	-	-	-	-	1	2	3	3
C210.4	1	2	3	2	3	-	-	-	3	2	1	1	1	2	1
C210.5	1	2	3	2	3	-	-	-	3	2	1	1	2	1	1

SEMESTER–IV

Engineering Electromagnetics			
Course Code	**22ECT43**	**CIE Marks**	**50**
Teaching Hours/Week(L:T:P:S)(4:0:0:0)	**Credits (4:0:0:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**52 hours**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

This course will enable students to:

1. Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient and also understand the Coulomb's law and its applications.
2. Understand the applications of Gauss law to different charge distributions, energy and current
3. Apply the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions and the physical significance of Biot-Savart's, Ampere's Law and Stokes' theorem for different current distributions.
4. Infer the effects of magnetic forces, materials and inductance.
5. Evaluate the Maxwell's equations and applications for Plane waves for their behavior in different media.

Teaching-Learning Process (General Instructions)

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

1. Lecturemethod(L)doesnotmeanonlytraditionallecturemethod,butdifferenttypeofteaching met Hods may be adopted to develop the outcomes.
2. Encourage collaborative (Group) Learning in the class.
3. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
4. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
5. Topics will be introduced in a multiple representation.
6. Showthedifferentwaystosolvethesameproblemandencouragethestudentstocomeupwith their own creative ways to solve them.
7. Discusshoweveryconceptcanbeappliedtotherealworld-andwhenthat'spossible,it helps improve the students' understanding.
8. AdoptFlippedclasstechniquebysharingthematerials/SampleVideospriortotheclassandhave diScissions on the topic in the succeeding classes.

Module-1

Coulomb's Law, Electric Field Intensity and Flux density: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Field due to Sheet of charge, Electric flux density, Numerical Problems.

10 Hours

Module-2

Gauss's law and Divergence: Gauss law, Application of Gauss law to point charge, line charge, Surface charge and volume charge, Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator V and divergence theorem, Numerical Problems.

Energy, Potential and Conductors: Energy expended or work done in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Potential gradient, Numerical Problems. Current and Current density, Continuity of current.

11 Hours

Module-3

Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, Numerical problems on Laplace equation.

Steady Magnetic Field: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Basic concepts Scalar and Vector Magnetic Potentials, Numerical problems.

10 Hours

Module-4

Magnetic Forces: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems.

Magnetic Materials: Magnetization and permeability, Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutual reactance, Numerical problems.

Faraday' law of Electromagnetic Induction -Integral form and Point form, Numerical problems.

10 Hours

Module-5

Maxwell's equations 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

Uniform Plane Wave: 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 frees pace, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media (y,a,,ri) and good conductors, Skin effect or Depth of penetration, Poynting's theorem and wave power, Numerical problems.

11 Hours

Teaching-Learning Process for all modules	**Chalk and Talk/Power Point presentation/YouTube videos.**

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

1. Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
2. Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume

Charge distribution by using Divergence Theorem.

3. Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations

4. Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.

5. Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem.

Assessment Details(both CIE and SEE)

Evaluation Type		Component	Max Marks	Marks Reduced to	Min Marks	Evaluation Details
Theory Component	Internal Assessment Test(IATs)	IAT-1	25	25	20	Average of two IATs scaled down to 20 marks
		IAT-2	25			
	Comprehensive Continuous Evaluation(CCE)	CCE-1	25	25		Any two assessment methods as per 22OB42 of regulations , Average of two CCEs scaled down to 20 marks
		CCE-2	25			
Total CIE-Theory				50	20	Scaled down marks of IAT and CCE to 25
SEE			100	50	18	Conducted for 100 marks and scaled down to 50.
CIE + SEE				100	40	

Suggested Learning Resources:

Text Books:

1. W.H.Hayt and J.A. Buck, -Engineering Electromagnetics, 8th Edition, TataMcGrawHill, 2014, ISBN-978-93-392-0327-6.

Reference Books:

1. Elements of Electromagnetics –Matthew N.O., Sadiku, Oxford university press, 4thEdn.
2. Electromagnetic Waves and Radiating systems-E.C. Jordan and K.G. Balmain,PHl,2ndEdn.
3. Electromagnetics-Joseph Edminister, Schaum Outline Series, McGraw Hill.
4. Fundamentals of Electromagnetics for Engineering-N. Narayana Rao, Pearson

E-Resources:

- https://archive.nptel.ac.in/courses/108/105/108105159/
- https://nptel.ac.in/courses/108105159
- https://onlinecourses.nptel.ac.in/noc22_ee07/

Activity-BasedLearning(SuggestedActivitiesinClass)/Practical-Based Learning

- Quizzes
- Assignments
- Seminars

CO-PO Mapping:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C211.1	3	3	2	--	--	--	--	--	--	--	--	--	3	3	1
C211.2	3	3	2	--	--	--	--	--	--	--	--	--	3	3	1
C211.3	3	3	3	--	--	--	--	--	--	--	--	--	3	3	1
C211.4	3	3	3	--	--	--	--	--	--	--	--	--	3	3	1
C211.5	3	3	3	--	--	--	--	--	--	--	--	--	3	3	1

SEMESTER–IV

Analog Communication Lab			
Course Code	**22ECL44**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (0:0:2:0)	**0:0:1:0**	**SEE Marks**	**50**
Credits	**1**	**Exam Hours**	**3**

Course objectives:

This laboratory course enables students to

1. Model an analog communication system signal transmission and reception.
2. Understand the concepts of filters used in Communication systems.
3. Realize the electronic circuits to perform analog and pulse modulations and demodulations.
4. Understand the necessity of Pre-emphasis and de-emphasis used in FM system.
5. Understand the implementation of circuits using open-source software.

Sl. No.	Experiments
1	Design and conduct an experiment to generate Pulse amplitude modulation and demodulation.
2	Design and conduct an experiment for Pre-emphasis and de-emphasis.
3	Design and construction of active band pass filter and plot the frequency response.
4	Design and construction of active band stop filter and plot the frequency response.
5	Illustration of Double side band suppressed carrier modulation and demodulation and its spectrum Analysis using SCILAB/open source software
6	Illustration of Amplitude Modulation and Demodulation and also study the Spectral characteristics using SCILAB
7	Illustration of FM modulation and display the signal and its spectrum using SCILAB
8	Demonstrate the Pulse amplitude Modulation and Demodulation and its Spectrum analysis using SCILAB

Course outcomes:

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

1. Demonstrate the filtering process used in the modulation and demodulation.
2. Demonstrate the amplitude modulation and demodulation.
3. Design and test the Pulse Amplitude Modulation (PAM) and demodulation.
4. Illustrate and implement the circuit design concept for Pre-emphasis and de-emphasis used in FM system.
5. Demonstrate the Amplitude /DSBSC/Frequency modulation and demodulation operations using open-source software.

Assessment Details (both CIE and SEE)

Lab Courses : 1 Credit				
Evaluation Type	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
CIE (Lab)	50		20	The split-up of CIE marks for record/ journal and test are in the ratio 60:40.

SEE	100	50	18	All laboratory experiments are to be included for practical examination
CIE + SEE		100	40	

suggested Learning Resources:

1. Louis E Frenzel, Principles of Electronic Communication Systems, McGraw Hill Education (India) Private Limited, 2016. ISBN-13- 978-0073373850.
2. B P Lathi, Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University Press, 2015, ISBN 978-0-19-538493-2.

E-Resources :

1. http://www.radio-electronics.com/info/rf-technology-design/am-amplitude-modulation/single-sideband-ssb-modulation.php
2. https://electronicspost.com/explain-the-generation-of-am-waves-using-square-law-modulator-and- switching-modulator

CO- PO Mapping :

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C212.1	3	3	1	2	1	-	-	-	2	2	1	1	3	2	1
C212.2	3	3	1	3	1	-	-	-	2	2	1	1	3	2	1
C212.3	3	2	1	2	1	-	-	-	2	2	1	1	3	2	1
C212.4	3	2	1	2	1	-	-	-	2	2	1	1	3	1	1
C212.5	3	2	1	1	2	-	-	-	2	2	1	1	3	1	1

SEMESTER–IV

8051 Microcontroller			
Course Code	**22EC45A**	**CIE Marks**	**100**
Teaching Hours/Week (L: T: P: S)	**Credits (3:0:0:0)**	**SEE Marks**	**00**
Total Hours of Pedagogy	**40 hours**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**--**

Course objectives:

The Course will

1. Enable to identify the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller.
2. Programming using 8051 Assembly level programs using 8051 instructions set Sound knowledge of the Interrupt system, operation of Timers/Counters and Serial port of 8051.
3. Enable student to make use of instructions sets for simple interfaces.
4. Interfacing of 8051 to external memory.
5. Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using 8051 I/O ports.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
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 skills such as 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 their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 architecture Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.

08 Hours

Module-2

8051 Instruction Set:

Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch Instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to Use these instructions.

08 Hours

Module-3

8051 Stack, I/O Port Interfacing and Programming:

8051 Stack, Stack and Subroutine instructions. Assembly language program examples on subroutine and involving loops. Interfacing simple switch and LED to I/O ports to switch on/off LED with respect to switch status.

08 Hours

Module-4

8051 Timers and Serial Port:

8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin. 8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially.

08 Hours

Module-5

8051 Interrupts and Interfacing Applications:

8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly language interfacing programming.

08 Hours

Course Outcomes:

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

1. Capable of identifying the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, Interfacing of 8051 to external memory and Instruction set of 8051.
2. Program microcontrollers boards using 8051 Assembly level programs using 8051 instruction set.
3. Write 8051 Assembly language program to generate timings and waveforms using 8051 timers, to send & receive serial data using 8051 serial port and to generate an external interrupt using a Switch.
4. Write 8051 Assembly language programs to generate square wave on 8051 I/O port pin using Interrupt and C Program to send & receive serial data using 8051 serial port.
5. Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using 8051 I/O Ports.

Assessment Details (both CIE and SEE)

Theory Courses : 3 Credits or 2 Credits						
Evaluation Type		**Component**	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
Theory Component	Internal Assessment Tests(IAT)	IAT-1	25	25	20	Average of two IATs, Scaled down to 25 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	25	25		Any two Assessment methods as per 22OB4.2of regulations. Average of two CCEs, scaleddown to 25 marks
		CCE-2	25			
	Total CIE - Theory			50	20	Scale down marks of IAT and CCE to 25
Total CIE (Theory + Lab)				50	20	
SEE			100	50	18	Conducted for 100 marks And scaled down to 50.
CIE + SEE				100	40	

Text Books:

1. The 8051 Microcontroller and Embedded Systems – using assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2. "The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Thomson/Cengage Learning.
3. "The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
4. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.

Web links and Video Lectures (e-Resources):

1. https://archive.nptel.ac.in/courses/108/105/108105102/
2. https://nptel.ac.in/courses/117104072
3. https://nptel.ac.in/courses/108105102
4. https://onlinecourses.nptel.ac.in/noc22_ee12

CO- PO Mapping:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C213a.1	3	1	-	-	-	-	-	-	-	-	1	1	3	2	2
C213a.2	3	2	1	-	-	-	-	-	-	-	1	1	3	2	2
C213a.3	3	3	2	1	1	-	-	-	-	-	1	1	3	3	2
C213a.4	3	3	2	1	1	-	-	-	-	-	1	1	3	3	2
C213a.5	3	3	2	1	1	-	-	-	-	-	2	1	3	3	2

SEMESTER–IV

Java Programming			
Course Code :	**22ECT45B**	**CIE Marks**	**50**
Teaching Hours/Week(L:T:P:S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40hours**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course objectives:

1. Understand the object-oriented concepts
2. Develop computer programs to solve real world problems in Java
3. Develop simple GUI interfaces for a computer program to interact with users

Teaching-Learning Process (General Instructions)

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

1. Lecturer method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotescritical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, developdesign thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to comeup with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, ithelps improve the students' understanding.

Module-1

An Overview of Java:

Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings

Text book 1: Ch 2, Ch 3

08 Hours

Module-2

Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java‟s Selection Statements, Iteration Statements, Jump Statements.

Text book 1: Ch 4, Ch 5

08 Hours

Module-3
Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class. **Text book 1: Ch 6, Ch 7.1-7.9, Ch 8** **08 Hours**
Module-4
Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java‟s Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions. **Text book 1: Ch 9, Ch 10** **08 Hours**
Module-5
Enumerations: Type Wrappers, I/O, Applets, and Other Topics: I/O Basics, Reading Console Input, Writing Console Output, The Print Writer Class, Reading and Writing Files, Applet Fundamentals, The transient and volatile Modifiers, Using instance of, strictfp, Native Methods, Using assert, Static Import, Invoking Overloaded Constructors Through this( ), String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String , Additional String Methods, String Buffer, StringBuilder. **Text book 1: Ch 12.1,12.2, Ch 13, Ch 15** **08 Hours**
Teaching-Learning Process for all modules — **Chalk and Talk/Power Point presentation/YouTube videos.**
Course Outcomes: At the end of the course, the student will be able to : 1. Explain the concept of OOP,s java. 2. Able to understand the operator in java 3. Applying programming knowledge to solve a problem 4. Able to understand the operator in java 5. Understand the concept of Enumerations

Assessment Details (both CIE and SEE)

Theory Courses : 3 Credits or 2 Credits						
Evaluation Type		**Component**	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
Theory Component	Internal Assessment Tests(IAT)	IAT-1	25	25	20	Average of two IATs, Scaled down to 25 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	25	25		Any two Assessment methods as per 22OB4.2of regulations. Average of two CCEs, scaleddown to 25 marks
		CCE-2	25			
	Total CIE - Theory			50	20	Scale down marks of IAT and CCE to 25
Total CIE (Theory + Lab)				50	20	
SEE			100	50	18	Conducted for 100 marks And scaled down to 50.
CIE + SEE				100	40	

Suggested Learning Resources:

Text Books:

1. **Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 2, 3, 4, 5, 6,7, 8, 9,10, 12,13,15)**

Reference Books:1. Cay S Horstmann, "Core Java - Vol. 1 Fundamentals", Pearson Education, 10th Edition, 2016.

2. **Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, "Java 8 in Action", Dream tech Press/Manning Press, 1st Edition, 2014.**

CO-PO Mapping:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C213b.1	3	3	2	2	2	1	--	--	1	--	--	1	3	3	1
C213b.2	3	3	2	2	2	1	--	--	1	--	--	1	3	3	1
C213b.3	3	3	2	2	2	1	--	--	1	--	--	1	3	3	1
C213b.4	3	3	2	2	2	1	--	--	1	--	--	1	3	3	1
C213b.5	3	3	2	2	2	1	--	--	1	--	--	1	3	3	1

SEMESTER–IV

Operating system			
Course Code :	**22EC45C**	**CIE Marks**	**50**
Teaching Hours/Week(L:T:P:S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40hours**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course objectives:

- Understand the services provided by an operating system.
- Explain how processes are synchronized and scheduled.
- Understand the different approaches of memory management and virtual memory management,
- Describe the structure and organization of the file system.
- Understand inter process communication and dead lock situations.

Teaching-Learning Process (General Instructions)

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

1. Lecturer method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, developdesign thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Operating System: OS, goals of an OS, Computational structures, resource allocation techniques, efficiency, system performance and user convenience, classes operating system, batch processing, multiprogramming, time sharing system, real time operating systems, Operating System Services.

(Topics from sections 1.2, 1.3, 2.2 to 2.7 of text 1, 2.7 of text 2).

08 Hours

Module-2

Process Management: OS view of processes, PCB, Fundamental state, Transitions of a process**,** Threads, Kernel and User level Threads, Non-Preemptive Scheduling-FCFS and SRN, Preemptive Scheduling- RR andLCN, Real time Scheduling.

(**Topics from sections 3.3,3.3.1,3.4,3.4.1,3.4.2, Selected scheduling topics from 4.2,4.3 and 4.5 of Text 1**)

08 Hours

Module-3

Memory Management: Managing the memory Hierarchy, Contiguous Memory Allocation, Non-contiguous Memory Allocation, Paging, Segmentation with Paging, Virtual Memory Management, Demand Paging, VM Handler, FIFO, LRU Page replacement policies, Virtual memory in Unix (**Topics from Sections 5.1,5.5 to 5.9, 6.1 to 6.3 except optimal policy and 6.3.1, 6.7 of Text 1**).

08 Hours

Module-4

File systems: File systems and IOCS, File Operation, File Organization, Directory Structure, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access. (**Topics from section 7.1 to 7.8 of Text**).

08 Hours

Module-5

Message passing and deadlocks: Overview of Message Passing, Implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Handling deadlocks, Deadlocks detection algorithm, Deadlocks Prevention.

(**Topics from sections 10.1 to 10.3, 11.1 to 11.4 of Text**).

08 Hours

Teaching-Learning Process for all modules	**Chalk and Talk/Power Point presentation/YouTube videos.**

Course Outcomes:

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

1. Explain the goals, structure, operation and types of operating system.
2. Apply scheduling techniques to find performance factors.
3. Explain organization of file system and IOCS.
4. Apply suitable techniques for contiguous and non contiguous memory allocation.
5. Describe message passing, deadlock detection and prevention methods.

Assessment Details (both CIE and SEE)

Theory Courses : 3 Credits or 2 Credits

Evaluation Type		**Component**	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
Theory Component	Internal Assessment Tests(IAT)	IAT-1	25	25	20	Average of two IATs, Scaled down to 25 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	25	25		Any two Assessment methods as per 22OB4.2of regulations. Average of two CCEs, scaleddown to 25 marks
		CCE-2	25			
	Total CIE - Theory			50	20	Scale down marks of IAT and CCE to 25

Total CIE (Theory + Lab)		50	20	
SEE	100	50	18	Conducted for 100 marks And scaled down to 50.
CIE + SEE		100	40	

Suggested Learning Resources:

Text Books:

1. Operating system – A concept based Approach, by Dhamdhere, TMH, 2nd edition.

2. Operating System Concepts-AbrahamSilberchatz,PeterB.Galvin,GregGagne,9thed

Reference Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley- India, 2006
2. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition.
3. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.
4. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI (EEE), 2014.
5. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.

E-Resources:

- https://archive.nptel.ac.in/courses/106/105/106105214/
- https://onlinecourses.nptel.ac.in/noc20_cs04/preview
- https://onlinecourses.nptel.ac.in/noc21_cs72/preview
- https://nptel.ac.in/courses/106106144
- https://nptel.ac.in/courses/106102132
- https://nptel.ac.in/courses/106106168
- https://archive.nptel.ac.in/courses/106/102/106102132/.

Activity-BasedLearning(SuggestedActivitiesinClass)/Practical-Based Learning

- Real world problem solving using group discussion.
- Role play for process scheduling.
- Present animation for deadlock.
- Real world example of memory management concepts.

CO-PO Mapping:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C213c.1	3	3	2	2	2	1	--	--	1	--	--	1	3	1	-
C213c.2	3	3	2	2	2	1	--	--	1	--	--	1	3	1	-
C213c.3	3	3	2	2	2	1	--	--	1	--	--	1	3	-	-
C213c.4	3	3	2	2	2	1	--	--	1	--	--	1	3	1	-
C213c.5	3	3	2	2	2	1	--	--	1	--	--	1	3	1	-

SEMESTER–IV

Electronic Devices			
Course Code :	**22EC46A**	**CIE Marks**	**50**
Teaching Hours/Week(L:T:P:S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40hours**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course objectives:

1. Understand the basics of semiconductor physics and electronic devices.
2. Describe the mathematical models BJTs and FETs along with the constructional details.
3. Understand the construction and working principles of optoelectronic devices
4. Understand the fabrication process of semiconductor devices and CMOS process integration.

Teaching-Learning Process (General Instructions)

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

1. Lecturer method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotescritical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, developdesign thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to comeup with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, ithelps improve the students' understanding.

Module-1

Semiconductors

Bonding forces in solids, Energy bands, Metals, Semiconductors and Insulators, Direct and Indirect semiconductors, Electrons and Holes, Intrinsic and Extrinsic materials, Conductivity and Mobility, Drift and Resistance, Effects of temperature and doping on mobility, Hall Effect.

(Text1:3.1.1,3.1.2,3.1.3,3.1.4,3.2.1,3.2.3,3.2.4,3.4.1,3.4.2,3.4.3,3.4.5).

08 Hours

Module-2

PN Junctions

Forward and Reverse biased junctions-Qualitative description of Current flow at a junction, reverse bias, Reverse bias breakdown- Zener breakdown, avalanche breakdown, Rectifiers.
(Text1:5.3.1,5.3.3,5.4,5.4.1,5.4.2,5.4.3)

Optoelectronic Devices Photodiodes: Current and Voltage in an Illuminated Junction, Solar Cells, Photodetectors. Light Emitting Diode: Light Emitting materials.
(Text1:8.1.1,8.1.2,8.1.3,8.2,8.2.1),

08 Hours

Module-3

Bipolar Junction Transistor

Fundamentals of BJT operation, Amplification with BJTS,BJT Fabrication, The coupled Diode model(Ebers-Moll Model),Switching operation of a transistor, Cutoff, saturation, switching cycle, specifications, Drift in the base region, Base narrowing, Avalanche breakdown.

(Text1:7.1,7.2,7.3,7.5.1,7.6,7.7.1,7.7.2, 7.7.3)

08 Hours

Module-4

Field Effect Transistors

Basic PN JFET Operation, Equivalent Circuit and Frequency Limitations, MOSFET-Two terminal MO Sstructure Energy Band diagram, Ideal Capacitance -Voltage Characteristics and Frequency Effects, Basic MOSFET Operation- MOSFET structure, Current-Voltage Characteristics.

(Text2:9.1.1, 9.4, 9.6.1, 9.6.2, 9.7.1, 9.7.2, 9.8.1, 9.8.2).

08 Hours

Module-5

Fabrication of p-n junctions

Thermal Oxidation, Diffusion, Rapid Thermal Processing, Ion implantation, chemical vapour deposition, photolithography, Etching, metallization. (Text 1: 5.1)

Integrated Circuits Background, Evolution of ICs, CMOS Process Integration, Integration of Other Circuit Elements. **(Text 1:9.1,9.2,9.3.1,9.3.3).**

08 Hours

Teaching-Learning Process for all modules	**Chalk and Talk/Power Point presentation/YouTube videos.**

Course Outcomes:

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

1. Understand the principles of semiconductor Physics
2. Understand the principles and characteristics of different types of semiconductor devices
3. Understand the fabrication process of semiconductor devices
4. Utilize the mathematical models of semiconductor junctions for circuits and systems.
5. Identify the mathematical models of MOS transistors for circuits and systems.

Assessment Details (both CIE and SEE)

Theory Courses : 3 Credits or 2 Credits

Evaluation Type		Component	Max Marks	Marks reduced to	Min. Marks	Evaluation Details
Theory Component	Internal Assessment Tests(IAT)	IAT-1	25	25	20	Average of two IATs, Scaled down to 25 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	25	25		Any two Assessment methods as per 22OB4.2of regulations. Average of two CCEs,
		CCE-2	25			

						scaleddown to 25 marks
	Total CIE - Theory			50	20	Scale down marks of IAT and CCE to 25
Total CIE (Theory + Lab)				50	20	
SEE			100	50	18	Conducted for 100 marks And scaled down to 50.
CIE + SEE				100	40	

Suggested Learning Resources:

Text Books:

1. Ben. G. Streetman, Sanjay Kumar Banerjee, "Solid State Electronic Devices",7th Edition, Pearson Education, 2016, ISBN 978-93-325-5508-2.
2. Donald A Neamen, Dhrubes Biswas, "Semiconductor Physics and Devices", 4th Edition,McGraw Hill Education, 2012,ISBN 978-0-07- 107010-2.

Reference Books:

6. S.M.Sze,KwokK.Ng,"PhysicsofSemiconductorDevices",3rd Edition, Wiley,2018.
7. 4. AdirBar-Lev,"SemiconductorandElectronicDevices",3 Edition,PHI, 1993

CO-PO Mapping:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C214a.1	3	3	2	2	2	1	--	--	1	--	--	1	3	2	-
C214a.2	3	3	2	2	2	1	--	--	1	--	--	1	3	2	-
C214a.3	3	3	2	2	2	1	--	--	1	--	--	1	3	2	-
C214a.4	3	3	2	2	2	1	--	--	1	--	--	1	3	2	-
C214a.5	3	3	2	2	2	1	--	--	1	--	--	1	3	2	-

SEMESTER–IV

PCB DESIGN			
Course Code	**22EC46B**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (2:0:0:0)	**1:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**13**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course objectives:

1. Study about layout planning, art work and design of PCB
2. To understand the PCB production process
3. Discuss the role of Modern trends and automatic design of PCB

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 the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes
2. Show Video/animation films to explain the functioning of various
3. Encourage collaborative (Group) Learning in the class to promote critical thinking
4. Topics for seminars on several MEMS related topics and their applications
5. Encourage the students to take up mini projects and main projects
6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Design of Printed Circuit Boards: Layout Planning: Introduction, General Consideration, PCB Sizes, Layout Approaches, Documentation, Layout, General Rules and Parameters: Introduction, Resistance, Capacitance, Inductance of PCB conductors, Conductor Spacing, Component Placing and Mounting, Cooling Requirements and Package Density, Layout Check, Art work. PCB hands on

03 Hours

Module-2

Technology of PCB: Film Master Production: Introduction, Emulsion Parameters, Film Emulsions, Dimensional Stability of Film Masters, Reprographic Cameras, Darkroom, Film Processing, Film Registration, Properties of Copper Clad Laminates: Introduction, Manufacture of Copper Clad Laminates, Properties and Types of Laminates, Specifications and Test Methods, Board cleaning before Pattern Transfer: Manual and Machine Cleaning Processes.
[Text 1]

03 Hours

Module-3

Photo printing: Basic Processes for Double Sided PCBs, Photoresists, Wet Film Resists, Coating Processes, Exposure and further Processing of Wet Film Resists, Dry Film Resists. Screen Printing: Screen Fabrics, Screen and Frame Preparation, Pattern Transfer onto the screen, Reclamation of the Screen Fabrics, Printing, Troubleshooting

[Text 1]

03 Hours

Module-4

Plating: Introduction, Immersion Plating, Electroless Plating, Electroplating, Plating Quality Control, Etching, Etching Machines, Etchant Systems, Minimising Pollution, Mechanical Machining operations. Multilayer Boards: Introduction, Design and Test Considerations, Multilayer Construction, Equipment, Laminating Process and further processing.
[Text 1,2]

03 Hours

Module-5

PCB Technology Trends: Fine line conductors with Ultra-Thin Copper Foil, Multilayer and Multiwire Boards, Flexible Printed Circuit Boards. Automation and Computers in PCB Design: Automated Artwork Draughting, Computer Aided Design, Design Automation.

[Text 1,2]

03 Hours

Teaching-Learning Process for all modules	**Chalk and Talk/PowerPoint presentation/YouTube videos.**

Course Outcomes:

After successfully completing the course, the students will be able

1. Define the detailed circuit diagram and prerequisite before the actual PCB layout.
2. Understand the process of PCB production and Material selection
3. Understand the PCB fabrication by transferring the conductor pattern on base material
4. Know about the Plating techniques, Etching process and multilayer PCB board construction
5. Understand about new streams in PCB technology and modern facilities for PCB design

Assessment Details (both CIE and SEE)

Component		**Weightage (%)**	
Internal Assessment Tests (IAT)	IAT 1	25	25
	IAT 2	25	
Comprehensive continuous evaluation (CCE)	CCE1	25	25
	CCE-2	25	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Suggested Learning Resources:

1.Printed Circuit Boards-Design & Technology by Walter C Bosshart, Tata Mc Graw-Hill

Pvt. Ltd, 2010

2. Printed Circuit Boards-Design, Fabrication, Assembly and Testing by Dr.R.S. Khandapur,

Mc Graw-Hill Education, 2017

E-Resources:

- PCB designing software YouTube links
- NPTEL courses and videos

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

- PCB making for simple electronic circuit and testing
- Quizzes and seminar

CO- PO Mapping:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C214b.1	3	1	--	--	--	--	--	--	--	--	--	--	1	--	--
C214b.2	3	3	--	--	--	--	--	--	--	--	--	--	1	--	--
C214b.3	3	2	--	--	--	--	--	--	--	--	--	--	1	--	--
C214b.4	3	3	--	--	--	--	--	--	--	--	--	--	1	--	--
C214b.5	2	2	--	--	--	--	--	--	--	--	--	--	1	--	--

SEMESTER IV

LabVIEW Programming Basics			
Course Code	**22EC46C**	**CIE Marks**	**50**
Teaching Hours/Week (L: T:P: S)	**0:0:2:0**	**SEE Marks**	**50**
Credits	**1**	**Exam Hours**	**100**

Course objectives:

1. Understand the basics of virtual instrumentation concept and dataflow programming.
2. Analyze various front panel controls and indicators.
3. Apply and manipulate nodes and wires, various toolbars and pull-down menus in the block diagram.
4. Design simple projects using the functions available in Lab VIEW
5. Develop Real time Applications using LabVIEW software.

Sl.No	Programs (using LabVIEW software) to realize the following:
1	Basic arithmetic operations: addition, subtraction, multiplication and division
2	Boolean operations: AND, OR, XOR, NOT and NAND, Demorgan's Theorem
3	Sum of 'n' numbers using 'for' loop
4	Factorial of a given number using 'for' loop
5	Determine square of a given number
6	Sorting even numbers using 'while' loop in an array
7	Finding the array maximum and array minimum
	Demonstration Experiments (For CIE)
8	Create a VI to produce voltage output from 0 to 10 volts in steps of 0.5 volts.
9	Build a Virtual Instrument that simulates a Basic Calculator (using formula node).
10	Build a Virtual Instrument that simulates a Water Level Detector.

Course outcomes (Course Skill Set):

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

1. Understand to various functions available in Lab VIEW for engineering applications
2. Gain knowledge to create data acquisition, analysis and display operations
3. Analyze programming structures and data types that exist in Lab VIEW
4. Apply various editing and debugging techniques.
5. Create Real time user interfaces with charts, graph and buttons.

Assessment Details (both CIE and SEE) for Practical Subjects

Lab Courses : 1 Credit				
Evaluation Type	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
CIE (Lab)	50		20	The split-up of CIE marks for record/ journal and test are in the ratio 60:40.
SEE	100	50	18	All laboratory experiments are to be included for practical examination
CIE + SEE		100	40	

Suggested Learning Resources:

1. Jovitha Jerome , "Virtual Instrumentation using LABVIEW" , PHI, 2011, ISBN: 9788120340305
2. Sanjay Gupta & Joseph John, "Virtual Instrumentation Using Lab View" , Tata McGraw Hill. Publisher Ltd., 2nd Edition, New Delhi, 2010, ISBN : 978-0070700284

CO- PO Mapping:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C214b.1	3	1	--	--	3	--	--	--	1	--	--	--	1	2	--
C214b.2	3	3	--	--	3	--	--	--	1	--	--	--	1	2	--
C214b.3	3	2	--	--	3	--	--	--	1	--	--	--	1	2	--
C214b.4	3	3	--	--	3	--	--	--	1	--	--	--	1	2	--
C214b.5	2	2	--	--	3	--	--	--	1	--	--	--	1	2	--

SEMESTER IV

Risk Management in IOT Implementation			
Course Code	**22EC46D**	**CIE Marks**	**50**
Teaching Hours/Week (L: T:P: S)	**0:0:2:0**	**SEE Marks**	**50**
Credits	**1**	**Exam Hours**	**100**

Course objectives:

This course will enable students to:

1. Understand the fundamental concepts and principles of the Internet of Things (IoT) and its relevance in various industries.
2. Identify and assess potential risks and challenges associated with implementing IoT projects.
3. Develop effective risk management strategies and mitigation plans specific to IoT implementations.
4. Implement security controls and best practices to ensure the confidentiality, integrity, and availability of IoT systems.
5. Comply with relevant regulations and standards to address data privacy, security, and ethical considerations in IoT implementations.

Module-1

Introduction to IoT and Risk Management

Introduction to IoT, Overview of IoT Levels, Understanding the importance of risk management in IoT Implementation, Key components, Common risks and challenges in IoT implementation, Case studies and examples of successful and failed IoT implementations.

08 Hours

Module-2

Identifying and Assessing Risks in IoT

Identification of potential risks in IoT implementation; Risk assessment methodologies and techniques for IoT projects; Threat modelling and risk analysis in IoT systems; Assessing the impact and likelihood of identified risks; Prioritization of risks based on their significance.

08 Hours

Module-3

Challenges in IoT Design challenges

Development Challenges, secure communication protocols, Security Challenges, Data privacy and protection measures Other challenges IoT Applications

08 Hours

Module-4

Monitoring and Response to IoT Risks

Real-time monitoring of IoT devices and networks; Intrusion detection and prevention in IoT systems; Incident response planning for IoT security breaches; Continuous monitoring and vulnerability management in IoT; Data backup and disaster recovery strategies for IoT systems.

08 Hours

Module-5

Compliance and Regulatory Considerations

Overview of relevant regulations and standards for IoT implementation; Compliance requirements for data privacy and security in IoT; Impact of industry-specific regulations on IoT projects; Role of audits and assessments in ensuring

compliance; Ethical considerations and responsible use of IoT technologies.

08 Hours

Course Outcomes

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

1. To explain the core concepts and applications of the Internet of Things
2. To identify and assess risks and challenges in IoT implementations, applying appropriate methodologies and techniques.
3. To implement security controls and best practices to protect IoT devices, networks, and data from potential threats and vulnerability.
4. To analyze and comply with relevant regulations, standards, and ethical considerations to ensure responsible and secure IoT implementations.
5. To develop comprehensive risk management strategies and mitigation plans tailored to specific IoT projects

Assessment Details (both CIE and SEE) :

Component		Weightage (%)	
Internal Assessment Tests (IAT)	IAT 1	25	25
	IAT 2	25	
Comprehensive continuous evaluation (CCE)	CCE1	25	25
	CCE-2	25	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Suggested Learning Resources:

1. MindMatrix.io

2. "Practical IoT Security: A Guide to Building Secure Connected Systems" by Brian Russell, Drew Van Duren, and John R. Scharlau

3. "Internet of Things: Principles and Paradigms" by Rajkumar Buyya, Amir Vahid Dastjerdi, and Sriram Venugopal

4. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" by David Hanes, Gonzalo Salgueiro, and Patrick Grossetete

5. "Managing Risk and Security in the Internet of Things: Frameworks and Best Practices" by Tim Lister, Brian Russell, and Tom Olzak

6. "The Internet of Risky Things: Trusting the Devices That Surround Us" by Sean Smith and Abel Sanchez

E-Resources:

1. makes.mindmatrix.io

CO-PO MAPPING:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C214d.1	2	3	3	3	2	1	-	-	-	-	-	-	2	3	3
C214d.2	2	3	3	2	2	1	-	-	-	-	-	-	2	3	3
C214d.3	2	3	3	3	2	1	-	-	-	-	-	-	2	3	3
C214d.4	2	3	3	2	2	1	-	-	-	-	-	-	2	3	3
C214d.5	2	3	2	3	2	1	-	-	-	-	-	-	2	3	2

SEMESTER IV

BIOLOGY FOR ENGINEERS			
Course Code	**22BET47**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**3**

Course objectives:

- Understand Why Should Engineers Know Biology
- Analyze the Chemical Composition of Living Forms
- Explain the Human organ systems and bio-designs
- Analyze the nature-bioinspired materials and mechanisms
- Evolution and trends in bioengineering

Teaching-Learning Process (General Instructions)

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

1. Explanation via real life problem, situation modelling, and deliberation of solutions, hands-onsessions, reflective and questioning /inquiry-based teaching.
2. Instructions with interactions in classroom lectures (physical/hybrid).
3. Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
4. Flipped classroom sessions (~10% of the classes).
5. Industrial visits, Guests talks and competitions for learning beyond the syllabus.
6. Students' participation through audio-video based content creation for the syllabus (as assignments).
7. Use of Gamification tools (in both physical/hybrid classes) for creative learning outcomes.
8. Students' seminars (in solo or group) /oral presentations.

Module-1

BIOMOLECULES AND THEIR APPLICATIONS:

Carbohydrates (cellulose-based water filters, PHA and PLA as bio plastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/detergents).

8 Hours

Module-2

HUMAN ORGAN SYSTEMS AND BIO DESIGNS 1 :

Brain as a CPU system (CNS and Peripheral Nervous System, EEG, Robotic arms for prosthetics, Engineering solutions for Parkinson's disease),Eye as a Camera system(bionic eye), Heart as a pump system (Electrical Signaling, ECG, Design of stents, Pace makers, Defibrill ators

8 Hours

Module-3

HUMAN ORGAN SYSTEMS AND BIO DESIGNS 2:

Lungs as purification system (spirometry, abnormal lung physiology- COPD, Ventilators, Heart-lung machine), Kidney as a filtration system (dialysis System and fabrication), Muscular and Skeletal Systems as scaffolds (Bioengineering solutions for muscular dystrophy and osteoporosis).

8 Hours

Module-4

NATURE-BIOINSPIRED MATERIALS AND MECHANISMS :

Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf), 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).

8 Hours

Module-5

TRENDS IN BIOENGINEERING:

Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods, Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bio imaging and Artificial Intelligence for disease diagnosis. Bioremediation and Bio mining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

8 Hours

Course outcome (Course Skill Set)

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

1. Understand Why Should Engineers Know Biology
2. Analyze the Chemical Composition of Living Forms
3. Explain the Human organ systems and bio designs
4. Analyze the Nature-bioinspired materials and mechanisms
5. Analyze the evolution and trends in bioengineering

Assessment Details (both CIE and SEE)

Theory Courses : 3 Credits or 2 Credits						
Evaluation Type		**Component**	**Max Marks**	**Marks reduced to**	**Min. Marks**	**Evaluation Details**
Theory Component	Internal Assessment Tests(IAT)	IAT-1	25	25	20	Average of two IATs, Scaled down to 25 marks
		IAT-2	25			
	Comprehensive Continuous Evaluations (CCE)	CCE-1	25	25		Any two Assessment methods as per 22OB4.2of regulations. Average of two CCEs, scaleddown to 25 marks
		CCE-2	25			
	Total CIE - Theory			50	20	Scale down marks of IAT and CCE to 25
Total CIE (Theory + Lab)				50	20	
SEE			100	50	18	Conducted for 100 marks And scaled down to 50.
CIE + SEE				100	40	

Suggested Learning Resources:

Books

1. Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
2. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
3. 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.
4. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
5. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
6. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
7. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
8. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
9. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N GeethaA C Udayashankar Lambert Academic Publishing, 2019.
10. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
11. 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

CO-PO MAPPING:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C215.1	3	2	2	1	1	1	-	-	-	-	-	-	1	2	3
C215.2	3	2	2	1	1	1	-	-	-	-	-	-	1	2	3
C215.3	3	2	2	1	1	2	-	-	-	-	-	-	1	2	3
C215.4	3	2	2	1	1	2	-	-	-	-	-	-	1	2	3
C215.5	3	2	2	1	1	2	-	-	-	-	-	-	1	2	3

SEMESTER IV

Universal Human Values			
Course Code	**22UHV49**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (2:0:0:0)	**Credits (1:0:0:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**13 hours Theory**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course objectives:

This course will enable students:

1. To distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To initiate a process of dialog within themselves to know what they really want to be in their life and profession
3. To understand the meaning of happiness and prosperity for a human being.
4. To facilitate and understand harmony at all the levels of human living, and live accordingly.
5. To help students, to design technologies that are holistic sustainable with the nature.

Module-1

Introduction to Value Education: Understanding the need, basic guidelines, content and process for Value Education-Self Exploration–what is it? - its content and process; 'Natural Acceptance' and ExperientialValidation- as the mechanism for self-exploration, Continuous Happiness and Prosperity, Relationship and Physical Facilities, Understanding Happiness and Prosperity correctly.

03 Hours

Module-2

Harmony in the Human Being: Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) , Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

03 Hours

Module-3

Harmony in the Family: Understanding harmony in the Family- the basic unit of human interaction, understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship

02 Hours

Module-4

Harmony in the Society: Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!

03 Hours

Module-5

Harmony in the Nature (Existence): Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability andself-regulation in nature, Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space.

02 Hours

Course outcomes:

On completion of this course, the students will be able to

1. Understand the significance of value inputs in a classroom and start applying them in their life and profession.
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual etc.
3. Understand the value of harmonious relationship based on trust and respect in their life and profession.
4. Understand the role of a human being in ensuring harmony in society and nature.

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
Internal Assessment Tests (IAT)	IAT 1	25	25
	IAT 2	25	
Comprehensive continuous evaluation (CCE)	CCE1	25	25
	CCE-2	25	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Suggested Learning Resources:

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

Reference Books:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

CO-PO MAPPING:

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C216.1	1	-	-	-	-	-	-	2	1	1	-	-	-	-	-
C216.2	1	-	-	-	-	-	-	2	1	1	-	-	-	-	-
C216.3	1	-	-	-	-	-	-	2	1	1	-	-	-	-	-
C216.4	1	-	-	-	-	-	-	2	1	1	-	-	-	-	-
C216.5	1	-	-	-	-	-	-	2	1	1	-	-	-	-	-