COURSE INFORMATION SHEET

Course code: BE101
Course title: Biology for Engineers
Pre-requisite(s): NIL
Co- requisite(s): NIL
Credits: 2 L:2 T:0 P:0
Class schedule per week: 02
Class: B. Tech
Semester / Level: III-IV /First
Branch: All
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Recognize and understand the basic cell biology, biomolecules, related metabolic pathways and applicable bioenergetics.
2.	Relate common biological phenomenon at molecular level.
3.	Describe the chemical nature of enzymes and mechanism of action for their function in biochemical reactions.
4.	Correlate the molecular methods of biological signal generation and propagation in living system.
5.	Comprehend the steps involved in common application of biotechnology such as applicable for creation of transgenics, stem cells, plant metabolites production, PCR, ELISA.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Demonstrate an understanding of fundamental biochemical principles, such as the structure/function of biomolecules involved in living system.
CO2	Interpret the biomechanism involved in signal generation and transmission.
CO3	Correlate the basic methods involved in common biotechnological application.
CO4	Apply and effectively communicate scientific reasoning and data involved in common biotechnological applications.

BE101 Biological Science for Engineers

Credit:2

Module-1:
Basic Cell Biology: Origin of life, Cell theory, Cell Structure and function, Biomolecules, Cell cycle and cell division, Biological Organization. **[5L]**

Module-2:
Bioenergetics and Metabolism: Gibbs free energy and thermodynamics, aerobic and anaerobic respiration, Glycolysis, Krebs cycle and electron transport chain, Beta oxidation, Photosynthesis. **[6L]**

Module-3:
Enzymes and its Application: Classification of enzymes, Structure and mechanism of enzyme action and uses of enzymes, factors affecting enzyme activity, Immobilization of enzymes and their application. **[5L]**

Module-4:
Biological Signal Generation and Propagation: Nerve cell structure and signal propagation. Mechanism of vision and hearing, cell signaling, Circadian rhythm. **[6L]**

Module-5:
Engineering Biological Systems and its Applications:
Central dogma of molecular biology, Methods in genetic engineering and application, PCR, ELISA and its application, stem cell and tissue engineering. Artificial Intelligence in Biology, Plant factory. **[6L]**

Books Recommended
Recommended Text Book

1. Purves et al, (1998) Life: *The Science of Biology*, 4th Ed.
2. R. Dulbecco, The Design of Life.
3. Lehninger A, Principals of Biochemistry , 5th Ed

Reference Book

1. Stryer, L. (2002). *Biochemistry*. New York: W.H. Freeman.
2. K. Wilson & K.H. Goulding, (2006) *A biologist's guide to Principles and Techniques of Practical Biochemistry*.

Gaps in the syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods

Lecture by use of boards/LCD projectors/OHP projectors
Tutorials/Assignments
Seminars
Mini projects/Projects
Laboratory experiments/teaching aids
Industrial/guest lectures
Industrial visits/in-plant training
Self- learning such as use of NPTEL materials and internets
Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Mid Sem Examination Marks	25
End Sem Examination Marks	50
Assignment / Quiz (s)	10+10
Teacher's Assesment	5

Assessment Components	CO1	CO2	CO3	CO4
Mid Sem Examination Marks	√	√	√	√
End Sem Examination Marks	√	√	√	√
Quiz I	√	√	√	
Quiz II	√	√	√	

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes											
	a	b	c	d	e	f	g	h	i	j	k	l
1	3	3	3	3	1	1	1	2	1	1	1	1
2	3	3	3	3	1	1	1	2	1	1	1	1
3	1	3	3	3		1	1	1		1	1	1
4	2	2	2	2		2	2	2		1	1	2

If satisfying< 34%=1, 34-66% =2, > 66% = 3

Mapping Between COs and Course Delivery (CD) methods			
CD	**Course Delivery methods**	**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1, 2, 3, 4	CD1, CD2, CD3, CD8
CD2	Tutorials/Assignments	CO1, 2, 3, 4	CD1, CD2, CD3, CD8
CD3	Seminars		
CD4	Mini projects/Projects		
CD5	Laboratory experiments/teaching aids		
CD6	Industrial/guest lectures		
CD7	Industrial visits/in-plant training		
CD8	Self- learning such as use of NPTEL materials and internets		
CD9	Simulation		

COURSE INFORMATION SHEET

Course code: IT201
Course title: **Basics of Intelligent Computing**
Pre-requisite(s):
Co- requisite(s):
Credits: L:3 T:0 P: 0
Class schedule per week: 3
Class: B. Tech
Semester / Level: II/2
Branch: All

Course Objectives
This course enables the students:

A.	To know the basic functions of different AI branches.
B.	To understand the functionalities of IoT .
C.	To know the application of fuzzy logic.
D.	To understand the basic functionalities of a cloud based system.
E.	To find the basic functions of soft computing.

Course Outcomes:
After the completion of this course, students will be to:

1.	Identify the difference between difference branches of AI.
2.	Analysis a fuzzy based system.
3.	Design a Neural Network to solve a problem.
4.	Analyze a problem in terms of ANN point of view.
5.	Identify the components of a cloud based system.

SYLLABUS

Module I
AI Concepts
Introduction to AI and Intelligent Agents, AI problems and Solution approaches, Problem solving using Search and Heuristics, AI Knowledge-base: creation, updation and reasoning, Broad category of branches in AI and intelligent Systems .

(8 L)

Module II
Introduction to Soft Computing and Fuzzy Logic
Hard Computing: Features of Hard Computing, Soft Computing: Features of Soft Computing, Introduction to different Evolutionary Algorithms: Genetic Algorithm: Working Cycle of GA, Binary -Coded GA, Crossover, Mutation.
Classical Sets Vs Fuzzy Sets, Representation of Classical Set, Representation of Fuzzy Set, Basic Properties of Fuzzy Sets , Fuzzy Set operations: Intersection, Union, Complement, Important Terminologies in Fuzzy set Operations, Properties of fuzzy sets, Fuzzy Relations and fuzzy Compositions: Operations on Fuzzy Relations, Max-Min Composition, Max-Product Composition, Max-Average Composition, Fuzzy Inference System: Fuzzification, Fuzzy

Proposition, Defuzzification Mamdani Model, Fuzzy Logic Applications : Fuzzy Controllers, Antecedent/ Consequent variables, IF-THEN rules and Inference, Fuzzy Decision Making .

(8L)

Module III

Introduction to Artificial Neural Networks:

Development of ANNs, Biological Inspiration, Biological Neural Networks to ANN , Classification of ANN: NN Architecture, Learning/ Training, Training/ Testing Modes, Activation and Transfer Functions , First Generation Neural Network: Perceptron Network, Adaline, Madaline , Introduction to Second Generation Neural Networks: Backpropagation Training for Multi-Layer NN, Calculation of weights for Output-layer Neurons, Calculation of weights for Hidden-layer Neurons, Factors Influencing BPN training , Applications of Neural Network .

(8L)

ModuleIV Introduction to IOT

The IoT Paradigm, Concept of Things, IoT Hardwares, IoT Protocols, IoT Architecture, enabling technologies of IoT, IoT Designing and its levels.

(8L)

Module V

Introduction to Cloud computing

Brief overview, historical developments, computing platform and technologies, element of distributed computing, virtualization: characteristics of virtualized environment, virtualization and cloud computing, pros and cons of virtualization, virtualization technologies, cloud computing architecture: IAAS, PAAS, SAAS, types of cloud, cloud application.

(8L)

Text books:

Madisetti Vijay and Bahga Arshdeep, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.(T1)

Buyya Raj Kumar, Vecchiola Christian & Selvi S. Thamarai , Mastering Cloud Computing, McGraw Hill Publication, New Delhi, 2013.(T2)

Engelbrecht Andries P., Computational Intelligence: An Introduction, Wiley. (T3)

Reference Books:

Raj Pethuru and Raman Anupama C.,The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press.(R1)

Konar Amit, Computational Intelligence: Principles, Techniques and Applications, Springer. (R2)

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: P10 will be met though report-writing/presentation-based assignment

Topics beyond syllabus/Advanced topics/Design: Teaching through paper

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through paper

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training
CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Mid SEM Examination Marks	25
End SEM Examination Marks	60
Assignment / Quiz (s)	15

Assessment Components	CO1	CO2	CO3	CO4
Mid SEM Examination Marks	3	3	2	
End SEM Examination Marks	3	3	3	3
Assignment / Quiz (s)	3	3	3	2

If satisfying < 34% = 1, 34-66% = 2, > 66% = 3

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping of Course Outcomes onto Program Outcomes

Course Outcome	**Program Outcomes**										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1	3	2	2	1	1	1	2	1	1	1	1
2	2	3	2	1	1	2	1	1	3	1	1

3	3	1	3	3	2	1	1	2	1	1	1
4	2	3	1	1	1	1	2	1	1	1	1
5	1	2	1	1	3	1	1	1	2	1	1

COURSE INFORMATION SHEET

Course code: EE205
Course title: CIRCUIT THEORY
Pre-requisite(s):EE101 (Basics of Electrical Engineering)
Co- requisite(s): Mathematics
Credits: 4 L:3 T:1 P:0
Class schedule per week: 04
Class: B. E.
Semester / Level:02
Branch:EEE
Name of Teacher:

Course Objectives

This course enables the students to:

A. list the Properties and discuss the concepts of graph theory
B. solve problems related to network theorems
C. illustrate and outline the Multi- terminal network in engineering
D. select and design of filters

Course Outcomes

After the completion of this course, students will:

1. be able to solve problems related to DC and AC circuits
2. become adept at interpreting network analysis techniques
3. be able to determine response of circuits consisting of independent and dependent sources
4. analyse linear and non linear circuits
5. be able to design the filters with help of electrical element

Syllabus

Syllabus : EE205 CIRCUIT THEORY

MODULE – I

Network Topology: Definition and properties, Matrices of Graph, Network Equations &Solutions: Node and Mesh transformation; Generalized element; Source transformation; Formulation of network equations; Network with controlled sources; Transform networks; Properties of network matrices; Solution of equations; Linear time-invariant networks; Evaluation of initial conditions; Frequency and impedance scaling

MODULE – II

Network Theorem: Substitution theorem, Tellegen's theorem, Reciprocity theorem; State space concept and State variable modeling

MODULE – III

Multi-terminal Networks: Network function, transform networks, natural frequency (OCNF and SCNF); Two-port parameters, Equivalent networks.

MODULE – IV

Elements of Network Synthesis: Positive real function, Reactance functions, RC functions, RL Network, Two-port functions, Minimum phase networks.

MODULE – V

Approximation: Filter specifications; Butterworth approximation; Chebyshev approximation; Frequency transformation; High pass; Band pass; all pass and notch filter approximation.

Text books:

TEXT BOOK:

1. V.K. Aatre, Network Theory & Filter Design, New Age International Pvt. Ltd., New Delhi.(T1)
2. M.S. Sukhija, T.K.Nagsarkar, Circuits and Networks, Oxford University Press, 2nd ed., New Delhi.(T2)

REFERENCE BOOK:

1. M.E. Van Valkenberg, Introduction to Modern Network Synthesis, John Wiley & Sons (1 January 1966)(R1)
2. Balabanian, N. and T.A. Bickart, "Electric Network Theory",John Wiley & Sons, New York, 1969.(R2)
3. C. L. Wadhwa, Network Analysis and Synthesis,New Age International Pvt. Ltd., New Delhi(R2)

Gaps in the syllabus (to meet Industry/Profession requirements)

i. Practical aspects and demonstration of electrical and non-electrical systems

POs met through Gaps in the Syllabus

a) Demonstrate appropriate inter-personal skills to function effectively as an individual, as a member or as a leader of a team and in a multi-disciplinary setting (POi)
b) Be able to comprehend and write effective reports and design documentations; give and receive clear instructions; make effective presentations and communicate effectively and convincingly on complex engineering issues with engineering community and with society at large. (POj)
c) Be conscious of financial aspects of all professional activities and shall be able to undertake projects with appropriate management control and control on cost and time.(POk)
d) Recognize the need for continuous learning and will prepare himself/ herself appropriately for his/her all-round development throughout the professional career. (POl)

Topics beyond syllabus/Advanced topics/Design

i. Design of filter using operational amplifier

POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods
Lecture by use of boards/LCD projectors/OHP projectors
Tutorials/Assignments
Seminars
Mini projects/Projects
Laboratory experiments/teaching aids
Industrial/guest lectures
Industrial visits/in-plant training
Self- learning such as use of NPTEL materials and internets
Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Mid Sem Examination Marks	25
End SemExamination Marks	50
Assignment	05
Quiz (s)	20

Assessment Compoents	CO1	CO2	CO3	CO4	CO5
Mid Sem Examination Marks	√	√	√		
End Sem Examination Marks	√	√	√	√	√
Assignment				√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes											
	a	b	c	d	e	f	g	h	i	j	k	l
1	H	H	M							L	L	L
2	H	H	H	M	L					L	L	L
3	H	H	H	H	M	M				L	L	L
4	H	H	H	H	H	H				M	M	M
5	H	H	H	M	M	H	H	H	H	L	H	H

CD	Course Delivery methods	Course Outcome	Course Delivery Method
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1	CD1
CD2	Tutorials/Assignments	CO2	CD1
CD3	Seminars	CO3	CD1 and CD2
CD4	Mini projects/Projects		
CD5	Laboratory experiments/teaching aids		
CD6	Industrial/guest lectures		
CD7	Industrial visits/in-plant training		
CD8	Self- learning such as use of NPTEL materials and internets		
CD9	Simulation		

Lecture wise Lesson planning Details.

Week No.	Lect. No.	Tentative Date	Ch. No.	Topics to be covered	Text Book / References	COs mapped	Actual Content covered	Methodology used	Remarks by faculty if any
1	L1		1		T1, R1	1, 2		PPT Digi Class/Chock -Board	

COURSE INFORMATION SHEET

Course code: EC201
Course title: Electronic Devices
Pre-requisite(s): EC101 Basics of Electronics & Communication Engineering
Co- requisite(s):
Credits: L: 3 T: 0 P: 0 C: 3
Class schedule per week: 03
Class: B. Tech.
Semester / Level: III/02
Branch: ECE
Name of Teacher:

Course Objectives:
This course enables the students to:

1.	Understand Atoms, Electrons, Energy Bands and Charge Carriers in Semiconductors.
2.	Grasp the impact of Excess Carriers in Semiconductors, Optical Absorption, Carrier Lifetime, Photoconductivity and Diffusion of Carriers and apply the obtained knowledge.
3.	Appraise and analyze the characteristics of PN Junction and Junction Diodes.
4.	Evaluate the characteristics of Bipolar Junction Transistor (BJT).
5.	Comprehend the characteristics of Field-Effect Transistors and create their structures.

Course Outcomes:
After the completion of this course, a student will be able to:

CO1	Describe and illustrate the Atoms, Electrons, Energy Bands and Charge Carriers in Semiconductors.
CO2	Sketch and explain the Carrier Transport Phenomena in the semiconductor.
CO3	Illustrate with the sketch of the structure of PN Junction and Junction Diodes diagram their characteristics and analyze them.
CO4	Appraise the principle of operation BJTs, schematize their characteristics, assess and summarize their features.
CO5	Schematize the structure and design of Field Effect Transistors. Schematize their characteristics and prepare an inference.

SYLLABUS

Module – 1:
Atoms, Electrons, Energy Bands and Charge Carriers in Semiconductors:
Quantum Mechanics, Bonding Forces and Energy Bands in Solids, Direct and Indirect Semiconductors, **LED**, Variation of Energy Bands with Alloy Composition, Effective Mass, Electrons and Holes in Quantum Wells, **Gunn Diode,** Temperature Dependence of Carrier Concentrations, Conductivity and Mobility, High-Field Effects, The Hall Effect.

(8L)

Module – 2:
Excess Carriers in Semiconductors:
Optical Absorption, Luminescence, Carrier Lifetime and Photoconductivity, Solar Cells; Diffusion of Carriers: Diffusion Processes, Diffusion and Drift of Carriers; Built-in Fields,

Diffusion and Recombination; The Continuity Equation, Steady State Carrier Injection; Diffusion Length, The Haynes–Shockley Experiment.

(8L)

Module – 3:

PN Junction and Junction Diodes:

Fabrication of PN junctions, Space Charge at Junction, Contact Potential, Capacitance of p-n Junctions, Reverse-Bias Breakdown: Zener and Avalanche Breakdown, **Zener diode, Varactor Diode,** Effects of Contact Potential on Carrier Injection, Recombination and Generation in Transition Region, Metal-Semiconductor Junctions, PIN diodes, Step Recovery Diodes, IMPATT diodes, Tunnel Diode.

(8L)

Module – 4:

Bipolar Junction Transistor (BJT):

Fundamentals of BJT Operation, Amplification with BJTs, Minority Carrier Distributions and Terminal Currents, Drift in the Base Region, Base Narrowing, Avalanche Breakdown, Gummel–Poon Model, Kirk Effect; Frequency Limitations of Transistors, High-Frequency Transistors, Heterojunction Bipolar Transistors.

(8L)

Model – 5:

Field-Effect Transistors:

Junction FET, GaAs MESFET, High Electron Mobility Transistor (HEMT); Metal–Insulator–Semiconductor FET, MOSFET: Output Characteristics, Transfer Characteristics, Mobility Models, Short Channel MOSFET I–V Characteristics, Control of Threshold Voltage, Substrate Bias Effects— "body" effect, Subthreshold Characteristics, Equivalent Circuit for the MOSFET.

(8L)

Books recommended:

Textbooks:

1. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson, 2014.
2. J. P. Colinge, C. A. Colinge, "Physics of Semiconductor Devices", Springer Science & Business Media, 2007.

Reference books:

1. SM Sze, Kwok K. Ng, "Physics of Semiconductor Devices", 3/e, Wiley-Interscience, 2006.
2. Donald A. Neamen, Dhrubes Biswas "Semiconductor Physics and Devices", 4/e, McGraw-Hill Education, 2012.

<u>Gaps in the syllabus (to meet Industry/Profession requirements):</u> Hands-on-practical for Device fabrication.

<u>POs met through Gaps in the Syllabus:</u> PO10 (will be met though report-writing/ assignment/viva).

<u>Topics beyond syllabus/Advanced topics/Design</u>: N/A

<u>POs met through Topics beyond syllabus/Advanced topics/Design</u>: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as the use of NPTEL materials and internets
CD7	Simulation

Mapping between Course Outcomes and Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	3	1	1			3		3
CO2	3	3	2	3	3	2	1			3		3
CO3	3	3	2	3	3	2	1			3		3
CO4	3	3	2	3	3	3	1			3		3
CO5	3	3	2	3	3	3	1			3		3

$< 34\% = 1$, $34\text{-}66\% = 2$, $> 66\% = 3$

The mapping between Course Outcomes and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3, CD6, CD7
CO2	CD1, CD2, CD3, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD2, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course code: EC203
Course title: Digital System Design
Pre-requisite(s): EC101 Basics of Electronics & Communication Engineering
Co- requisite(s):
Credits: L: 3 T:0 P:0 C:3
Class schedule per week: 3x1
Class: B. Tech
Semester / Level: III/02
Branch: ECE
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Understand the basics of digital electronics.
2.	Apply the knowledge of digital electronics to construct various digital circuits.
3.	Analyze the characteristics and explain the outputs of digital circuits.
4.	Evaluate and asses the application of the digital circuits.
5.	Design digital machine for simple computing and control.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Explain the concept of digital electronics.
CO2	Apply the knowledge to produce digital electronics circuits.
CO3	Analyse and categorize digital circuits.
CO4	Justify the uses of different digital circuits.
CO5	Schematize and demonstrate simple computing machines.

SYLLABUS

Module – 1:
Basics of Digital Electronics: Number representation, Binary number system, Number base conversion, Octal, Hexadecimal and BCD codes, Binary Arithmetic, Logic gates, Introduction to VHDL and Verilog, VHDL Models, Logic Families: TTL, ECL, and CMOS Logic Circuits, Logic levels, voltages and currents, fan-in, fan-out, speed, power dissipation. Comparison of logic families.

Module – 2:
Simplification of Boolean functions: Boolean Algebra, Basic theorems and Properties, De Morgan's theorem, Canonical & Standard forms, Simplification of a Boolean function using Karnaugh map, POS & SOP simplification, Prime implicant, NAND and NOR implementation,

Module – 3:
Design of Combinational Circuits: Analysis and design procedure, Parity Generators and Checkers, Adders, Subtractors, Look ahead carry, Adder, 4-bit BCD adder/subtractor, Magnitude

comparator, Decoders, Encoders, Multiplexers, De-multiplexers, Design of 1 bit ALU for basic logic and arithmetic operations.

Module – 4:
Design of Sequential Circuits and Memories: Basic Latch, Flip-Flops (SR, D, JK, T and Master-Slave), Triggering of Flip Flops, Synchronous and asynchronous counters, Registers, Shift Registers, Memories and Programmable Logic design, Types of memories, Memory Expansion and its decoding, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL)

Module – 5:
Design of simple computing machines: SAP-I concepts with stress on timing diagrams, Microinstructions, Fetch and Execution cycle variable machine cycle, Hardware control Matrix, Macroinstructions, Microprogramming, Bus concepts, Multiplexed Minimum system. Pipelining concepts.

Books recommended:
Textbooks:

1. "Digital Design", Morris Mano and Michael D. Ciletti ,5th edition PHI
2. "Digital System Design using VHDL", Charles H Roth, Thomson Learning

Reference books:

1. Digital computer Electronics AP Malvino, 3rd Edition Mc Graw Hill

Gaps in the syllabus (to meet Industry/Profession requirements): Hands-on-practical on microprocessor trainer Kit

POs met through Gaps in the Syllabus: N/A

Topics beyond syllabus/Advanced topics/Design: N/A

POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as the use of NPTEL materials and internets
CD7	Simulation

Mapping between Course Outcomes and Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	3	1	1			3		3
CO2	3	3	2	3	3	3	2			3		3
CO3	3	3	2	3	3	3	2			3		3
CO4	3	3	2	3	3	2	2			3		3
CO5	3	3	2	3	3	2	2			3		3

< 34% = 1, 34-66% = 2, > 66% = 3

The mapping between Course Outcomes and Course Delivery Method

Course Outcomes	**Course Delivery Method**
CO1	CD1, CD2, CD3, CD6, CD7
CO2	CD1, CD2, CD3, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD2, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course code: EC205
Course title: Signals and Systems
Pre-requisite(s): EC101 Basics of Electronics & Communication Engineering
Co- requisite(s):
Credits: L: 3 T: 0 P: 0 C: 3
Class schedule per week: 03
Class: B. Tech.
Semester / Level: III/02
Branch: ECE
Name of Teacher:

Course Objectives:
This course enables the students:

1.	To understand the fundamental characteristics of signals and systems.
2.	To understand the concepts of different transforms for signal and system.
3.	To understand signals and systems in terms of both the time and transform domains.
4.	To develop the mathematical skills to solve problems involving convolution, filtering, modulation, and sampling.
5.	To understand the response of LTI systems using Transform theory.

Course Outcomes:
After the completion of this course, a student will be able to

CO1	define signal, systems and its importance in life.
CO2	represent the signal in the time domain as well as in Frequency domain and find the response of the system.
CO3	explain the transform theory and its importance to analyze signal and system.
CO4	identify system properties based on impulse response and Fourier analysis.
CO5	explain Sampling theorem and its importance in discrete time systems representation.

SYLLABUS

Module 1:

INTRODUCTION TO SIGNALS AND SYSTEMS:

Signals and systems as seen in everyday life and in various branches of engineering and science, Signal properties: periodicity, absolute integrability, determinism, and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

Module 2:

BEHAVIOR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS:

Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of frequency response and its relation to the impulse response.

Module 3:

FOURIER AND LAPLACE TRANSFORMS:

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality, Laplace Transform for continuous-time signals and systems, Transfer/system functions, poles and zeros of system functions and signals, Laplace domain analysis, the solution to differential equations and system behavior.

Module 4:

Z-TRANSFORM, DTFT, AND DFT:

Z-transform, Region of convergence and its properties, Inverse Z transform, properties of ZT, The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT), Parseval's Theorem., Properties of DTFT and DFT, convolution property, multiplication property, Duality, Systems Characterized by Linear Constant Coefficient Difference Equation, The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

Module 5:

SAMPLING AND RECONSTRUCTION:

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. The relation between continuous and discrete time systems. Applications of signal and system theory: modulation for communication, filtering, feedback control systems.

Books recommended:

Textbooks:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, “Signals and systems”, Prentice Hall India, 1997.
2. S. Haykin and B. V. Veen, “Signals and Systems”, John Wiley and Sons, 2007.

Reference books:

1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications.
2. Robert A. Gable, Richard A. Roberts, Signals & Linear Systems
3. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
4. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c1999.
6. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.

Gaps in the syllabus (to meet Industry/Profession requirements): Hands-on-practical for Signal and system.

POs met through Gaps in the Syllabus: PO10 (will be met though report-writing/ assignment/viva).

Topics beyond syllabus/Advanced topics/Design: N/A

POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid-semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as the use of NPTEL materials and internets
CD7	Simulation

Mapping between Course Outcomes and Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	2	2	3	1	2	3	2	2	2	2
CO2	2	3	2	2	2	1	3	3	3	2	2	2
CO3	1	3	2	3	2	1	3	3	2	2	2	2
CO4	3	2	2	3	1	1	2	3	1	2	1	2
CO5	1	3	2	2	3	1	2	3	2	2	2	2

< 34% = 1, 34-66% = 2, > 66% = 3

Mapping between Course Outcomes and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3, CD6, CD7
CO2	CD1, CD2, CD3, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD2, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course code: EE102
Course title: EE102 ELECTRICAL ENGINEERING LABORATORY
Pre-requisite(s): Physics, Fundamentals of Mathematics and Electrical Engineering.

Credits:	L	T	P
	0	0	3

Class schedule per week: 3

Course Overview: Concepts of measuring instruments, AC RLC series parallel circuit operation, resonance, KVL and KCL, circuit theorems, 3-phase star and delta connections, measurement of low and high resistance of D.C. machine, measurement of power by three voltmeter, three-ammeter methods, measurement of power of 3-phase induction motor by two-wattmeter method.

Course Objectives

This course enables the students :

A.	To describe students practical knowledge of active and passive elements and operation of measuring instruments
B.	To demonstrate electrical circuit fundamentals and their equivalent circuit models for both 1-φ and 3- φ circuits and use circuit theorems
C.	To establish voltage & current relationships with the help of phasors and correlate them to experimental results
D.	1. To conclude performance of 1 – Φ AC series circuits by resonance phenomena 2. To evaluate different power measurement for both 1-φ and 3- φ circuits

Course Outcomes

After the completion of this course, students will be able to:

1.	classify active and passive elements, explain working and use of electrical components, different types of measuring instruments;
2.	illustrate fundamentals of operation of DC circuits, 1-φ and 3- φ circuits and also correlate the principles of DC, AC 1-φ and 3- φ circuits to rotating machines like Induction motor and D.C machine.;
3.	measure voltage, current, power, for DC and AC circuits and also represent them in phasor notations;
4.	analyse response of a circuit and calculate unknown circuit parameters;
5.	recommend and justify power factor improvement method in order to save electrical energy.

LIST OF EXPERIMENTS :

1. **Name: Measurement of low & high resistance of DC shunt motor**
   Aim: (i) To measure low resistance of armature winding of DC shunt motor
   (ii) To measure high resistance of shunt field winding of DC shunt motor

2. **Name: AC series circuit**
   Aim: (i) To obtain current & voltage distribution in AC RLC series circuit and to draw phasor diagram
   (ii) To obtain power & power factor of single phase load using 3- Voltmeter method and to draw phasor diagram

3. **Name: AC parallel circuit**
   Aim: (i) To obtain current & voltage distribution in AC RLC parallel circuit and to draw phasor diagram
   (ii) To obtain power & power factor of single phase load using 3- Ammeter method and to draw phasor diagram

4. **Name: Resonance in AC RLC series circuit**
   Aim : (i) To obtain the condition of resonance in AC RLC series circuit
   (ii) To draw phasor diagram

5. **Name: 3 phase Star connection**
   Aim : (i) To establish the relation between line & phase quantity in 3 phase star connection
   (ii) To draw the phasor diagram

6. **Name: 3 phase Delta connection**
   Aim : (i) To establish the relation between line & phase quantity in 3 phase delta connection
   (ii) To draw phasor diagram

7. **Name: 3 phase power measurement**
   Aim : (i) To measure the power input to a 3 phase induction motor using 2 wattmeter method
   (ii) To draw phasor diagram

8. **Name: Self & mutual inductance**
   Aim : To determine self & mutual inductance of coils

9. **Name: Verification of Superposition, Thevenin's and Reciprocity theorem**
   Aim : (i) To verify Superposition theorem for a given circuit
   (ii) To verify Thevenin's theorem for a given circuit

10. **Name: Verification of Norton's, Tellegen's and Maximum Power transfer theorem**
    Aim : (i) To verify Norton's theorem for a given circuit
    (ii) To verify Maximum Power transfer theorem for a given circuit

Gaps in the syllabus (to meet Industry/Profession requirements)

1. Application of principles of magnetic circuits to electrical machines like transformers, generators and motors
2. Visualize Phase sequence

POs met through Gaps in the Syllabus : a, b, c, g

Topics beyond syllabus/Advanced topics/Design

1. Assignment : Simulation of electrical circuits with dependent/independent sources by various techniques (Mesh current/Node Voltage/Thevenin's theorem/Norton's theorem/Maximum power transfer theorem etc.) using MATLAB/PSIM/C++ softwares
2. Active/reactive power calculation for 3 – Φ circuits

POs met through Topics beyond syllabus/Advanced topics/Design: e, f, i, j, k

Mapping of lab experiment with Course Outcomes

Experiment	**Course Outcomes**				
	1	**2**	**3**	**4**	**5**
1	3	3	3	2	
2	3	3	3	3	2
3	3	3	3	3	2
4	3	3	3	3	2
5	3	3	3	1	
6	3	3	3	1	
7	3	3	3	2	2
8	3	3	3	3	
9	3	3	3	2	
10	3	3	3	2	

3=High, 2=Medium, 1=Low

Course Delivery methods	
CD1	Lecture by use of boards/LCD projectors
CD2	Tutorials/Assignments

CD3	Mini projects/Projects
CD4	Laboratory experiments/teaching aids
CD5	Self- learning such as use of NPTEL materials and internets
CD6	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
(1) Progressive Evaluation (60)	
Day to Day performance & Lab files	30
Quiz (s)	10
Viva	20
(2) End Semester (40)	
Examination Experiment performance	30
Quiz	10
Grand Total	100

Assessment Compoents	CO1	CO2	CO3	CO4	CO5
Progressive Evaluation Marks					
End Semester Marks					

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping of Course Outcomes onto Course Objectives

Course Outcome #	Course Objectives			
	A	**B**	**C**	**D**
1	3	3	3	3
2	3	3	3	3
3	3	3	3	3
4	3	3	3	3
5	2	3	3	3

Mapping of Course Outcomes onto Program Outcomes

Course Outcome #	Program Outcomes											
	a	b	c	d	e	f	g	h	i	j	k	l
1	3	3	3	3	3	1	3	3	3	3	3	3
2	3	3	3	2	2	2	2	3	3	3	3	3
3	3	3	3	2	2	2	2	2	3	3	2	3
4	3	3	3	3	3	1	2	2	3	3	2	2
5	3	3	3	3	3	2	3	3	3	3	3	3

Mapping of Course Outcomes onto Program Educational Objectives

Course Outcome #	Program Educational Objectives			
	1	2	3	4
1	3	3	2	2
2	3	3	3	
3	3	3	3	2
4	3	3	3	
5	3	3	2	2

Mapping Between COs and Course Delivery (CD) methods

Course Outcome	Course Delivery Method
CO1	CD1,CD2,CD4, CD5
CO2	CD1,CD4,CD5
CO3	CD1,CD3,CD4,CD5,CD6
CO4	CD1,CD2,CD4, CD5
CO5	CD4, CD5

Course Delivery (CD) methods		Program Outcomes (PO)											
		PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h	PO i	PO j	PO k	PO l
CD1	Lecture by use of boards/LCD projectors	2	1	1	2	3	1						
CD2	Tutorials/ Assignments	2	2	2	2	3	3			3	3	1	2
CD3	Seminars												
CD4	Mini projects/Projects												
CD5	Laboratory experiments/teaching aids	3	3	3	3	3	1		2	3	2	2	3
CD6	Industrial/guest lectures												
CD7	Industrial visits/in-plant training												
CD8	Self- learning such as use of NPTEL materials and internets	3	3	3	3	3	3	2	3	2	3	2	2
CD9	Simulation	3	3	3		3	3			2	2		

COURSE INFORMATION SHEET

Course code: EC202
Course title: Electronics Device Lab
Pre-requisite(s): Basic Electronic Engineering
Co- requisite(s): Electronic Devices
Credits: L: 0 T: 0 P: 3 C: 1.5
Class periods per week: 03
Class: B. Tech.
Semester / Level: III/02
Branch: ECE
Name of Teacher:

Course Objectives

This course enables the students to:

1.	understand the material and electrical parameters of intrinsic and extrinsic semiconductor materials.
2.	understand the basic characteristics of MOS transistor, Tunnel diode and solar cell
3.	apply their understanding to use advance design TCAD tool to obtain the material and electrical parameters of intrinsic and extrinsic semiconductor materials.
4.	apply their understanding to use advance design TCAD tool to describe basic characteristics of BJT and MOS transistors and inverter.
5.	apply their understanding to use advance design TCAD tool to analyze characteristics of the inverter.

Course Outcomes

After the completion of this course, students will be able to:

CO1	illustrate the material and electrical parameters of intrinsic and extrinsic semiconductor materials.
CO2	interpret the basic characteristics of Tunnel diode and solar cell
CO3	outline the basic characteristics of MOS transistors
CO4	use the advance design tool TCAD to analyze the material and electrical parameters of intrinsic and extrinsic semiconductor materials.
CO5	use the advance design tool TCAD to analyze basic characteristics of BJT and MOS transistors and inverter.

SYLLABUS

List of Compulsory experiments:

1. Measurement of mobility and diffusion coefficient of minority carrier using Haynes Shockley experiment.
2. Identification of the type of semiconductor material and measurement of mobility, conductivity and carrier concentration using Hall Effect.
3. Measurement of the band gap of semiconductor materials.

4. Determine the Id-Vd and Id-Vg characteristics of an enhancement mode nMOSFET and a depletion mode nMOSFET.
5. Determine the I-V characteristics of a tunnel diode.
6. Determine the I-V characteristics of an illuminated PN junction (solar cell).
7. Characterize and find the parameters (sheet resistance, mobility, saturation velocity, etc.) of the intrinsic and the extrinsic semiconductor materials using TCAD tool.
8. Construct a silicon PN junction diode and find I-V characteristics curve using TCAD tool.
9. Construct an NPN Transistor and find the I-V characteristics curves in Common Emitter (CE) mode using TCAD tool.
10. Construct an enhancement mode nMOSFET and determine Id-Vd and Id-Vg characteristics using TCAD tool.
11. Construct an enhancement mode pMOSFET and determine Id-Vd and Id-Vg characteristics using TCAD tool.
12. Construct a CMOS inverter and determine the DC/transient characteristics using TCAD tool.

List of Optional experiments:

1. Determine the I-V characteristics of an NPN transistor in Common Emitter (CE) mode.
2. Determine the I-V characteristics of an NPN transistor in Common Collector (CC) mode.
3. Determine the I-V characteristics of an NPN transistor in Common Base (CB) mode.
4. Determine the I-V characteristics of a PNP transistor in Common Emitter (CE) mode.
5. Determine the I-V characteristics of a PNP transistor in Common Collector (CC) mode.
6. Determine the I-V characteristics of a PNP transistor in Common Base (CB) mode.
7. Study the I-V characteristics of forward and reverse biased Silicon and Germanium PN-junction diode.
8. Study the I-V characteristics of forward and reverse biased Zener diode. Study the breakdown characteristics of the Zener diode.
9. Construct a PNP Transistor and find the I-V characteristics curves in Common Emitter (CE) mode using TCAD tool.
10. Study diode application as a rectifier using TCAD tool
11. Construct a depletion mode nMOSFET and determine Id-Vd and Id-Vg characteristics using TCAD tool.

12. Construct a depletion mode pMOSFET and determine Id-Vd and Id-Vg characteristics using TCAD tool.

Books recommended:

Textbooks:

1. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson, 2014.
2. J. P. Colinge, C. A. Colinge, "Physics of Semiconductor Devices", Springer Science & Business Media, 2007.
3. J. Rabaey, A. Chandrakasan, B. Nikolic, "Digital Integrated Circuits: A Design Perspective", 2nd ed., Prentice Hall, 2003.

Reference books:

1. SM Sze, Kwok K. Ng, "Physics of Semiconductor Devices", 3/e, Wiley-Interscience, 2006.
2. Donald A. Neamen, Dhrubes Biswas "Semiconductor Physics and Devices", 4/e, McGraw-Hill Education, 2012.
3. Cogenda Visual TCAD tool user manual.

<u>Gaps in the syllabus (to meet Industry/Profession requirements):</u>

<u>POs met through Gaps in the Syllabus:</u>

<u>Topics beyond syllabus/Advanced topics/Design:</u> through experiments involving design/modeling of device/circuits on advanced topics

<u>POs met through Topics beyond syllabus/Advanced topics/Design:</u> through experiments involving design/modeling of device/circuits on advanced topics

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

<u>Direct Assessment</u>

Assessment Tools	**% Contribution during CO Assessment**
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	**% Distribution**
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	**% Distribution**
Examination Experiment Performance	30
Quiz	10

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**

Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as the use of NPTEL materials and internets
CD7	Simulation

Mapping between Course Outcomes and Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	1	1		3		3
CO2	3	3	3	3	3	1	1	1		3		3
CO3	3	3	3	3	3	1	1	1		3		3
CO4	3	3	3	3	3	1	1	1		3		3
CO5	3	3	3	3	3	1	1	1		3		3

< 34% = 1, 34-66% = 2, > 66% = 3

The mapping between Course Outcomes and Course Delivery Method

Course Outcomes	**Course Delivery Method**
CO1	CD1, CD3, CD6, CD7
CO2	CD1, CD3, CD6, CD7
CO3	CD1, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course code: EC204
Course title: Digital System design Lab
Pre-requisite(s): EC101 Basics of Electronics & Communication Engineering
Co- requisite(s):
Credits: L:0 T:0 P:3 C:1.5
Class schedule per week: 03
Class: B. Tech
Semester / Level: III/ 02
Branch: ECE
Name of Teacher:

Course Objectives
This course enables the students to:

1.	Understand the basics of logic gates, input, output, power supply, and gates IC’s.
2.	Apply the knowledge of digital electronics to construct combinational and sequential circuits.
3.	Analyze controlled digital circuits with different Boolean function.
4.	Evaluate combinational/sequential circuits and memories.
5.	Translate real-world problems into digital logic formulations using VHDL.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Describe the knowledge of basic logic gates and their design using universal gates.
CO2	Demonstrate the working of combinational and sequential circuits.
CO3	Integrate and experiment with controlled digital circuits.
CO4	Appraise combinational/sequential circuits and memories.
CO5	Schematize, simulate and implement combinational and sequential circuits to solve real-world problems using VHDL systems.

SYLLABUS

List of experiments:

1. Design and implement a controlled CMOS Inverter.
2. To study and verify the truth table of NAND and EX-OR gate using IC 7400.
3. Design and implement SEVEN segment display unit.
4. Design and verify half adder and full Adder circuits using gates and IC 7483.
5. Design and implement a 3:8 Decoder.
6. Design and implement 8:3 priority encoder.
7. Design a 4 bit magnitude comparator using combinational circuits.
8. Design and implement 8:1 multiplexer and 1:4 demultiplexer.

9. Design ALU with functions of ADD, SUB, INVERT, OR, AND. XOR, INC, DEC, and CMP.
10. Design and verify the Decade Counter.
11. Design a ROM (8X4) using a decoder, gates, and diodes.
12. Design of pre settable up/down counter.

Implement all the above experiments using VHDL platform and verify.

Books recommended:

Textbooks:

1. "Digital Design", Morris Mano and Michael D. Ciletti ,5th edition PHI
2. "Digital System Design using VHDL", Charles H Roth, Thomson Learning

Reference books:

1. Digital computer Electronics AP Malvino, 3rd Edition Mc Graw Hill

<u>Gaps in the syllabus (to meet Industry/Profession requirements):</u>

<u>POs met through Gaps in the Syllabus:</u>

<u>Topics beyond syllabus/Advanced topics/Design:</u>

<u>POs met through Topics beyond syllabus/Advanced topics/Design:</u>

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

<u>Direct Assessment</u>

Assessment Tools	**% Contribution during CO Assessment**
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	**% Distribution**
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	**% Distribution**
Examination Experiment Performance	30
Quiz	10

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment					
Semester End Examination					

<u>Indirect Assessment</u>

1. Student Feedback on Faculty

2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as the use of NPTEL materials and internets
CD7	Simulation

Mapping between Course Outcomes and Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	1	1		3		3
CO2	3	3	3	3	3	1	1	1		3		3
CO3	3	3	3	3	3	1	1	1		3		3
CO4	3	3	3	3	3	1	1	1		3		3
CO5	3	3	3	3	3	1	1	1		3		3

< 34% = 1, 34-66% = 2, > 66% = 3

The mapping between Course Outcomes and Course Delivery Method

Course Outcomes	**Course Delivery Method**
CO1	CD1, CD3, CD6, CD7
CO2	CD1, CD3, CD6, CD7
CO3	CD1, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course code: EC208
Course title: Electronic Measurement Lab
Pre-requisite(s): EC101 Basics of Electronics & Communication Engineering
Co- requisite(s):
Credits: L: T: 0 P: 4 C:2
Class schedule per week: 04
Class: B. Tech.
Semester / Level: III/02
Branch: ECE
Name of Teacher:

Course Objectives
This course enables the students to:

1.	Understand the concepts of calibration and measurement.
2.	Apply the concepts of AC bridges for the measurements of the different electrical parameters.
3.	Explain the basic principles of transducers and their uses for the measurements of different physical parameters**.**
4.	Demonstrate the signal analysis using digital storage oscilloscope.
5.	Design the signal conditioners and converters for different applications.

Course Outcomes
After the completion of this course, students will be able to:

CO1	To list the functions of various components of a measurement system.
CO2	Describe the balancing of different AC bridges and calculate unknown resistance, inductance, quality of a coil, and capacitance at balance condition.
CO3	Calibrate and measure different physical parameters using measurement systems.
CO4	Find and investigate the errors in measuring a parameter.
CO5	Schematize electronic measurement systems for the measurement of different physical parameters.

SYLLABUS

List of experiments:

1. Balancing of AC Bridge Circuits and measurements of Inductance, DC Resistance, Capacitance and AC resistance of a capacitor.
2. Balancing of Wien's bridge Circuit and measurements of capacitance, frequency, and total harmonic distortion.
3. Calibration and measurement of pressure (in Kg/cm^2) using diaphragm and strain gauge.
4. Calibration and measurement of temperature (in ^oC) using RTD, Thermocouple, and Thermistor.
5. Measurement of rotating speed in (RPM) using Photo-reflective and Magnetic pickup sensor.
6. Calibration and measurement of displacement (in mm) using LVDT.
7. Calibration and measurement of the level (in cm) using Load Cell.

8. Torque Measurement of torque (in kgm) using reaction torque sensor.
9. Design of bipolar DAC using the R-2R Ladder network.
10. Measurement of the rise time of the RC circuit using Digital Storage Oscilloscope.
11. Design and implementation of an instrumentation amplifier for a variable gain of 50, 100 and 200.
12. Design Analog to Digital convertor using voltage to frequency converter technique.

Books recommended:

Textbooks:

1. "Electrical and Electronic Measurements and Instrumentation" by A. K. Sawhney.
2. "Modern Electronic Instrumentation & Measurement Techniques" by Helfrick& Cooper.

Reference books:

1. "Electronic Instrumentation", by H. S. Kalsi.

Gaps in the syllabus (to meet Industry/Profession requirements): Visit CIF lab at BIT Mesra.

POs met through Gaps in the Syllabus: N/A.

Topics beyond syllabus/Advanced topics/Design: N/A

POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as the use of NPTEL materials and internets
CD7	Simulation

Mapping between Course Outcomes and Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	1	1		3		3
CO2	3	3	3	3	3	1	1	1		3		3
CO3	3	3	3	3	3	1	1	1		3		3
CO4	3	3	3	3	3	1	1	1		3		3
CO5	3	3	3	3	3	1	1	1		3		3

< 34% = 1, 34-66% = 2, > 66% = 3

The mapping between Course Outcomes and Course Delivery Method

Course Outcomes	**Course Delivery Method**
CO1	CD1, CD3, CD6, CD7
CO2	CD1, CD3, CD6, CD7
CO3	CD1, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD3, CD6, CD7

MA 203 **Syllabus**

Numerical Methods **2-0-0-2**

Module I: Errors and Nonlinear Equations

Error Analysis: Definition and sources of errors, propagation of errors, floating-point arithmetic

Solution of Nonlinear equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson method and its variants, General Iterative method. [05L]

Module II: System of Linear Equations

Gauss-Elimination, Gauss-Jordan, LU-Decomposition, Gauss-Jacobi and Gauss- Siedel methods to solve linear system of equations and Power method to find least and largest eigenvalues. [05L]

Module III: Interpolation

Lagrange's interpolation, Newton's divided differences interpolation formulas, inverse interpolation, interpolating polynomial using finite differences. [05L]

Module IV: Differentiation and Integration

Differentiation using interpolation formulas, Integration using Newton-Cotes formulas: Trapezoidal rule, Simpson's rule [05L]

Module V: Solution of Ordinary Differential Equations

Euler's method, modified Euler's method, Runge - Kutta Methods of second and fourth order to solve initial value problems. [05L]

Text Books:

3. Jain M.K, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age Publications, 2004.
4. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI.
5. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

3. S.C. Chapra and R. P. Canale, Numerical Methods for Engineers, McGraw Hill, 1985.
4. C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson Education, Seventh Edition, 2003.
5. R. W. Hamming: Numerical Methods for Scientists and Engineers, Second Edition, Dover

COURSE INFORMATION SHEET

Course code: CE101
Course title: Environmental Science
Pre-requisite(s): NA
Co- requisite(s): NA
Credits: L:2 T:0 P:0
Class schedule per week: 02
Class: B.Tech
Semester / Level: 03/01
Branch: All
Name of Teacher:

Course Objectives
This course enables the students:

1	To develop basic knowledge of ecological principles and their applications in environment. (K_1,K_2)
2	To identify the structure and composition of the spheres of the earth, the only planet sustaining life. (K_1,K_2)
3	To analyse, how the environment is getting contaminated and probable control mechanisms for them. (K_1,K_2)
4	To generate awareness and become a sensitive citizen towards the changing environment. (K_1,K_2)

Course Outcomes
After the completion of this course, students will be:

1	Able to explain the structure and function of ecosystems and their importance in the holistic environment. (K_1,K_2)
2	Able to identify the sources, causes, impacts and control of air pollution. (K_1,K_2)
3	Able to distinguish the various types of water pollution happening in the environment and understand about their effects and potential control mechanisms. (K_1,K_2)
4	Able to judge the importance of soil, causes of contamination and need of solid waste management. (K_1,K_2)
5	Able to predict the sources of radiation hazards and pros and cons of noise pollution. (K_1,K_2)

Syllabus

Module 1. Ecosystem and Environment
Concepts of Ecology and Environmental science, ecosystem: structure, function and services, Biogeochemical cycles, energy and nutrient flow, ecosystem management, fate of environmental pollutants, environmental status and reports on climate change.

Module 2: Air Pollution

Structure and composition of unpolluted atmosphere, classification of air pollution sources, types of air pollutants, effects of air pollution, monitoring of air pollution, control methods and equipment for air pollution control, vehicular emissions and control, indoor air pollution, air pollution episodes and case studies.

Module 3: Water Pollution
Water Resource; Water Pollution: types and Sources of Pollutants; effects of water pollution; Water quality monitoring, various water quality indices, water and waste water treatment: primary, secondary and tertiary treatment, advanced treatments (nitrate and phosphate removal); Sludge treatment and disposal.

Module 4: Soil Pollution and Solid Waste Management
Lithosphere – composition, soil properties, soil pollution, ecological & health effects, Municipal solid waste management – classification of solid wastes, MSW characteristics, collection, storage, transport and disposal methods, sanitary landfills, technologies for processing of MSW: incineration, composing, pyrolysis.

Module 5: Noise pollution & Radioactive pollution
Noise pollution: introduction, sources: Point, line and area sources; outdoor and indoor noise propagation, Effects of noise on health, criteria noise standards and limit values, Noise measurement techniques and analysis, prevention of noise pollution; Radioactive pollution: introduction, sources, classification, health and safety aspects, Hazards associated with nuclear reactors and disposal of spent fuel rods-safe guards from exposure to radiations, international regulation, Management of radioactive wastes.

Text books:

1. A, K. De. (3rd Ed). 2008. Environmental Chemistry. New Age Publications India Ltd.
2. R. Rajagopalan. 2016. Environmental Studies: From Crisis to Future by, 3rd edition, Oxford University Press.
3. Eugene P. Odum. 1971. Fundamentals of Ecology (3rd ed.) -. WB Sunders Company, Philadelphia.
4. C. N. Sawyer, P. L. McCarty and G. F. Parkin. 2002. Chemistry for Environmental Engineering and Science. John Henry Press.
5. S.C. Santra. 2011. Environmental Science. New Central Book Agency.

Reference books:

1. D.W. Conell. Basic Concepts of Environmental Chemistry, CRC Press.
2. Peavy, H.S, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International
3. G.M. Masters & Wendell Ela. 1991. Introduction to Environmental Engineering and Science, PHI Publishers.

Gaps in the syllabus (to meet Industry/Profession requirements)

POs met through Gaps in the Syllabus

Topics beyond syllabus/Advanced topics/Design

POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods	
Lecture by use of boards/LCD projectors/OHP projectors	✓
Tutorials/Assignments	✓
Seminars	✓
Mini projects/Projects	✓
Laboratory experiments/teaching aids	✓
Industrial/guest lectures	✓
Industrial visits/in-plant training	✓
Self- learning such as use of NPTEL materials and internets	✓
Simulation	✓

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Mid Sem Examination Marks	25
End Sem Examination Marks	50
Quiz (s) (1 & 2)	10+10
Teacher's assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Mid sem exam	✓	✓	✓		
End Sem Examination Marks	✓	✓	✓	✓	✓
Quiz 1	✓	✓			
Quiz 2			✓	✓	✓
Assignment	✓	✓	✓	✓	✓

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Graduate Attributes

Course Outcome #	Program outcomes												Program specific outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3

1		**1**	**3**			**1**	**3**						**1**		
2		**1**	**3**			**1**	**3**						**1**		
3		**1**	**3**			**1**	**3**						**1**		
4		**1**	**3**			**1**	**3**						**1**		
5		**1**	**3**			**1**	**3**						**1**		

Mapping Between COs and Course Delivery (CD) methods				
CD	**Course Delivery methods**		**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors		CO1	CD1, CD2, CD8
CD2	Tutorials/Assignments		CO2	CD1, CD2, CD8
CD3	Seminars		CO3	CD1, CD2, CD8
CD4	Mini projects/Projects		CO4	CD1, CD2, CD8
CD5	Laboratory experiments/teaching aids		CO5	CD1, CD2, CD8
CD6	Industrial/guest lectures			
CD7	Industrial visits/in-plant training			
CD8	Self- learning such as use of NPTEL materials and internets			
CD9	Simulation			

COURSE INFORMATION SHEET

Course code: EC251
Course title: Probability and Random Processes
Pre-requisite(s): EC205 Signals and Systems
Co- requisite(s):NA
Credits: L: 3 T: 0 P: 0 C: 3
Class schedule per week: 03
Class: B. Tech.
Semester / Level: IV/02
Branch: ECE
Name of Teacher:

Course Objectives:
This course enables the students:

1.	To explain the random phenomena and impart knowledge on the mathematical modelling of the random experiment.
2.	To develop an ability to describe random vectors and their characterization.
3.	To develop an ability to understand the concept of random processes or stochastic processes.
4.	To develop an ability to analyze the stochastic processes with the help of probability models and its characterization
5.	To develop an ability to evaluate different emerging techniques to improve real-time estimation and detection of random parameters.

Course Outcomes:

After the completion of this course, students will be able to:

CO1	Demonstrate an understanding of the mathematical modelling of the random experiment or random phenomena.
CO2	Describe random vectors and their characterization.
CO3	Demonstrate an understanding of the concept of random processes or stochastic processes.
CO4	Analyze the stochastic processes with the help of probability models and their characterization.
CO5	Evaluate the different emerging techniques to improve real-time estimation and detection of random parameters.

SYLLABUS

Module-1

Randomness, Uncertainty and its Description

Random experiments/phenomenon, outcomes of the random experiment, Sample Space, Events, Probability of an event, Concepts of sets and probability theory to explain Random experiments, Probability space; Conditional probability, Independence and Bayes theorem; Combinatorial probability and sampling models.

Module-2

Random Variable and its characterization:

Continuous random variables: distribution function, probability density function, Conditional Densities and Distributions, an example of distributions, Gaussian, Rayleigh, and Rician; exponential, chi-squared; gamma. Discrete random variables: distribution function, probability mass function, Example of random variables and distributions (Bernoulli, binomial, Poisson, geometric, negative binomial, etc.), Expectations, Variance, MGF and Characteristics Function of Random Variable, moments of Random Variable.

Module-3

Random vector and its characterization:

Joint Events, Joint CDF and PDF, Properties of Joint CDF and PDF, Bivariate Gaussian Distributions, Joint Moments, Random Vectors, Vector Gaussian Random Variables, Moments of Random Vectors, Independence of two random vectors,

Module-4

Inequalities, Convergences, and Limit Theorems:

Random sequences Markov, Chebyshev and Chernoff bounds; modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Stochastic convergence, the law of large numbers, central limit theorem, Limit theorems; Strong and weak laws of large numbers.

Module-5

Random Processes and Linear Systems:

Random Data/Signals, stationarity; mean, correlation, and covariance functions, WSS random process; autocorrelation and cross-correlation functions; transmission of a random process through a linear System; power spectral density; white random process; Gaussian process; Poisson process, Application of Probability and Random Processes to understand important domain like digital communication, estimation and information theory.

Text Books:

1. Papoulis. A.,” Probability, Random variables, and Stochastic Processes”, McGraw Hill, 2002.

2. H.Stark & J.W.Woods, “Probability, Random Processes and Estimations Theory for Engineers”, (2/e), Prentice Hall, 1994

Reference Book:

1. E.Wong, “Introduction to Random Processes”, Springer Verlag, 1983.

2. W.A.Gardner, “Introduction to Random Processes”, (2/e), McGraw Hill, 1990.

3. Davenport,” Probability and Random Processes for Scientist and Engineers”, McGraw-Hill, 1970.

Gaps in the syllabus (to meet Industry/Profession requirements): Hands-on-practical for Signal Processing using MATLAB.

POs met through Gaps in the Syllabus: PO10 (will be met though report-writing/ assignment/viva).

Topics beyond syllabus/Advanced topics/Design: N/A

POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
Mid-semester examination	25
Two quizzes	20 (2×10)
Teacher’s Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment

1. Student Feedback on Faculty

2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as the use of NPTEL materials and internets
CD7	Simulation

Mapping between Course Outcomes and Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	3	1	1	1	2	3	2	3
CO2	3	3	2	3	3	3	2	1	2	3	2	3
CO3	3	3	2	3	3	3	2	1	2	3	2	3
CO4	3	3	2	3	3	2	2	1	2	3	2	3
CO5	1	3	2	2	3	1	2	3	2	2	2	2

< 34% = 1, 34-66% = 2, > 66% = 3

The mapping between Course Outcomes and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3, CD6, CD7
CO2	CD1, CD2, CD3, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD2, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course code: **EC253**
Course title: **Analog Circuits**
Pre-requisite(s): **EC101 Basics of Electronics & Communication Engineering**
Co-requisite(s): None
Credits: L: 3 T: 0 P: 0 C: 3
Class schedule per week: 03
Class: B. Tech
Semester / Level: 04
Branch: ECE
Name of Teacher:

Course Objectives
This course enables the students:

1.	To help them understand the operation of Transistors for low-frequency applications and power amplifiers
2.	To know the operation of multistage amplifiers and transistors for high-frequency applications and tuned amplifiers
3.	To help them understand the operation of feedback amplifiers and oscillators
4.	To help them realize the non-linear applications of op-amp and filters
5.	To help them design the analog-to-digital and digital-to-analog converters

Course Outcomes
After the completion of this course, students will be able to:

CO1	Design and analyze the low-frequency transistor circuits and power amplifiers
CO2	Design the multistage amplifiers and analyze transistors at high frequency
CO3	Design and characterize the negative feedback amplifier circuits and oscillators
CO4	Design the practical operational amplifiers and active filters
CO5	Design and Characterize the analog-to-digital and digital-to-analog converters

SYLLABUS

Module – 1:
Review of hybrid models of BJT, simplified hybrid models of CE, CB, CC configurations, CE amplifier with emitter resistance, Emitter follower, High-input-resistance transistor circuits: Darlington Circuit, Cascode Amplifier. Transistor Power Amplifiers: Circuits and Operations of Class A, Class B, Class C and Push-Pull Configurations.

Module – 2:
Multistage amplifiers: Frequency response of an amplifier, Bandpass of cascaded stages, Low-frequency response of RC coupled amplifier. Transistors at High Frequencies: Hybrid π model and parameters; the high-frequency response of CE transistor amplifier, Gain-Bandwidth product, Emitter follower at high frequencies, FET (CS & CD) at high frequencies. Tuned amplifiers: single-tuned amplifier, synchronously tuned amplifier, Gain-Bandwidth product.

Module – 3:
Feedback Amplifiers: Classification of amplifiers, feedback concept, transfer gain with feedback, characteristics of the negative-feedback amplifier, a method of analysis of feedback amplifiers, voltage-series feedback, current-series feedback, current-shunt feedback, voltage-shunt feedback. The concept of stability, gain margin and phase margin. Oscillators: RC phase shift oscillator, Wien bridge oscillator, crystal oscillator. Current mirror circuits.

Module – 4:
An emitter-coupled differential amplifier, transfer characteristics of the differential amplifier, IC of operational amplifier: gain stages and output stages, Electronic analog computation using an op-amp, Non-linear applications of OP-AMP: zero-crossing detector, precision rectifier, peak detector, logarithmic amplifier, Schmitt trigger. Active filters: Low pass, high pass, band pass and band stop, design guidelines.

Module – 5:
Sample-and-hold circuit, D/A converters: Weighted-resistor D/A Converter, R-2R Ladder type D/A converter, Specifications for D/A Converters. A/D Converters: Parallel-comparator type A/D converter, Successive approximation type A/D converter, Counter type A/D converter, Dual slope converter, Comparison of converter types.

Text books:
1. "Integrated Electronics", Millman & Halkias, TMH
2. "Electronics Circuits: Discrete and Integrated", D. Schilling and C. Belove, McGraw-Hill
3. "Operational Amplifiers and Linear Integrated Circuits" by R. A. Gayakwad, PHI
4. "Digital Integrated Electronics". Taub & Schilling, TMH.

Reference books:
1. "Electronic Devices and Circuit", Millman , Halkias, S Jit, TMH
2. "Micro Electronic Circuits", A. S. Sedra and K. C. Smith, Oxford press

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/teaching aids/Seminars
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as the use of NPTEL materials and internets
CD7	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tools	**% Contribution during CO Assessment**
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	**% Distribution**
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment					

Semester End Examination					

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as the use of NPTEL materials and internets
CD7	Simulation

Mapping between Course Outcomes and Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	3	1	1			3		3
CO2	3	3	2	3	3	2	1			3		3
CO3	3	3	2	3	3	2	1			3		3
CO4	3	3	2	3	3	3	1			3		3
CO5	3	3	2	3	3	3	1			3		3

< 34% = 1, 34-66% = 2, > 66% = 3

The mapping between Course Outcomes and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3, CD6, CD7
CO2	CD1, CD2, CD3, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD2, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course Code: EC 255
Course Title: Analog Communication
Pre-requisite(s): EC205 Signals and Systems
Co-requisite(s): N/A
Credits: L: 3 T: 0 P: 0
Class schedule per week: 03
Class: B. Tech
Semester / Level: 04/02
Branch: ECE
Name of Teacher:

Course Objectives
This course enables the students:

1	To understand the analog communication system and representation of signals.
2	To comprehend different methods of amplitude modulation and demodulation schemes, their design, operation and applications.
3	To comprehend different methods of angle modulation and demodulation schemes, their design, operation and applications.
4	To understand different methods of pulse modulation, their design, operation and applications.
5	Comprehend the performance of analog communication system in the presence of noise.

Course Outcomes:
After the completion of this course, students will be able to:

CO1	Explain the analog communication system and representation of signals.
CO2	Analyze different methods of amplitude modulation and demodulation schemes, their design, operation and applications.
CO3	Analyze different methods of angle modulation and demodulation schemes, their design, operation and applications.
CO4	Explain different methods of pulse modulation, their design, operation and applications.
CO5	Evaluate the performance of analog communication system in the presence of noise.

SYLLABUS

Module 1:
Model of the communication system, Fourier analysis of Continuous and Discrete signal, Energy spectral density spectrum, Power spectral density spectrum, correlation, Hilbert transform, distortion less transmission, pre-envelope and canonical representation of band pass signals.

Module 2:
Amplitude modulation systems: amplitude modulation, square law modulator, switching modulator, square law demodulator, envelope detector, double side band suppressed carrier modulation, balanced and ring modulators, single side band modulation, frequency discrimination and phase discrimination modulators, coherent detection of SSB, frequency division multiplexing and time division multiplexing, super heterodyne AM receiver and its characteristics. Vestigial Side band,

Module 3:
Angle modulation systems: basics of frequency and phase modulation, single tone frequency modulation, NBFM, WBFM, the Transmission bandwidth of FM wave, indirect and direct methods of FM generation, frequency discriminator, phase locked loop demodulator, super heterodyne FM receiver.

Module 4:
Difference between Continuous wave and Pulse Modulation, Pulse modulation systems: pulse amplitude modulation, pulse duration modulation, pulse position modulation, Time Division Multiplexing.

Module 5:
Noise in communication systems: noise, shot noise, thermal noise, white noise, noise equivalent bandwidth, signal to noise ratio for coherent detection of DSBSC, SNR for coherent reception with SSB modulation, SNR for AM receiver using envelope detection, Noise in FM reception, FM Threshold effect, pre-emphasis and de-emphasis.

Text Book:

1. Simon Haykin, "Communication Systems", Wiley Eastern Limited, New Delhi, 2016, 4/e.
2. B. P. Lathi and Zhi Ding, "Modern Digital and Analog Communication Systems", Oxford University Press, 2011, 4/e, (Indian Edition)

Reference Books:

1. John G. Proakis and Masoud Salehi, "Fundamentals of Communication Systems" Pearson Education, Inc., New Delhi, 2013.
2. Bruce Carlson and Paul B. Crilly, "Communication Systems: An Introduction to Signals and Noise in Electrical Communication", Tata McGraw Hills Education Pvt. Ltd., New Delhi, 2011, 5/e.

Gaps in the syllabus (to meet Industry/Profession requirements): Teaching with reference to current industrial needs

POs met through Gaps in the Syllabus: PO 11 will be met though report-writing/presentation-based assignment

Topics beyond syllabus/Advanced topics/Design: Teaching using current research and developments

POs met through Topics beyond syllabus/Advanced topics/Design: PO 9

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50
Continuous Internal Assessment	% Distribution
Mid-semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as the use of NPTEL materials and internets
CD7	Simulation

Mapping between Course Outcomes and Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	-	-	-	-	-	-	-	2
CO2	3	3	3	3	2	-	-	-	-	-	-	1
CO3	3	3	3	3	2	-	-	-	-	-	-	1
CO4	3	3	3	3	3	-	-	-	-	-	-	1
CO5	3	3	3	3	3	-	-	-	-	-	-	1

< 34% = 1, 34-66% = 2, > 66% = 3

Mapping between Course Outcomes and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3, CD6, CD7
CO2	CD1, CD2, CD3, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD2, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course code: EC257
Course title: Electromagnetic Field and Waves
Pre-requisite(s): MA 103 Mathematics – I, MA107 Mathematics - II
Co- requisite(s):
Credits: L:3 T:0 P:3
Class schedule per week: 03
Class: B. Tech
Semester / Level: 04
Branch: ECE
Name of Teacher:

Course Objectives:

This course enables the students:

1.	To apply the basic skills of mathematics, physics and science to understand, design and develop various engineering problems involving electromagnetic fields.
2.	To lay the foundations of electromagnetic engineering and its applications in modern communications involving both wireless and guided wave medium.
3.	To analyze the electromagnetic wave propagation in a guided and unguided medium having different medium properties and different boundary conditions.
4.	To develop an ability to identify, formulate, and solve electromagnetic engineering problems.
5.	To review and present the literature ethically and also develop the skill to work individually or in a team.

Course Outcomes:

After the completion of this course, students will be able to:

CO1.	Explain the basic concepts of time-varying electric and magnetic fields in different electromagnetic media.
CO2.	Analyze Maxwell's equation in differential and integral forms and apply them to diverse engineering problems.
CO3.	Examine and understand the phenomena of wave propagation in different media and its interfaces as well as in guided medium and its applications in microwave engineering.
CO4.	Identify, formulate and solve electromagnetic engineering problems.
CO5.	Work in a small team and communicate electromagnetic concepts both orally and in writing following ethical rules.

Syllabus

Module – 1:
Introduction to Maxwell's Equations, Faraday's Law, Transformer & Motional EMF, Displacement Current, Maxwell's Equations (Generalized form), Boundary Conditions and Wave Equation: Electromagnetic Boundary Conditions, Time-varying Potentials, Time harmonic fields, Time harmonics Maxwell's Equations.

Module – 2:
Wave Equation & Plane Waves in unbounded homogeneous, plane waves in free space and lossy media, Skin depth, Poynting vector and Power considerations, Polarization of Electromagnetic waves, Reflection of a plane wave at Normal incidence and Oblique incidence. Parallel & Perpendicular Polarization at perfect conducting & dielectric boundaries, Brewster's Angle.

Module – 3:
Transmission line parameters & Equations, Input Impedance, SWR and Power, The Smith Chart, Quarter Wave Transformer Matching, Single Stub Tuner(Matching), Slotted line (Impedance Measurement, Transients on transmission lines, Microstrip Transmission lines, strip lines, Slot lines and Co-planar lines.

Module –4:
Transverse Electric and Transverse Magnetic wave propagation in Rectangular Waveguide, Rectangular Cavity Resonator, Circular Cavity Resonator, a Quality factor of the rectangular Cavity Resonator.

Module-5:
Solution for potential function, Radiation from the Hertz dipole, Power radiated by Hertzian dipole, Radiation Parameters of antenna, Monopole and Dipole antenna.

Text books:

1. Principle of Electromagnetics, Matthew N.O. *Sadiku* & S.V. Kulkarni, Oxford University Press, Sixth Edition.

Reference books:

1. Electromagnetics field Theory and Transmission Line G.S.N Raju, Pearson Education
2. Electromagnetic Waves and Radiating Systems, 2/e, E. C. Jordan and K. G.Balmain, PHI.
3. Electromagnetics, David Cheng, Prentice Hall

Gaps in the syllabus (to meet Industry/Profession requirements): Hands-on-practical for Electromagnetic waves Lab.

POs met through Gaps in the Syllabus: PO10 (will be met though report-writing/ assignment/viva).

Topics beyond syllabus/Advanced topics/Design: N/A

POs met through Topics beyond syllabus/Advanced topics/Design: N/A

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

Direct Assessment

Assessment Tools	**% Contribution during CO Assessment**
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	**% Distribution**
Mid semester examination	25
Two quizzes	20 (2×10)
Teacher's Assessment	5

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as the use of NPTEL materials and internets
CD7	Simulation

Mapping between Course Outcomes and Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	1	2	-	-	-	1	1	-	1
CO2	-	1	-	1	1	-	-	-	1	1	-	1
CO3	3	1	-	1	1	-	-	-	1	1	-	1

CO4	1	2	1	2	1	1	1	1	1	1	1	1
CO5	1	1	1	1	1	1	1	1	1	1	-	1

< 34% = 1, 34-66% = 2, > 66% = 3

The mapping between Course Outcomes and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3, CD6, CD7
CO2	CD1, CD2, CD3, CD6, CD7
CO3	CD1, CD2, CD3, CD6, CD7
CO4	CD1, CD2, CD3, CD6, CD7
CO5	CD1, CD2, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course code: MA 204
Course title: Numerical Methods Lab
Pre-requisite(s): NIL
Co- requisite(s): ---NIL
Credits: L: 0 T: 0 P: 2 C:1
Class schedule per week: 2 Sessionals
Class: BE
Semester / Level: III / UG
Branch: ALL
Name of Teacher:

List of Assignment

1. Find a simple root of $f(x)=0$ using bisection method. Read the end points of the interval (a,b) in which the root lies, maximum number of iterations n and error tolerance eps.
2. Find a simple root of $f(x)=0$ using Regula-Falsi method. Read the end points of the interval (a,b) in which the root lies, maximum number of iterations n and error tolerance eps.
3. Find a simple root of $f(x)=0$ using Newton Raphson method. Read any initial approximation x_0, maximum number of iterations n and error tolerance eps.
4. Solution of a system of $n \times n$ linear equations using Gauss elimination method with partial pivoting. The program is for 10×10 system or higher order system.
5. Matrix inversion and solution of $n \times n$ system of equations using Gauss-Jordan method. If the system of equations is larger than 15×15 change the dimensions of the float statement.
6. Program to solve a system of equation using Gauss-Seidel iteration method. Order of the matrix is n, maximum number of iterations $niter$, error tolerance is eps and the initial approximation to the solution vector is x_0. If the system of equations is larger than 10×10 change the dimension in float.
7. Program to find the largest Eigen value in magnitude and the corresponding Eigen vector of a square matrix A of order n using power method.
8. Program for Lagrange interpolation.
9. Program for Newton divided difference interpolation.
10. Program for Newton's forward and backward interpolation.
11. Program for Gauss's central difference interpolation (both backward and forward).
12. Program to evaluate the integral of $f(x)$ between the limits a to b using Trapezoidal rule of integration based on n subintervals or $n+1$ nodal points. The values of a,b and n are to be read. The program is tested for $f(x)=1/(1+x)$.
13. Program to evaluate the integral of $f(x)$ between the limits a to b using Simpson's rule of integration based on $2n$ subintervals or $2n+1$ nodal points. The values of a,b and n are to be read and the integrand is written as a function subprogram. The program is tested for $f(x)=1/(1+x)$.
14. Program to solve an IVP, $dy/dx = f(x), y(x_0)=y_0$ using Euler method. The initial value x_0, y_0 the final value x_f and the step size h are to be read. The program is tested for $f(x,y)=-2xy^2$.
15. Program to solve an IVP, $dy/dx = f(x), y(x_0)=y_0$ using the classical Runge-Kutta fourth order method with step size h, $h/2$ and also computes the estimate of the truncation error. Input parameters are: initial point, initial value, number of intervals and the step length h. Solutions with h, $h/2$ and the estimate of the truncation error are available as output. The right hand side The program is tested for $f(x,y)=-2xy^2$.

COURSE INFORMATION SHEET

Course code: IT202
Course title: **Basic IT Workshop**
Pre-requisite(s):
Co- requisite(s):
Credits: L: 0 T: 0 P: 2
Class schedule per week: 2
Class: B. Tech
Semester / Level: II
Branch: All

Course Objectives

This course enables the students:

1.	Understand and use the basic Matlab functions and understand its environment and variables
2.	Know about handling operations and advanced features like menus and toolbars
3.	Implement programs with the use of arrays, strings and graphical data representations
4.	Understand Python, Data Types, Operators, Arrays
5.	Implement Functions and loops, object oriented programming using Python

Course Outcomes

After the completion of this course, students will be able:

1.	Apply features of Matlab and algorithms to solve problems
2.	Develop application programs with the help of various tool boxes available in Matlab.
3.	Apply data analysis through graphical data representations
4.	Implement programs with the use of arrays, strings in Matlab
5.	Implement Functions and loops, using Python

Syllabus

Module I

Introduction to MATLAB and Basics Part I:

Introduction, Advantage, Disadvantage of MATLAB, MATLAB Environment, Variables and Array, Built-in Functions of MATLAB, Subarrays, Multidimensional Arrays, Data Files.

Module II

MATLAB Basic Part II:

Scalar and Array Operations, Hierarchy of Operations, Introduction to Plotting, Polar Plots, Subplots, MATLAB profiler. String Functions, Complex Data, Three-Dimensional Plot

Module III

MATLAB Advanced Features:

Sparse Arrays, Cell Arrays,Structure Arrays, I/O Functions, Object Handles, Position and Units, Graphical User Interface: Dialog Boxes, Menus, Toolbars.

Module IV

Introduction to Python Basics

Basics, I Python, Data Types, Operators, Arrays, Plotting

Module V

Python Programming Part 2:

Functions and loops, object oriented programming, Numerical Formalism

Sample list of Assignments:

Sample Assignments on Python

Data Types, Input- Outputs, Variables

1. Write a program in Python to swap two variables.

2. Write a program in Python to check the input character is an alphabet or not.

Loop

3. Write a program in python to shuffle a deck of card using the module random and draw 5 cards.

4. Write a program in python to find the factors of a number.

Array and Lists

5. Write a program in python to transpose a given matrix M = [[1, 2], [4, 5], [3, 6]].

6. Write a program in python to print the median of a set of numbers in a file.

Function

6. Write a function in Python to find the resolution of a JPEG image.

7. Write a program in python and use in-built functions to convert a decimal number to binary, octal and hexadecimal number.

8. Write a program in python to sort words in alphabetical order.

Plot

9. Use Matplotlib to draw histogram to represent average age of population given as Age [21, 54, 66, 44, 32,42, 54, 62, 93, 45, 32, 70]

10. Create a 3-D plot in Python for the function $\sqrt{y^2 - x^2}$ over the interval -3 ≤ x ≤ 3 and -3 ≤ x ≤ 3.

Sample Assignments on MATLAB

Assignment Statements:

1. Given two sides a= 3.2 and b=4.6 of a triangle and angle theta= 600 between these two sides. Find the length of the third side and the area of the triangle.

2. Write a MATLAB statement to calculate the sum of the series:

S= 1- x2/2! + x4/4! – x6/6! + x8/8!   for x= 1.5

Arrays

3. The array A is given below. Extend the 2-D array to 3-D array by including another 2-D array as second element in the third dimension.

$$A = \begin{matrix} 1 & 2 & 3; \\ 5 & 4 & 3; \\ 1 & 3 & 6; \end{matrix}$$

4. Let a matrix A of size (3x4) is defined as, $A = \begin{matrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \end{matrix}$. Reshape the matrix A into matrix B of the size (6x2).

5. Let a column vector z be given as z = [2; 3; 4; 5].

(i) Form a diagonal matrix A, using the elements of z as he main diagonal elements of A.

(ii) Form the matrix B, using the elements of vector z as elements of upper diagonal of B.

(iii) Form the matrix C, using the elements of vector z as elements of first lower diagonal of C.

Polynomials

6. Integrate the polynomial y = 4x3 + 12x2 + 16x + 1. Take the constant of integration as 3.

7. Find the polynomial of degree 2 to fit the following data:

x	0	1	2	4
y	1	6	20	100

Input-Output statement and files

8. Write a program in MATLAB to illustrate the use of ‘pause’ command.

9. Write a program in MATLAB to illustrate the use of fwrite function for writing binary data of different formats to a file named ‘check.txt’.

Plots

10. Plot the curve given by the equation y = sin(x) where x varies from 0 to 2π. Also label the x-axis and y-axis and provide a suitable title for the plot

11. Plot a bar graph for the data given as x = [1 2 3 4 5 6] and y = [10 15 25 30 27 19]

12. Given x = t2 and y = 4t for -4 < t < 4. Using MATLAB obtain a 3-D plot showing the matrix in (x, y) space as a factors of time.

Control structures

13. Write a program in MATLAB to find the count of even values in the given n numbers.

Functions

14. Write a function in MATLAB to calculate the roots of the quadratic equation ax2 + bx + c = 0, where a, b, c are constants.

Text Books:

1. MATLAB® Programming for Engineers:Stephen J. Chapman, Thomson Corporation, 4th Edition
2. Introduction to Python for Engineers and Scientists, Sandeep Nagar, Apress, 2018

Reference Books

1. Learn Python The Hard Way, Zed A. Shaw, Addison-Wesley, Third Edition

Gaps in the syllabus (to meet Industry/Profession requirements): N/A

POs met through Gaps in the Syllabus: N/A

Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

POs met through Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

CD #	Course Delivery methods
CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Seminars/ Quiz (s)
CD4	Mini projects/Projects
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training

CD8	Self- learning such as use of NPTEL materials and internets
CD9	Simulation

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Progressive Evaluation	(60)
Attendance Marks	12
Lab file Marks	12
Viva Marks	24
Day-to-day performance Marks	12
End SEM Evaluation	(40)
Lab quiz Marks	20
Lab performance Marks	20

Assessment Components	CO1	CO2	CO3	CO4
Progressive Evaluation	3	3	3	3
End SEM Evaluation	3	3	3	3

If satisfying < 34% = 1, 34-66% = 2, > 66% = 3

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping between Objectives and Outcomes

Mapping of Course Outcomes onto Program Outcomes

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

Course Outcome #	Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	1	3	2	1	3	1	2
CO2	2	3	3	3	3	1	1	2	1	3
CO3	1	3	2	1	3	1	1	1	1	1
CO4	2	3	3	2	2	1	1	2	1	3
CO5	3	3	1	2	3	1	1	2	1	1

COURSE INFORMATION SHEET

Course code: **EC254**
Course title: **Analog Circuits Lab.**
Pre-requisite(s): EC101 Basics of Electronics & Communication Engineering
Co- requisite(s): Analog Circuits
Credits: L: 0 T: 0 P: 3 C: 1.5
Class periods per week: 03
Class: B. Tech.
Semester / Level: IV
Branch: ECE
Name of Teacher:

Course Objectives
This course enables the students to:

1.	Realize the two-stage amplifier and simple tuned amplifier circuits.
2.	Implement the Feedback amplifier circuits.
3.	Realize the differential amplifier and oscillator.
4.	Realize the active band pass, band stop filter circuits.
5.	Know the operation of analog-to-digital and digital-to-analog converter circuits.

Course Outcomes
After the completion of this course, students will be able to:

CO1	Design two-stage amplifier and simple tuned amplifier circuits.
CO2	Design and analyze the feedback amplifier circuits.
CO3	Design and Characterize the differential amplifier and oscillator.
CO4	Design and Characterize the active band pass, band stop filter circuits.
CO5	Design the analog-to-digital and digital-to-analog converter circuits.

List of experiments:

1. Determine the h-parameters: h_{ie} and h_{fe} of a transistor.

2. Design and obtain the frequency response of Darlington pair amplifier.

3. Measurement of voltage gain, input resistance and output resistance of cascode Amplifier.

4. Determine the bandwidth of single stage and multistage amplifiers.

5. Design and determine the frequency, gain and bandwidth of single tuned amplifier.
6. Design and test the current-series and voltage-shunt feedback amplifier and to calculate the following parameters with and without feedback: a) Mid-band gain, B) Bandwidth and cut-off frequencies, c) Input and output impedance.
7. Design a Wein bridge oscillator and to draw its output waveform.
8. Design a differential amplifier using BJT and determine the CMRR.
9. Design and determine the characteristics of logarithmic and antilogarithmic amplifiers using op-amp.
10. Design and determine the characteristics of Active filters: band pass, band stop.
11. Construction of R-2R Ladder type 4-bit D/A converter.
12. Construction of 4-bit comparator type A/D Converter.

Text books:

1. “Integrated Electronics”, Millman & Halkias, McGraw Hill.

Reference books:

1. “Electronic Devices and Circuit Theory”, Nashelesky & Boylestead, PHI/Low price edition.

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design: through experiments involving design/modelling of device/circuits on advanced topics

<u>POs met through Topics beyond syllabus/Advanced topics/Design:</u> through experiments involving design/modelling of device/circuits on advanced topics

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/teaching aids/Seminars
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure

<u>Direct Assessment</u>

Assessment Tools	% Contribution during CO Assessment
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	% Distribution
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	% Distribution
Examination Experiment Performance	30
Quiz	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment					
Semester End Examination					

<u>Indirect Assessment</u>

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects

CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

Mapping between Course Outcomes and Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	1	1		3		3
CO2	3	3	3	3	3	1	1	1		3		3
CO3	3	3	3	3	3	1	1	1		3		3
CO4	3	3	3	3	3	1	1	1		3		3
CO5	3	3	3	3	3	1	1	1		3		3

< 34% = 1, 34-66% = 2, > 66% = 3

Mapping between Course Outcomes and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD3, CD6, CD7
CO2	CD1, CD3, CD6, CD7
CO3	CD1, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD3, CD6, CD7

COURSE INFORMATION SHEET

Course code: EC258

Course title: Electromagnetic Waves Lab.

Pre-requisite(s): MATLAB
Co- requisite(s): Electromagnetic Fields and Waves
Credits: L: 0 T: 0 P: 3
Class schedule per week: 03
Class: B. E.
Semester / Level: 04
Branch: ECE
Name of Teacher:

Course Objectives

This course enables the students to:

A.	Analyze Maxwell's equation in explaining the phenomenon of wave propagation.
B.	Apply Maxwell's equation in solving the time-varying electromagnetic field problems.
C.	Apply appropriate boundary conditions to solve the time-varying Electromagnetic Phenomena.
D.	Characterize the wave propagation in guided and unguided media under different media characteristics.
E.	Develop an insight to visualize and solve practical electromagnetic engineering problems.

Course Outcomes

After the completion of this course, students will be able to:

CO1	Formulate the electromagnetic problem and solve them using MATLAB simulation tool.
CO2	Visualize the wave propagation in different media and its implication on transmission, reflection and propagation phenomena.
CO3	Visualize the concept of wave propagation in guided media such as transmission lines and waveguides.
CO4	Visualize the concept of wave polarization.
CO5	Visualize and solve practical Electromagnetic engineering problems.

SYLLABUS

LIST OF EXPERIMENTS:

1. Using MATLAB, simulate and plot the phenomenon of Skin effect in current carrying conductors as a function of the conductivity of the conductor and the frequency of operation.

2. Using MATLAB, simulate and plot the variation of the time-varying field as a function of distance. Also plot the waveforms to depict linear, circular and elliptical polarization of the wave.

3. A parallel-plate capacitor with plate area 5 cm^2 and plate separation of 3 mm has a voltage 50 sin 10^3 t V applied to its plates. Using MATLAB, Compute the displacement current assuming (i) $\varepsilon = \epsilon_0$ (ii) $\varepsilon = 2\epsilon_0$

4. An electric field in free space is given by $E = 50 \cos (10^8 t + \beta x)\, a_y$ V/m. Using MATLAB, Compute (i) k, λ and T (ii) the time it takes to travel a distance of λ/2. (iii) Plot the wave at t = 0, T/4, and T/2.

5. Using MATLAB Compute the following problems

   (a) In free space, $E = 20 \cos (\omega t - 50 x)\, a_y$ V/m. Compute (i) J_d (ii) H (iii) ω

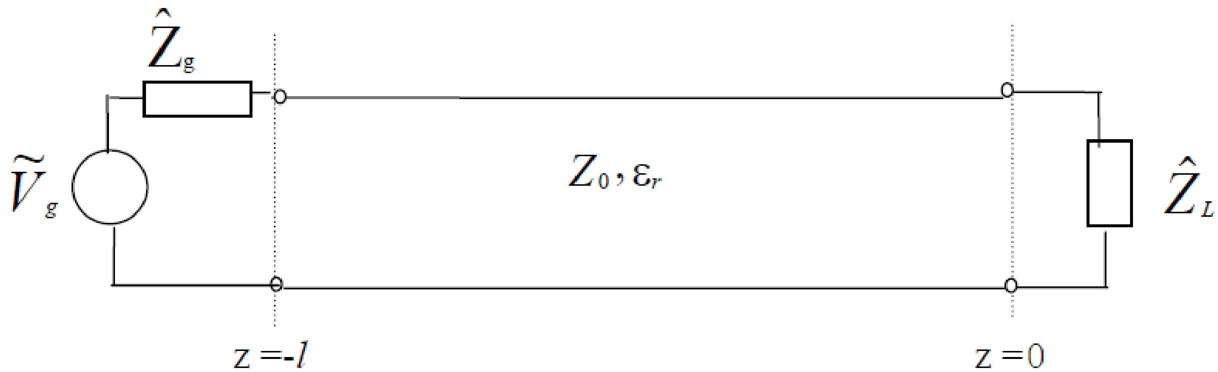
   (b) In a medium characterized by $\sigma = 0$, $\mu = \mu_0$, $\varepsilon = 4\epsilon_0$, and $E = 20 \sin(10^8 t - \beta z)\, a_y$ V/m

6. A plane wave propagating through a medium with $\epsilon_r = 8$, $\mu_r = 2$ and $E = 0.5\, e^{-z/3} \sin(10^8 t - \beta z)\, a_x$ V/m. Using MATLAB, compute (i) β (ii) the loss tangent (c) Intrinsic impedance (iv) Wave velocity (v) H field.

7. In free space ($z \leq 0$), a plane wave with $H_i = 10 \cos (10^8 t - \beta z)\, a_x$ mA/m is incident normally on a lossless medium ($\mu = 8\mu_0$, $\varepsilon = 2\epsilon_0$) in region $z \geq 0$. Using MATLAB, compute and plot the reflected wave H_r, E_r and the transmitted wave H_t and E_t.

8. Given a uniform plane wave in air as $E_i = 40 \cos(\omega t - \beta z) a_x + 30 \sin(\omega t - \beta z) a_y$ V/m. Using MATLAB compute and plot
   (i) H_i
   (ii) If the wave encounters a perfectly conducting plate normal to the z-axis at z = 0, find the reflected wave E_r and H_r.
   (iii) The total E and H fields for $z \leq 0$.
   (iv) The time-average Poynting vectors for $z \leq 0$ and $z \geq 0$.

9.



For the transmission line system shown,
f = 600 MHz, Zg = 50 Ω, Z0 = 50 Ω, l = 0.75 λ0, εr = 1.0. The values of the load is given as
(i) ZL = 0 Ω
(ii) ZL = open
(iii) ZL = 100 Ω
(iv) ZL = (25 + j 25) Ω
(v) ZL = (25 – j 25) Ω
Using MATLAB, obtain the following for each of the loads given above.
• The Standing Wave pattern
• Calculate SWR for each load. And plot the normalized SWR pattern.

10. A right-hand circularly polarized wave at 1.5 GHz is propagating through a material with ε_r = 6.2 and μ_r = 2.0 and arrives at an interface with air. It is incident at an elevation angle of 15° and an azimuthal angle of 45°. The wave has an amplitude of 12 V/m. The interface lies in the x-y plane. Using MATLAB, Compute
    (i) the angle of incidence θ_1.
    (ii) the critical angle and the Brewster's angles for this configuration for both polarizations.
    (iii) the reflection and transmission coefficients for both polarizations.
    (iv) the percent reflectance and transmittance for both polarizations. Verify the conservation of energy

11. Use MATLAB to visualize the first four electromagnetic modes in a rectangular waveguide with a/b = 2.25 and plot the phase constant β of the fundamental mode in from 0.5 GHz up to 3.0 GHz.

12. Write a MATLAB program that determines the first 20 modes supported by an air-filled rectangular waveguide and sorts them to be in ascending order, starting with the fundamental mode. The program should output a formatted table that labels each mode as either TEmn or TMmn along with its cutoff frequency. Create five difference tables, one

for each of the following five cases: Table 1: a = 0.5 cm and b = 1.0 cm Table 2: a = 1.0 cm and b = 1.0 cm Table 3: a = 1.5 cm and b = 1.0 cm Table 4: a = 2.0 cm and b = 1.0 cm Table 5: a = 2.5 cm and b = 1.0 cm.

Text books:

1. Principle of Electromagnetics, Matthew N.O. *Sadiku* & S.V. Kulkarni, Oxford University Press, Sixth Edition.

Reference books:

1. Electromagnetics field Theory and Transmission Line G.S.N Raju, Pearson Education
2. Electromagnetic Waves and Radiating Systems, 2/e, E. C. Jordan and K. G.Balmain, PHI.
3. Electromagnetics, David Cheng, Prentice Hall

Gaps in the syllabus (to meet Industry/Profession requirements): NA

POs met through Gaps in the Syllabus: NA

Topics beyond syllabus/Advanced topics/Design: Through simulations based on advanced topics after completion of compulsory twelve experiments.
POs met through Topics beyond syllabus/Advanced topics/Design: through experiments involving design of circuits on advanced topics

Course Outcome (CO) Attainment Assessment Tools and Evaluation Procedure
Direct Assessment

Assessment Tools	**% Contribution during CO Assessment**
Continuous Internal Assessment	60
Semester End Examination	40

Continuous Internal Assessment	**% Distribution**
Day to day performance & Lab files	30
Quiz(zes)	10
Viva	20

Semester End Examination	**% Distribution**
Examination Experiment Performance	30
Quiz	10

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Continuous Internal Assessment					
Semester End Examination					

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments
CD3	Laboratory experiments/Teaching aids/Seminars
CD4	Mini Projects
CD5	Industrial visits/in-plant training
CD6	Self- learning such as the use of NPTEL materials and internets
CD7	Simulation

The mapping between Course Outcomes and Program Outcomes

Course Outcome #	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	1	1	1	2	1	3
CO2	3	3	3	3	3	1	1	1	1	2	1	3
CO3	3	3	3	3	3	1	1	1	1	2	1	3
CO4	3	3	3	3	3	1	1	1	1	2	1	3
CO5	2	2	2	3	2	2	2	1	3	2	1	3

< 34% = 1, 34-66% = 2, > 66% = 3

The mapping between Course Outcomes and Course Delivery Method

Course Outcomes	**Course Delivery Method**
CO1	CD1, CD3, CD6, CD7
CO2	CD1, CD3, CD6, CD7
CO3	CD1, CD3, CD6, CD7
CO4	CD1, CD3, CD6, CD7
CO5	CD1, CD3, CD6, CD7