JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech. in ELECTRONICS AND COMMUNICATION ENGINEERING
COURSE STRUCTURE & SYLLABUS (R25 Regulations – Constituent Colleges)
Applicable from AY 2025-26 Batch

I Year I Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1.	5MA101BS	Matrices and Calculus	3	1	0	4
2.	5CH102BS	Engineering Chemistry	3	0	0	3
3.	5CS103ES	C Programming and Data Structures	3	1	0	4
4.	5EC104PC	Electronic Devices and Circuits	3	1	0	4
5.	5EC105ES	Introduction to Electrical Engineering	2	0	0	2
6.	5CH106BS	Engineering Chemistry Laboratory	0	0	2	1
7.	5CS107ES	C Programming and Data Structures Laboratory	0	0	2	1
8.	5EC108PC	Electronic Devices and Circuits Laboratory	0	0	2	1
9.	5EC109ES	Electrical Engineering Laboratory	0	0	2	1
10.		Induction Program				
		Total	**14**	**03**	**08**	**21**

I Year II Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1.	5MA201BS	Ordinary Differential Equations and Vector Calculus	3	0	0	3
2.	5PH202BS	Applied Physics	3	0	0	3
3.	5ME203ES	Engineering Graphics and Computer Aided Drafting	2	0	2	3
4.	5EE204ES	Network Analysis and Synthesis	3	0	0	3
5.	5EN205HS	English for Skill Enhancement	3	0	0	3
6.	5PH206BS	Applied Physics Laboratory	0	0	2	1
7.	5EC207ES	Applied Python Programming Laboratory	0	1	2	2
8.	5EN208BS	English Language and Communication Skills Lab	0	0	2	1
9.	5ME209ES	Engineering Workshop	0	0	2	1
		Total	**14**	**1**	**10**	**20**

II Year I Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1.	5EC301PC	Probability Theory and Stochastic Processes	3	0	0	3
2.	5EC302PC	Signals and Systems	3	1	0	4
3.	5EC303PC	Electronic Circuit Analysis	3	0	0	3
4.	5EC304PC	Digital Logic Design	3	0	0	3
5.	5EC305PC	Control Systems Engineering	2	0	0	2
6.	5MS306HS	Innovation and Entrepreneurship	2	0	0	2
7.	5EC307PC	Modelling and Simulation Laboratory	0	0	2	1
8.	5EC308PC	Electronic Circuit Analysis Laboratory	0	0	2	1
9.	5EC309PC	Digital Logic Design Laboratory	0	0	2	1
10.	5EC310SD	Linux and Shell Scripting	0	0	2	1
11.	5VA300ES	Environmental Science	1	0	0	0
		Total	**17**	**1**	**08**	**21**

II Year II Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1.	5MA401BS	Numerical Methods and Complex Variables	3	0	0	3
2.	5EC402PC	Electromagnetic Fields and Transmission Lines	3	0	0	3
3.	5EC403PC	Analog and Digital Communications	3	0	0	3
4.	5EC404PC	RISC and Microcontroller Architectures	3	0	0	3
5.	5EC405PC	Linear and Digital IC Applications	3	0	0	3
6.	5MA406BS	Computational Mathematics Laboratory	0	0	2	1
7.	5EC407PC	Analog and Digital Communications Laboratory	0	0	2	1
8.	5EC408PC	RISC and Microcontroller Interfacing Laboratory	0	0	2	1
9.	5EC409PC	Linear and Digital IC Applications Laboratory	0	0	2	1
10.	5EC410SD	Web and Mobile Applications	0	0	2	1
		Total	**15**	**0**	**10**	**20**

III Year I Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1.	5EC501PC	Digital Signal Processing	3	0	0	4
2.	5EC502PC	IoT Architectures and Protocols	3	0	0	3
3.	5EC503PC	CMOS VLSI Design	3	0	0	3
4.		Professional Elective-I	3	0	0	3
5.		Open Elective-I	2	0	0	2
6.	5EC504PC	IoT Architectures and Protocols Laboratory	0	0	2	1
7.	5EC505PC	CMOS VLSI Design Laboratory	0	0	2	1
8.	5EC506PC	Digital Signal Processing Laboratory	0	0	2	1
9.	5EC507PC	Field-based Research Project	0	0	4	2
10.	5EC508SD	FPGA based System Design	0	0	2	1
11.	5VA500HS	Indian Knowledge System	1	0	0	0
		Total	**15**	**0**	**12**	**21**

III Year II Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1.	5EC601PC	Antenna and Wave Propagation	3	1	0	4
2.	5EC602PC	Wireless Communications	3	0	0	3
3.	5MS603HS	Business Economics and Financial Analysis	3	0	0	3
4.		Professional Elective-II	3	0	0	3
5.		Open Elective – II	2	0	0	2
6.	5EC604PC	Advanced Communications Laboratory	0	0	2	1
7.	5EC605PC	Wireless Communications Laboratory	0	0	2	1
8.	5EC606PC	System Verilog and UVM Laboratory	0	0	2	1
9.	5EN607HS	English for Employability Skills Laboratory	0	0	2	1
10.	5EC608SD	Communication Technologies	0	0	2	1
11.	5VA600HS/ 5VA601HS	Gender Sensitization Lab*/ Human Values and Professional Ethics*	1	0	0	0
		Total	**15**	**1**	**10**	**20**

*Note: For the courses Gender Sensitization Lab and Human Values and Professional Ethics- one hour of instruction will be conducted on alternate weeks. For example, if a one-hour class for Gender Sensitization Lab is conducted this week, then a one-hour class for Human Values and Professional Ethics will be conducted in the following week.

IV Year I Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1.	5EC701PC	Microwave and Optical Communications	3	0	0	3
2.	5EC702PC	Embedded System Design	3	0	0	3
3.	5MS703HS	Fundamentals of Management for Engineers	3	0	0	3
4.		Professional Elective-III	3	0	0	3
5.		Professional Elective – IV	3	0	0	3
6.		Open Elective – III	2	0	0	2
7.	5EC704PC	Microwave and Optical Communications Laboratory	0	0	2	1
8.	5EC705PC	Embedded System Design Lab	0	0	2	1
9.	5EC706PC	Industry Oriented Mini Project/ Internship	0	0	4	2
		Total	**17**	**0**	**08**	**21**

IV Year II Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1.		Professional Elective – V	3	0	0	3
2.		Professional Elective – VI	3	0	0	3
3.	5EC801PC	Project Work	0	0	28	14
		Total	**06**	**0**	**28**	**20**

*Note: Students who wish to exit after II Year II Semester has to register for this optional course and acquire the credits allotted by doing 6 weeks Work-based Vocational Course/ Internship or Apprenticeship. Please refer R25 Academic Regulations for more information.

Professional Elective - I

5EC511PE	Computer Organization and Operating Systems
5EC512PE	Electronic Measurements and Instrumentation
5EC513PE	CMOS Fabrication Technology
5EC514PE	Sustainability for Electronics

Professional Elective - II

5EC621PE	Computer Networks & Protocols
5EC622PE	Artificial Neural Networks and Deep Learning
5EC623PE	Digital Signal Processors and Architectures
5EC624PE	Analog IC Design

Professional Elective-III

5EC731PE	Digital Image Processing
5EC732PE	Network Security and Cryptography
5EC733PE	Test and Testability
5EC734PE	Biomedical Instrumentation

Professional Elective-IV

5EC741PE	5G and Beyond Communications
5EC742PE	Adhoc Wireless Networks
5EC743PE	AI for Communications
5EC744PE	Biomedical Signal Processing

Professional Elective-V

5EC851PE	Radar Systems
5EC852PE	Computer Vision and Machine Learning
5EC853PE	Broadband Access Technologies
5EC854PE	RF Circuit Design

Professional Elective-VI

5EC861PE	Satellite Communications
5EC862PE	Quantum Technologies
5EC863PE	Global Navigation Satellite Systems
5EC864PE	System on Chip Architecture

OPEN ELECTIVES

Open Elective-I:

5EC511OE	C++ for Electronic Design Automation
5EC512OE	Digital Electronics for Engineers

Open Elective-II:

5EC621OE	Principles of Communications
5EC622OE	Electronics for Automated Testing

Open Elective-III:

5EC731OE	Measuring Instruments
5EC732OE	Hardware for IoT Applications

Annexure-II: Program Outcomes (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4).

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5).

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

5MA101BS: MATRICES AND CALCULUS

B.Tech. I Year I Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

Pre-requisites: Mathematical Knowledge at pre-university level

Course Objectives:

To learn

1. Applying basic operations on matrices and their properties.
2. Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
3. Concept of eigen values and eigen vectors and to reduce the quadratic form to canonical form
4. Geometrical approach to the mean value theorems and their application to the mathematical problems
5. Finding maxima and minima of functions of two and three variables.
6. Evaluation of multiple integrals and their applications.

Course outcomes:

After learning the contents of this course, the student must be able to:

1. Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations
2. Find the Eigen values and Eigen vectors
3. Reduce the quadratic form to canonical form using orthogonal transformations.
4. Solve the applications of the mean value theorems.
5. Find the extreme values of functions of two variables with/ without constraints.
6. Evaluate the multiple integrals and apply the concept to find areas, volumes.

UNIT-I: Matrices   **8 L**

Rank of a matrix by Echelon form and Normal form – Inverse of Non-singular matrices by Gauss-Jordan method. System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations. Gauss Seidel Iteration Method.

UNIT-II: Eigen values and Eigen vectors   **10 L**

Linear Transformation and Orthogonal Transformation: Eigen values – Eigen vectors and their properties – Diagonalization of a matrix – Cayley-Hamilton Theorem (without proof) – Fnding inverse and power of a matrix by Cayley-Hamilton Theorem. Quadratic forms and Nature of the Quadratic Forms – Reduction of Quadratic form to canonical form by Orthogonal Transformation.

UNIT-III: Single Variable Calculus   **10 L**

Limit and Continuous of functions and its properties. Mean value theorems: Rolle's theorem – Lagrange's Mean value theorem with their Geometrical Interpretation and applications – Cauchy's Mean value Theorem – Taylor's Series (All the theorems without proof).

Curve Tracing: Curve tracing in cartesian coordinates.

UNIT- IV: Multivariable Calculus (Partial Differentiation and applications)   **10 L**

Definitions of Limit and continuity – Partial Differentiation: Euler's Theorem – Total derivative – Jacobian – Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

UNIT-V: Multivariable Calculus (Integration)   **10 L**

Evaluation of Double Integrals (Cartesian and polar coordinates) – change of order of integration (only Cartesian form) – Change of variables for double integrals (Cartesian to polar). Evaluation of Triple Integrals – Change of variables for triple integrals (Cartesian to Spherical and Cylindrical polar coordinates). Applications: Areas by double integrals and volumes by triple integrals.

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Editon, 2016.

REFERENCES:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

5CH102BS: ENGINEERING CHEMISTRY

B.Tech. I Year I Semester

L	T	P	C
3	0	0	3

Course Objectives:
1. To develop adaptability to new advances in Engineering Chemistry and acquire the essential skills to become a competent engineering professional.
2. To understand the industrial significance of water treatment, fundamental principles of battery chemistry, and the impact of corrosion along with its control methods for structural protection.
3. To impart foundational knowledge of various energy sources and their practical applications in engineering.
4. To equip students with an understanding of smart materials, biosensors, and analytical techniques applicable in engineering, industrial, environmental, and biomedical fields.

Course Outcomes:
1. Students will be able to understand the fundamental properties of water and its applications in both domestic and industrial purposes. (SDG 4, 6)
2. Students will gain basic knowledge of electrochemical processes and their relevance to corrosion and its control methods. (SDG 4)
3. Students will comprehend the significance and practical applications of batteries and various energy sources, enhancing their potential as future engineers and entrepreneurs. (SDG 4, 7, 9)
4. Students will learn the basic concepts and properties of polymers and other engineering materials. (SDG 4, 9)
5. Students will be able to apply the principles of UV-Visible, IR spectroscopy and Raman spectroscopy in analyzing pollutants in dye industries and biomedical applications. (SDG 4, 9, 13)

UNIT - I: Water and its treatment: [8]
Introduction- Hardness, types, degree of hardness and units. Estimation of hardness of water by complexometric method - Numerical problems. Potable water and its specifications (WHO) - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and break-point chlorination. Defluoridation- Nalgonda technique.
Boiler troubles: Scales, Sludges and Caustic embrittlement. Internal treatment of boiler feed water - Calgon conditioning, Phosphate conditioning, Colloidal conditioning. External treatment methods - Softening of water by ion- exchange processes. Desalination of brackish water – Reverse osmosis.

UNIT - II: Electrochemistry and Corrosion: [8]
Introduction- Electrode potential, standard electrode potential, Nernst equation (no derivation), electrochemical cell - Galvanic cell, cell representation, EMF of cell - Numerical problems. Types of electrodes, reference electrodes - Primary reference electrode - Standard Hydrogen Electrode (SHE), Secondary reference electrode - Calomel electrode. Construction, working and determination of pH of unknownsolution using SHE and Calomel electrode.
Corrosion: Introduction- Definition, causes and effects of corrosion – Theories of corrosion, chemical and electrochemical theories of corrosion, Types of corrosion: galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion - Nature of the metal, Nature of the corroding environment. Corrosion control methods - Cathodic protection Methods - Sacrificial anode and impressed current methods.

UNIT - III: Energy sources: [8]
Batteries: Introduction – Classification of batteries - Primary, secondary and reserve batteries with examples. Construction, working and applications of Zn-air and Lithium ion battery. Fuel Cells – Differences between a battery and a fuel cell, Construction and applications of Direct Methanol Fuel Cell (DMFC).
Fuels: Introduction and characteristics of a good fuel, Calorific value – Units- HCV, LCV- Dulongs

formula - Numerical problems.
Fossil fuels: Introduction, Classification, Petroleum- Refining of Crude oil, Cracking - Types of cracking - Moving bed catalytic cracking. LPG and CNG composition and uses.
Synthetic Fuels: Fischer-Tropsch process, Introduction and applications of Hythane and Green Hydrogen.

UNIT - IV: Polymers: [8]

Definition - Classification of polymers: Based on origin and tacticity with examples – Types of polymerization - Addition (free radical addition mechanism) and condensation polymerization.
Plastics, Elastomers and Fibers: Definition and applications (PVC, Buna-S, Nylon-6,6). Differences between themoplastics and thermo setting plastics, Fiber reinforced plastics (FRP).
Conducting polymers: Definition and Classification with examples - Mechanism of conduction in trans-poly-acetylene and applications of conducting polymers.
Biodegradable polymers: Polylactic acid and its applications.

UNIT - V: Advanced Functional Materials: [8]

Smart materials: Introduction, Classification with examples - Shape Memory Alloys – Nitinol, Piezoelectric materials – quartz and their engineering applications.
Biosensor - Definition, Amperometric Glucose monitor sensor.
Interpretative spectroscopic applications of UV-Visible spectroscopy for Analysis of pollutants in dye industry, IR spectroscopy in night vision-security, Pollution Under Control- CO sensor (Passive Infrared detection), Raman spectroscopy (application) - Tumour detection in medical applications.

TEXT BOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010.
2. Engineering Chemistry by Rama Devi, Dr. P. Aparna and Rath, Cengage learning, 2025.

REFERENCE BOOKS:

1. Engineering Chemistry: by Thirumala Chary Laxminarayana & Shashikala, Pearson Publications (2020)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi 2011.
3. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi 2015.
4. Engineering Analysis of Smart Material Systems by Donald J. Leo, Wiley, 2007.
5. Challenges and Opportunities in Green Hydrogen by Editors: Paramvir Singh, Avinash Kumar Agarwal, Anupma Thakur, R.K Sinha.
6. Raman Spectroscopy in Human Health and Biomedicine, https://www.worldscientific.com/doi/epdf/10.1142/13094

5CS103ES: C PROGRAMMING AND DATA STRUCTURES

B.Tech. I Year I Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

Course Objectives:

1. Understand the fundamentals of computer systems, algorithms, and flowcharts for problem-solving.
2. Learn the syntax, semantics, and structure of C programming for procedural problem solving.
3. Apply modular programming concepts using arrays, structures, pointers, and functions.
4. Implement and analyze sorting, searching, and file-handling techniques.
5. Gain proficiency in core data structures (linked lists, stacks, queues, trees) and their applications.

Course Outcomes:

By the end of the course, students will be able to:
1. **Apply** the fundamentals of C programming to develop structured, efficient, and error-free programs.
2. **Implement** arrays, structures, unions, strings, pointers, and functions for modular program design.
3. **Use** sorting, searching, and file handling techniques to solve real-world computational problems.
4. **Design and manipulate** data structures such as linked lists, stacks, and queues for efficient data management.
5. **Construct and traverse** binary trees and apply tree-based structures in problem-solving scenarios.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	1	0	0	0	0	1	1
CO2	3	3	3	2	1	0	0	0	0	1	1
CO3	3	3	3	3	2	0	0	0	0	2	1
CO4	3	3	3	3	2	0	0	0	0	2	1
CO5	3	3	3	3	2	0	0	0	0	2	1

C Programming

Unit – I

Introduction to Computers: Block Diagram of Computer Hardware and software, Algorithms, Flowcharts
Introduction to 'C' Programming: Identifiers and keywords, Data types, Constants, Variables, Operators and Expressions, Data inputs and outputs, Control statements, Writing 'C' Programs.

Unit – II

Arrays, Structures, Unions, Strings, Storage classes, Pointers, Functions, Recursive functions, passing different data types into functions.

Unit – III

File Handling – Text vs Binary streams, File Access Modes in C: Read, Write and Append, Sorting Methods: Selection sort, Bubble sort, Insertion sort, Searching methods - Linear, Binary and Logarithmic Search.

Data Structures

Unit – IV

Introduction to Data Structures, Abstract Data types, Linear list - Single linked list, Doubly linked list, Circularly linked lists and search on lists.

Unit – V

Stacks and Queues – Operations on stacks, Array & Linked representation of Stacks and Queues, Trees – Introduction, Types of Trees, Creating a Binary Tree from a General Tree, Traversing a Binary tree.

TEXT BOOKS:

1. B. A. Forouzan and R. F. Gilberg, C Programming & Data Structures, Cengage Learning, 2010.
2. Y. Kanetkar, Data Structures Through C, BPB Publications, 2010.

REFERENCE BOOKS:

1. C & Data Structures, P. Padmanabham, 3ed., B.S Publications.
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press.
3. Programming in C, Stephen G. Kochan, 3ed., Pearson Education.
4. C for Engineers and Scientist, H. Cheng, McGraw-Hill International Edition.
5. Data Structures using C, A.H. Tanenbaum, Y. Langsam & M.J. Augenstein, Peason Education PHI.
6. C Programming & Data Structures, E. Balaguruswamy, TMH.
7. C Programming & Data Structures, P. Dey, M Ghosh, R Thereja, Oxford University Press.
8. C & Data Structures, E.V. Prasad and N.B. Venkateshwarlu, S. Chand & Co.
9. Programming with 'C', Byron Gottfried, Schaum Outline series, 4ed., TMH.
10. Data Structures using 'C', Reena Theraja, Oxford University Press.

5EC104PC: ELECTRONIC DEVICES AND CIRCUITS

B.Tech. I Year I Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

Course Objectives:

1. To introduce the basic semiconductor devices such as diodes, transistors, their characteristics and applications.
2. To analyze simple diode circuits and transistor amplifiers.
3. To acquire the knowledge of special purpose electronic devices and their application.

Course Outcomes: Upon completion of the Course, the students will be able to:

1. Describe the working of diode, BJT and FET, their biasing methods, and deduce the expressions for device parameters/ current/ and current-voltage relationships.
2. Discuss and analyze the various diode circuits such as rectifiers, filters, clippers and clampers.
3. Design appropriate biasing circuits using BJT and analyze the low frequency transistor (BJT) amplifier circuits.
4. Analyze the low frequency FET amplifier circuits and understand the MOSFET operation.
5. Acquire the knowledge about the role of special purpose electronic devices and their applications.

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

UNIT - I

Diode: PN junction as a Diode, V-I characteristics, Diode resistance, Transition and Diffusion capacitance, Diode equivalent circuit, Specifications.

Diode Applications: Rectifiers - Half-wave, Full-wave (center-tap and bridge), Capacitor filter for rectifiers, Clippers and clampers.

UNIT - II

Bipolar Junction Transistor (BJT): Working principle, Current components, Common Base (CB), Common Emitter (CE), Common Collector (CC) configurations, Input and output characteristics, Transistor as an Amplifier.

BJT Biasing: Load line and operating point, Biasing techniques: Fixed bias, Collector-to-base bias, Self bias, Bias Stability, Thermal runaway, Bias compensation using diodes.

UNIT - III

BJT Amplifiers: Transistor Hybrid parameter model, Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier.

UNIT - IV

Field Effect Transistors (FET): Junction FET: Structure, operation, and characteristics, MOSFET: Enhancement and Depletion mode, Comparison of BJT and FET, FET Small Signal Model, Analysis of CS and CD JFET Amplifiers, Introduction to FinFET and CNTFET.

UNIT - V

Special Purpose Devices: Breakdown mechanisms in Zener Diodes, Zener diode characteristics and application, Structure, operation and characteristics of SCR and UJT, Principle of operation and characteristics of Tunnel diode, Varactor Diode, Photo diode, Solar cell, LED, Schottky diode.

TEXT BOOKS:

1. Jacob Millman, Christos C. Halkias, Satyabrata Jit - Electronic Devices and Circuits, McGraw-Hill Education, 4ed., 2016.
2. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory. Pearson, 11ed., 2015.

REFERENCES:

1. David A. Bell, Electronic Devices and Circuits, Oxford University Press, 5ed., 2008.
2. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, Oxford University Press, 7ed., 2014.
3. G.K. Mithal, Electronic Devices and Circuits, Khanna Publishers, 23ed., 2017.
4. S. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits, McGraw-Hill Education, 4ed., 2017.

5EC105ES: INTRODUCTION TO ELECTRICAL ENGINEERING

B.Tech. I Year I Semester

L	T	P	C
2	0	0	2

Prerequisites: Mathematics

Course Objectives:
- To understand DC and Single & Three phase AC circuits.
- To study and understand the different types of DC, AC machines and Transformers.
- To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.

Course Outcomes: After learning the contents of this paper the student must be able to
- Understand and analyze basic Electrical circuits
- Study the working principles of Electrical Machines and Transformers
- Introduce components of Low Voltage Electrical Installations.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To understand DC and Single & Three phase AC circuits.	3	2	1		2	0	0	1	2	0	1	2
To study and understand the different types of DC, AC machines and Transformers.	3	2	1	1	3	0	0	0	2	0	1	1
To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.	3	2	0		3	0	0	0	1	2	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Understand and analyse basic Electrical circuits	3	2	1	0	1	0	0	0	2	0	2	2
Study the working principles of Electrical Machines and Transformers	3	2	1	0	3	1	0	1	1	2	1	2
Introduce components of Low Voltage Electrical Installations.	3	2	1	1	3	2	0	0	1	0	2	2

UNIT-I:
D.C. Circuits: Introduction to R, L and C elements, Independent voltage and current sources, KVL & KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT-II:
A.C. Circuits: Introduction to sinusoidal waveforms, phasor representation, the concept of power and power factor, Analysis of 1-phase RLC series and parallel circuits, resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III:
Transformers: Principle of operation**,** equivalent circuit, losses, regulation and efficiency. Introduction to Auto-transformer.

UNIT-IV:
Electrical Machines: Principle of operation of DC machine, performance characteristics of dc shunt machine. Principle of operation of a 3-phase induction motor, torque-slip characteristics. Principle of operation of synchronous generator.

UNIT-V:
Electrical Installations: Components of LT Switchgear: SFU, MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, and Characteristics. Elementary calculations for energy consumption, power factor improvement and battery backup.

TEXT BOOKS:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition, 2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCE BOOKS:

1. P. Ramana, M. Suryakalavathi, G.T. Chandrasheker, "Basic Electrical Engineering", S. Chand, 2nd Edition, 2019.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
3. M. S. Sukhija, T. K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford, 1st Edition, 2012.
4. Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, "Basic Electrical Engineering", 2nd Edition, McGraw Hill, 2021.
5. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
6. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
7. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

5CH106BS: ENGINEERING CHEMISTRY LABORATORY

B.Tech. I Year I Semester   **L T P C**
                                                               0 0 2 1

Course Objectives:
1. Students will understand and perform experiments based on core chemical principles relevant to engineering applications.
2. Students will learn to estimate the hardness of water to assess its suitability for drinking purposes.
3. Students will acquire the ability to perform acid-base titrations using instrumental methods such as conductometry, potentiometry, and pH metry.
4. Students will gain hands-on experience in synthesizing polymers like Bakelite and Nylon – 6, 6 in the laboratory.
5. Students will learn to determine the unknown concentration of potassium permanganate ($KMnO_4$) using a calibration curve.

Course Outcomes:
1. Students will develop practical skills through hands-on chemistry experiments relevant to engineering. (SDG 4, 9)
2. Students will learn to determine important parameters such as water hardness and the corrosion rate of mild steel under various conditions. (SDG 6, 12)
3. Students will be able to apply techniques like conductometry, potentiometry, and pH metry to determine concentrations or equivalence points in acid-base reactions. (SDG 4, 9)
4. Students will gain experience in synthesizing polymers such as Bakelite and Nylon-6,6. (SDG 9, 12)
5. Students will understand the working principle of Colorimetry and the relationship between absorbance and concentration (Beer-Lambert Law). (SDG 3, 13)

List of Experiments:
I. **Volumetric Analysis:** Estimation of Hardness of water by EDTA Complexometry method.
II. **Conductometry:**
   1. Estimation of the concentration of strong acid by Conductometry.
   2. Estimation of the concentration of strong and weak acid in an acid mixture by Conductometry.
III. **Potentiometry:**
   1. Estimation of concentration of Fe^{+2} ion by Potentiometry using $KMnO_4$.
   2. Estimation of concentration of strong acid with strong base by Potentiometry using quinhydrone
IV. **pH Metry:** Determination of an acid concentration using pH meter.
V. **Colorimetry:** Verification of Lambert-Beer's law using $KMnO_4$.

VI. **Preparations:**
   1. Preparation of Bakelite.
   2. Preparation Nylon – 6, 6.
VII. **Corrosion:** Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.
VIII. **Virtual lab experiments:**
   1. Construction of Fuel cell and it's working.
   2. Smart materials for Biomedical applications
   3. Batteries for electrical vehicles.
   4. Functioning of solar cell and its applications.

REFERENCE BOOKS:
1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022).
2. Vogel's text book of practical organic chemistry, 5th edition.
3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).

5CS107ES: C PROGRAMMING AND DATA STRUCTURES LABORATORY

B.Tech. I Year I Semester	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Course Objectives: The students will learn the following:

1. To work with an IDE to create, edit, compile, run and debug programs.
2. To analyze the various steps in program development.
3. To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
4. To develop modular, reusable and readable C Programs using the concepts like functions, arrays, etc.
5. To write programs using the Dynamic Memory Allocation concept.
6. To create, read from and write to text and binary files.

Course Outcomes: Upon completion of the Course, the students will be able to:

1. Develop modular and readable C Programs
2. Solve problems using strings, functions.
3. Handle data in files.
4. Implement stacks, queues using arrays, linked lists.
5. Understand and analyse various searching and sorting algorithms.

List of Experiments:

1. Write a C program to find the sum of individual digits of a positive integer.
2. Write a C program to generate a Fibonacci sequence.
   (Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence).
3. Write a C program to generate the first *n* natural numbers.
4. Write a C program to generate all the prime numbers between *1* and *n*, where *n* is a value supplied by the user.
5. Write a C program to find the roots of a quadratic equation.
6. Write a C program to find the factorial of a given integer.
7. Write a C program to find the GCD (greatest common divisor) of two given integers.
8. Write a C program to solve Towers of Hanoi problem.
9. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use Switch Statement).
10. Write a C program to find both the largest and smallest number in a list of integers.
11. Write a C program that uses functions to perform the following:

    i) Addition of Two Matrices   ii) Multiplication of Two Matrices
12. Write a C program that uses functions to perform the following operations:
    i) To insert a sub-string into a given main string from a given position.
    ii) To delete *n* characters from a given position in a given string.
13. Write a C program to determine if the given string is a palindrome or not.
14. Write a C program that displays the position or index in the string S where the string T begins, or − 1 if S doesn't contain T.
15. Write a C program to count the lines, words and characters in a given text.
16. Write a C program to generate Pascal's triangle.
17. Write a C program to construct a pyramid of numbers.
18. Write a C program that uses functions to perform the following operations:
    i) Reading a complex number
    ii) Writing a complex number
    iii) Addition of two complex numbers
    iv) Multiplication of two complex numbers (Note: represent complex number using a structure.)
19. Using files
    i) Write a C program which copies one file to another.
    ii) Write a C program to reverse the first *n* characters in a file.
    (Note: The file name and *n* are specified on the command line.)

20. Using files
    i) Write a C program to display the contents of a file.
    ii) Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file) .
21. Write a C program that uses functions to perform the following operations on singly linked list:
    i) Creation   ii) Insertion   iii) Deletion   iv) Traversal
22. Write C programs that implement Stack (its operations) using:
    i) Arrays   ii) Pointers
23. Write C programs that implement Queue (its operations) using:
    i) Arrays   ii) Pointers
24. Write a C program that implements the following sorting methods to sort a given list of integers in ascending order:
    i) Bubble sort   ii) Selection sort   iii) Insertion sort
25. Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a Key value in a given list of integers:
    i) Linear search   ii) Binary search

REFERENCE BOOKS:

1. C Programming & Data Structures, B.A. Forouzan and R. F. Gilberg, 3ed., Cengage Learning.
2. Let us C, Yeswanth Kanitkar.
3. C Programming, Balaguruswamy.

5EC108PC: ELECTRONIC DEVICES AND CIRCUITS LABORATORY

B.Tech. I Year I Semester	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Course Objectives:

1. To study the principle of working of various semiconductor devices, their characteristics and application.
2. Analyze the diodes circuits, BJT and FET amplifiers.

Course Outcomes: Upon completion of the Course, the students will be able to:

1. Identify and discuss the specifications, and Test the various passive and active electronic components including R, L, C, diodes, BJT, FET, SCR.
2. Demonstrate the characteristics of PN junction diode, Zener diode, SCR and Clippers and Clampers.
3. Design and compare various rectifier circuits with and without filter.
4. Examine the input and output characteristics of BJT and FET in various configurations and compute the various performance parameters.
5. Design the various transistor biasing circuits and obtain the frequency response of BJT and FET amplifiers.

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

PART - A

Electronic Workshop Practice (in 3 Lab sessions)

1. Identification and Testing of RLC components, Potentiometers, Switches, Transformers, Bread board, PCB.
2. Identification and Testing of Active Devices, Diodes, BJTs, FETs, LED, SCR, UJT.
3. Study and operation of Regulated Power Supply, Function Generator, Digital Multimeter, CRO.

PART - B

List of Experiments (Minimum of Twelve experiments to be done):

1. Forward and reverse bias characteristics of PN junction diode.
2. Reverse bias characteristics of a Zener diode and its application as a voltage regulator.
3. Full-wave rectifiers (center-tap and bridge) with and without capacitor filters.
4. Types of Clippers at different reference voltages.
5. Types of Clampers at different reference voltages.
6. Input and output characteristics of BJT in common base configuration.
7. Input and output characteristics of BJT in common emitter configuration.
8. Design of Self bias circuits to establish a stable operating point for a BJT amplifier and study DC load line behavior.
9. Frequency response of Common Emitter Amplifier.
10. JFET Characteristics.
11. Frequency response of Common Source FET Amplifier.
12. SCR Characteristics.
13. UJT Characteristics.
14. Enhancement-mode NMOS transistor characteristics.

Major Equipment required for Laboratories:

1. Regulated DC Power Supply, (0–30V)
2. Function Generator (0-1 MHz)
3. Digital Multimeter, Voltmeters and Ammeters
4. Cathode Ray Oscilloscope (CRO) or DSO
5. Breadboards and Connecting Wires
6. Electronic Components and Devices
7. Trainer Kits (optional but preferred for ease)

5EC109ES: ELECTRICAL ENGINEERING LAB

B.Tech. I Year I Sem.   **L T P C**
                                                                                  0 0 2 1

Prerequisites: Introduction to Basic Electrical Engineering.

Course Objectives:
- To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach.
- To study the transient response of various R, L and C circuits using different excitations.
- To determine the performance of different types of DC, AC machines and Transformers.

Course Outcomes: After learning the contents of this course, the students must be able to:
- Verify the basic Electrical circuits through different experiments.
- Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods.
- Analyze the transient responses of R, L and C circuits for different input conditions.

Course Objectives	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach	3	2	1		2	0	0	1	2	0	1	2
To study the transient response of various R, L and C circuits using different excitations	3	2	1	1	3	0	0	0	2	0	1	1
To determine the performance of different types of DC, AC machines and Transformers	3	2	0		3	0	0	0	1	2	1	1

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Verify the basic Electrical circuits through different experiments	3	2	1	0	1	0	0	0	2	0	2	2
Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods	3	2	1	0	3	1	0	1	1	2	1	2
Analyse the transient responses of R, L and C circuits for	3	2	1	1	3	2	0	0	1	0	2	2

different input conditions											

List of experiments/demonstrations:

PART- A (compulsory)
1. Verification of KVL and KCL
2. Verification of Thevenin's and Norton's theorem
3. Transient Response of Series RL and RC circuits for DC excitation
4. Resonance in series RLC circuit
5. Calculations and Verification of Impedance and Current of RLC series and Parallel AC circuits
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
7. Performance Characteristics of a DC Shunt Motor
8. Torque-Speed Characteristics of a Three-phase Induction Motor.

PART-B (any two experiments from the given list)
1. Verification of Superposition theorem.
2. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. No-Load Characteristics of a Three-phase Alternator

TEXT BOOKS:
1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4th Edition, 2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCE BOOKS:
1. P. Ramana, M. Suryakalavathi, G.T. Chandrasheker," Basic Electrical Engineering", S. Chand, 2nd Edition, 2019.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
3. M. S. Sukhija, T. K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford, 1st Edition, 2012.
4. Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, "Basic Electrical Engineering", 2nd Edition, McGraw Hill, 2021.
5. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
6. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
7. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

5MA201BS: ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

B.Tech. I Year II Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Pre-requisites: Mathematical Knowledge at pre-university level

Course Objectives:

To learn

1. Methods of solving the differential equations of first and higher order.
2. Concept, properties of Laplace transforms.
3. Solving ordinary differential equations using Laplace transforms techniques.
4. The physical quantities involved in engineering field related to vector valued functions
5. The basic properties of vector valued functions and their applications to line, surface and volume integrals

Course Outcomes:

After learning the contents of this course, the student must be able to:

1. Identify whether the given differential equation of first order is exact or not
2. Solve higher differential equation and apply the concept of differential equation to real world problems.
3. Use the Laplace Transforms techniques for solving Ordinary Differential Equations.
4. Evaluate the Line, Surface and Volume integrals and converting them from one to another.

UNIT- I: First Order Ordinary Differential Equations   **8 L**

Exact differential equations – Equations reducible to exact differential equations – linear and Bernoulli's equations – Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling – Law of natural growth and decay.

UNIT- II: Ordinary Differential Equations of Higher Order   **10 L**

Higher order linear differential equations with constant coefficients: Non-Homogeneous terms of the type $e^{ax}, \sin ax, \cos ax,$ polynomials in x, $e^{ax}V(x)$ and $x\,V(x)$ – Method of variation of parameters.

UNIT- III: Laplace Transforms   **10 L**

Laplace Transforms: Laplace Transform of standard functions – First shifting theorem – Laplace transforms of functions multiplied by 't' and divided by 't' – Laplace transforms of derivatives and integrals of function – Evaluation of integrals by Laplace transforms – Laplace transform of periodic functions – Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

UNIT- IV: Vector Differentiation   **10 L**

Vector point functions and scalar point functions – Gradient – Divergence and Curl – Directional derivatives – Vector Identities – Scalar potential functions – Solenoidal and Irrotational vectors.

UNIT- V: Vector Integration   **10 L**

Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and their applications

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Editon, 2016.

REFERENCES:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

5PH202BS: APPLIED PHYSICS

B.Tech. I Year II Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Pre-requisites: 10+2 Physics

Course Objectives:
1. To provide foundational knowledge in crystal structures, X-ray diffraction, and the principles and applications of nanomaterials.
2. To develop an understanding of the fundamental postulates and mathematical formulations of quantum mechanics.
3. To introduce the basic concepts and mathematical framework of quantum computing, including qubits, gates, and entanglement.
4. To explore the classification and properties of magnetic, dielectric, superconducting, and ferroelectric materials.
5. To explain the principles and applications of laser technology and fiber optics in modern communication and instrumentation.

Course Outcomes:
1. Students will be able to analyze crystal structures, apply Bragg's law, and explain the synthesis and characterization of nanomaterials. *(SDG 9)*
2. Students will demonstrate proficiency in quantum mechanical principles, such as the Schrödinger equation and wave function analysis. *(SDG 4, 9)*
3. Students will understand and apply the foundational elements of quantum computing, including quantum gates, measurement, and computation. *(SDG 9)*
4. Students will classify various magnetic and dielectric materials and explain the physics of superconductivity and polarization mechanisms. *(SDG 9)*
5. Students will describe the working principles of lasers and optical fibers and apply them to real-world technological applications. *(SDG 9, 7)*

UNIT - I: SOLID STATE PHYSICS &NANOTECHNOLOGY
Unit Cells, Crystal systems and Bravais lattices, Miller Indices and Inter-planar spacing, X-ray diffraction: Bragg's law, calculation of crystallite size with XRD. Introduction to nanomaterials, surface to volume ratio, quantum confinement, classification of nanomaterials, Synthesis (Sol-Gel, Ball Milling) and characterization techniques (SEM& TEM) of nanomaterials, applications of nanomaterials.

UNIT - II: QUANTUM MECHANICS
Introduction, de-Broglie hypothesis, Heisenberg uncertainty principle, physical significance of wave function, postulates of quantum mechanics: operators in quantum mechanics, eigen values and eigen functions, expectation value; Schrödinger's time independent wave equation, particle in a 1D box., Bloch's theorem(qualitative), Kronig-Penny model(qualitative), formation of energy bands, origin of bandgap, classification of solids.

UNIT - III: QUANTUM COMPUTING
Introduction, linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Bloch's sphere, concept of quantum computer, classical bits, Qubits, multiple Qubit system, quantum computing system for information processing, evolution of quantum systems, quantum measurements, entanglement, quantum gates, challenges and advantages of quantum computing over classical computation.

UNIT - IV: MAGNETIC AND DIELECTRIC MATERIALS
Introduction to magnetic materials, origin of magnetic moment-classification of magnetic materials, hysteresis, Weiss domain theory of ferromagnetism, soft and hard magnetic materials, introduction to superconductivity; properties, Type–I and Type–II superconductors. Applications of superconductors. Introduction to dielectric materials, types of polarization, electronic and ionic polarizabilities. Ferroelectric, piezoelectric, pyroelectric materials and their applications.

UNIT - V: LASER AND FIBRE OPTICS
Introduction to laser, characteristics of laser, population inversion, pumping, lasing action, Einstein coefficients and their relations, Ruby laser, He-Ne laser, CO_2 laser, semiconductor diode laser, applications of laser. Introduction to fibre optics, total internal reflection, construction of optical fibre, acceptance angle, numerical aperture, classification of optical fibres, losses in optical fibre, optical fibre for communication system, applications.

TEXT BOOKS:

1. Walter Borchardt-Ott, *Crystallography: An Introduction*, Springer.
2. Charles Kittel, *Introduction to Solid State Physics*, John Wiley & Sons, Inc.
3. Thomas G. Wong, *Introduction to Classical and Quantum Computing*, Rooted Grove

REFERENCE BOOKS:

1. Jozef Gruska, *Quantum Computing*, McGraw Hill
2. Michael A. Nielsen & Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press.
3. John M. Senior, *Optical Fiber Communications Principles and Practice*, Pearson Education Limited.

5ME203ES: ENGINEERING GRAPHICS AND COMPUTER AIDED DRAFTING

B.Tech. I Year II Semester   **L T P C**
                                                                        2 0 2 3

Course Objectives:

1. To develop the ability of visualization of different objects through technical drawings.
2. To acquire computer drafting skill for communication of concepts, ideas in the design of engineering products.

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

1. Apply computer aided drafting tools to create 2D and 3D objects.
2. Sketch conics and different types of solids.
3. Appreciate the need of Sectional views of solids and Development of surfaces of solids.
4. Read and interpret engineering drawings.
5. Conversion of orthographic projection into isometric view and vice versa manually and by using computer aided drafting.

UNIT – I: Introduction to Engineering Graphics
Principles of Engineering Graphics and their Significance, Geometrical Constructions, Scales – Plain & Diagonal, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid.
Introduction to Computer aided drafting – views, commands and conics

UNIT- II: Orthographic Projections (Conventional and Computer Aided)
Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes.
Computer aided orthographic projections – points, lines and planes.

UNIT – III: (Conventional and Computer Aided)
Projections of Regular Solids **-** Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views,
Computer aided projections of solids – sectional views

UNIT – IV: Development of Surfaces of Right regular solids
Prism, Cylinder, Pyramid and Cone.
Development of surfaces using computer aided drafting

UNIT – V: Isometric Projections (Conventional and Computer Aided)
Principles of Isometric Projection – Isometric Scale – Isometric Views –Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non-isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions.
Conversion of orthographic projection into isometric view using computer aided drafting.

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhatt, Charotar, 54th Edition, 2023.
2. Engineering Drawing and Graphics Using AutoCAD, T. Jeyapoovan and Vikas: S. Chand and company Ltd., 3rd Edition, 2010.

REFERENCE BOOKS:

1. Engineering Drawing, Basant Agrawal and C M Agrawal, McGraw Hill, 3rd Edition, 2019.
2. Engineering Graphics and Design, WILEY, John Wiley & Sons Inc, 3rdEdition, 2020.
3. Engineering Drawing, M. B. Shah and B.C. Rane, Pearson, 2nd Edition, 2009.
4. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford, 1st Edition, 2015.
5. Computer Aided Engineering Drawing, K Balaveera Reddy, CBS Publishers, 2nd Edition, 2015.

Note: - External examination is conducted in conventional mode and internal evaluation to be done by both conventional as well as using computer aided drafting.

5EE204ES: NETWORK ANALYSIS AND SYNTHESIS

B.Tech. I Year II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

1. To understand the basic concepts on RLC circuits.
2. To know the behavior of the steady state and transient states in RLC circuits.
3. To understand the two port network parameters.
4. Learn the concepts of various filters and attenuators.
5. To synthesize various networks using R, L and C combinations

Course Outcomes: Upon completion of the Course, the students will be able to:

1. Discuss the concepts of network topology and magnetically coupled circuits.
2. Compute the transient and steady state response of RLC circuits.
3. Analyze the electrical network and two port network parameters for different applications.
4. Understand and classify various filters, attenuators and equalizers.
5. Synthesize the RL, RC & RLC networks by Foster and Cauer forms.

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

UNIT - I

Network Topology and Magnetically coupled circuits: Basic cut-set and tie-set matrices for planar networks**,** Magnetic Circuits, Self and Mutual inductances, dot convention, impedance, reactance concept, Impedance transformation and coupled circuits, co-efficient of coupling, equivalent T for Magnetically coupled circuits, Ideal Transformer.

UNIT - II

Transient and Steady state analysis: RC, RL and RLC Circuits, Sinusoidal, Step and Square responses, RC Circuits as integrator and differentiators. 2nd order series and parallel RLC Circuits, Root locus, damping factor, over damped, under damped, critically damped cases, quality factor and bandwidth for series and parallel resonance, resonance curves.

UNIT - III

Two port network parameters: Z, Y, ABCD, h and g parameters, Characteristic impedance, Image transfer constant, image and iterative impedance, network function, driving point and transfer functions – using transformed (S) variables, Poles and Zeros. Standard T, π, L Sections, Characteristic impedance, image transfer constants.

UNIT - IV

Filters: Classification of Filters, Filter Networks, Constant-K Filters - Low pass, High pass, Band pass, Band-stop filters; m-derived Filters - T and π filters - Low pass, high pass.
Attenuators: Types - T-Type Attenuator, π -Type Attenuator, Lattice Attenuator, Bridged T attenuator, Ladder-Type Attenuator; Equalizers.

UNIT - V

Network Synthesis: Driving point impedance and admittance, transfer impedance and admittance, network functions of Ladder and non-ladder networks, Poles, Zeros analysis of network functions, Hurwitz polynomials, Positive Real Functions, synthesis of LC, RC and RL Functions by foster and cauer methods.

TEXT BOOKS:

1. William H. Hayt and Jack E. Kemmerly, Steven M. Durbin, Engineering Circuit Analysis, Tata Mc Graw Hill Education, 8ed., 2012.
2. John D. Ryder, Networks, Lines and Fields, 2ed., PHI, 1999.
3. S.P. Ghosh and A.K. Chakraborty, Network Analysis and Synthesis, McGraw Hill Education, 2014.

REFERENCES:

1. Van Valkenburg, Network Analysis, 3ed., Pearson, 2016.
2. A. Sudhakar and Shyammohan S. Palli, Circuits and Networks: Analysis and Synthesis, McGraw Hill Education, 5ed.
3. Ravish R. Singh, Network Analysis and Synthesis, McGraw Hill Education, 2013.
4. Mahmood Nahvi and Joseph A. Edminister, Electric Circuits, Schaum's Outlines Series, McGraw Hill Education, 4e., 2003.

5EN205HS: ENGLISH FOR SKILL ENHANCEMENT

B.Tech. I Year II Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

INTRODUCTION

National Education Policy-2020 aims at preparing students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. It also emphasizes language study and promotion of languages through understanding and proper interpretation. English language is central to the educational eco system. The importance of language as medium of communication for personal, social, official and professional needs to be emphasized for clear and concise expression. Teaching and learning of receptive and productive skills viz., Listening, Speaking, Reading and Writing (LSRW) are to be taught and learnt effectively in the undergraduate Engineering programs. Learners should be encouraged to engage in a rigorous process of learning to become proficient users of English language by adopting a deeply focused and yet flexible approach as opposed to rote learning.

In this connection, suitable syllabus, effective pedagogy, continuous assessments and students' involvement result in productive learning. This course supports the latest knowledge and skill requirements and shall meet specified learning outcomes. The main objectives of English language teaching and learning as medium of communication and for promotion of cultural values are embedded in this syllabus. Efforts are being made in providing a holistic approach towards value-based language learning which equips the learner with receptive as well as productive skills.

The focus in this syllabus is on skill development, fostering ideas and practice of language skills in various contexts and cultures in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed textbook for detailed study. The students should be encouraged to read the texts leading to reading comprehension. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material.

LEARNING OBJECTIVES: This course will enable the students to:
    a. Improve their vocabulary.
    b. Use appropriate sentence structures in their oral and written communication.
    c. Develop their reading and study skills.
    d. Equip students to write paragraphs, essays, précis and draft letters.
    e. Acquire skills for Technical report writing.

COURSE OUTCOMES: Students will be able to:
    a. Choose appropriate vocabulary in their oral and written communication.
    b. Demonstrate their understanding of the rules of functional grammar and sentence structures.
    c. Develop comprehension skills from known and unknown passages.
    d. Write paragraphs, essays, précis and draft letters.
    e. Write abstracts and reports in various contexts.

SYLLABUS: The course content / study material is divided into **Five Units.**

UNIT –I
Theme: **Perspectives**
            Lesson on 'The Generation Gap' by Benjamin M. Spock from the prescribed textbook titled *English for the Young in the Digital World* published by Orient Black Swan Pvt. Ltd*.*

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Words Often Misspelt - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Parts of Speech particularly Articles and Prepositions – Degrees of Comparison

Reading: Reading and Its Importance- Sub Skills of Reading – Skimming and Scanning.

Writing: Sentence Structures and Types -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing Precisely –Nature and Style of Formal Writing.

UNIT –II

Theme: **Digital Transformation**

Lesson on '*Emerging Technologies*' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd*.*

Vocabulary: Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Reading Strategies-Guessing Meaning from Context – Identifying Main Ideas – Exercises for Practice

Writing: Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence – Linkers and Connectives - Organizing Principles in a Paragraph – Defining- Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence - Essay Writing - Writing Introduction and Conclusion.

UNIT –III

Theme: **Attitude and Gratitude**

Poems on '*Leisure'* by William Henry Davies   and '*Be Thankful'* - Unknown Author from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd*.*

Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English.

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

Reading: Sub-Skills of Reading – Identifying Topic Sentence and Providing Supporting Ideas - Exercises for Practice.

Writing: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Job Application with CV/Resume –Difference between Writing a Letter and an Email - Email Etiquette.

UNIT –IV

Theme: **Entrepreneurship**

Lesson on '*Why a Start-Up Needs to Find its Customers First*' by Pranav Jain from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd*.*

Vocabulary: Standard Abbreviations in English – Inferring Meanings of Words through Context – Phrasal Verbs – Idioms.

Grammar: Redundancies and Clichés in Written Communication – Converting Passive to Active Voice and Vice-Versa.

Reading: Prompt Engineering Techniques– Comprehending and Generating Appropriate Prompts - Exercises for Practice

Writing: Writing Practices- Note Making-Précis Writing.

UNIT –V

Theme: **Integrity and Professionalism**
Lesson on '*Professional Ethics*' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Technical Vocabulary and their Usage– One Word Substitutes – Collocations.

Grammar: Direct and Indirect Speech **-** Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)

Reading: Survey, Question, Read, Recite and Review (SQ3R Method) – Inferring the Meaning and Evaluating a Text- Exercises for Practice

Writing: Report Writing - Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Technical Report.

Note: *Listening and Speaking skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.*

➢ (**Note**: As the syllabus of English given in AICTE *Model Curriculum-2018 for B.Tech. First Year is Open-ended,* besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the teachers collectively** in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.)

TEXT BOOK:
1. Board of Editors. *2025. English for the Young in the Digital World.* Orient Black Swan Pvt. Ltd*.*

REFERENCE BOOKS:
1. Swan, Michael. (2016). *Practical English Usage.* Oxford University Press. New Edition.
2. *Karal, Rajeevan. 2023. English Grammar Just for You.* Oxford University Press. New Delhi
3. 2024*. Empowering with Language: Communicative English for Undergraduates.* Cengage Learning India Pvt. Ltd. New Delhi
4. Sanjay Kumar & Pushp Lata. 2022. *Communication Skills – A Workbook.* Oxford University Press. New Delhi
5. Wood, F.T. (2007). *Remedial English Grammar.* Macmillan.
6. Vishwamohan, Aysha. (2013). *English for Technical Communication for Engineering Students.* Mc Graw-Hill Education India Pvt. Ltd.

5PH206BS: APPLIED PHYSICS LABORATORY

B.Tech. I Year II Semester	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Course Objectives:

1. Understand the fundamental properties of magnetic and dielectric materials through experimental evaluation.
2. Explore and verify quantum phenomena such as the photoelectric effect and energy quantization.
3. Investigate the behavior and characteristics of optoelectronic devices like lasers, LEDs, and solar cells.
4. Study the optical transmission properties of fibers through numerical aperture and bending loss experiments.
5. Apply analytical methods like the least squares method to interpret experimental data and enhance data analysis skills.

Course Outcomes: Upon successful completion of the course, students will be able to:

1. Analyze magnetic hysteresis behavior and determine material characteristics using the B-H curve. *(SDG 9)*
2. Experimentally determine physical constants such as the dielectric constant, Planck's constant, and work function. *(SDG 4, 9)*
3. Measure and interpret the optical properties of laser and fiber optics including wavelength, acceptance angle, and losses. *(SDG 7, 9)*
4. Evaluate the performance parameters of semiconductor and optoelectronic devices such as energy gap, Hall coefficient, and LED/Solar cell characteristics. *(SDG 7, 13)*
5. Utilize curve fitting techniques, such as the least squares method, for experimental data analysis and model validation. *(SDG 4, 9)*

List of Experiments:

1. Study of B-H curve of a ferromagnetic material.

2. Determination of dielectric constant of a given material.

3. Determination of work function and Planck's constant using photoelectric effect.

4. Determination of wavelength of a laser using diffraction grating.

5. Study of V-I & L-I characteristics of a given laser diode.

6. Determination of acceptance angle and numerical aperture of a given optical fibre.

7. Determination of bending losses of a given optical fibre.

8. Determination of energy gap of a semiconductor.

9. Determination of Hall coefficient and carrier concertation of a given semiconductor.

10. Understanding the method of least squares – Torsional pendulum as an example.

11. To study and analyze the characteristics of a solar cell by plotting the V-I (voltage-current) and P-V (power-voltage) curves.

12. To study the V-I (voltage-current) and L-I (Light Intensity- Current) characteristics of a Light Emitting Diode (LED).

Note: Any 8 experiments are to be performed.

5EC207ES: APPLIED PYTHON PROGRAMMING LABORATORY

B.Tech. I Year II Semester	**L**	**T**	**P**	**C**
	0	**1**	**2**	**2**

Course Outcomes: Upon completion of the Course, the students will be able to:

1. Build basic programs using fundamental programming constructs.
2. Write and execute python codes for different applications.
3. Implement on hardware boards.

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

List of Experiments:

Cycle - 1

1. Downloading and Installing Python and Modules
   a) Python 3 on Linux
      Follow the instructions given in the URL https://docs.python-guide.org/starting/install3/linux/
   b) Python 3 on Windows
      Follow the instructions given in the URL https://docs.python.org/3/using/windows.html
      (Please remember that Windows installation of Python is harder!)
   c) pip3 on Windows and Linux
      Install the Python package installer by following the instructions given in the URL
      https://www.activestate.com/resources/quick-reads/how-to-install-and-use-pip3/
   d) Installing numpy and scipy
      You can install any python3 package using the command pip3 install <packagename>
   e) Installing jupyterlab
      Install from pip using the command pip install jupyterlab

2. Introduction to Python3
   a) Printing your biodata on the screen
   b) Printing all the primes less than a given number
   c) Finding all the factors of a number and show whether it is a perfect number, i.e., the sum of all its factors (excluding the number itself) is equal to the number itself

3. Defining and Using Functions
   a) Write a function to read data from a file and display it on the screen
   b) Define a boolean function is *palindrome*(<input>)
   c) Write a function *collatz(x)* which does the following: if x is odd, $x = 3x + 1$; if x is even, then $x = x/2$. Return the number of steps it takes for $x = 1$
   d) Write a function $N(m, s) = exp(-(x-m)^2 / (2s^2)) / sqrt(2\pi)s$ that computes the Normal distribution

4. The package numpy
   a) Creating a matrix of given order $m \times n$ containing *random numbers* in the range 1 to 99999
   b) Write a program that adds, subtracts and multiplies two matrices. Provide an interface such that, based on the prompt, the function (addition, subtraction, multiplication) should be performed
   c) Write a program to solve a system of n linear equations in n variables using matrix inverse

5. The package scipy and pyplot
   a) Finding if two sets of data have the same *mean* value
   b) Plotting data read from a file

      c) Fitting a function through a set a data points using *polyfit* function
      d) Plotting a histogram of a given data set

6. The strings package
      a) Read text from a file and print the number of lines, words and characters
      b) Read text from a file and return a list of all *n* letter words beginning with a vowel
      c) Finding a secret message hidden in a paragraph of text
      d) Plot a histogram of words according to their length from text read from a file

Cycle - 2

7. Installing OS on Raspberry Pi
      a) Installation using PiImager
      b) Installation using image file
          • Downloading an Image
          • Writing the image to an SD card
              • using Linux
              • using Windows
          • Booting up
      Follow the instructions given in the URL
      https://www.raspberrypi.com/documentation/computers/getting-started.html

8. Accessing GPIO pins using Python
      a) Installing GPIO Zero library.
         First, update your repositories list:
         sudo apt update
         Then install the package for Python 3:
         sudo apt install python3-gpiozero
      b) Blinking an LED connected to one of the GPIO pin
      c) Adjusting the brightness of an LED
      d) Adjust the brightness of an LED (0 to 100, where 100 means maximum brightness) using the in-built PWM wavelength.

9. Collecting Sensor Data
      a) DHT Sensor interface
          • Connect the terminals of DHT GPIO pins of Raspberry Pi.
          • Import the DHT library using import *Adafruit_DHT*
          • Read sensor data and display it on screen.

5EN208BS: ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

B.Tech. I Year II Semester	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Course Objectives:

The **English Language and Communication Skills (ELCS) Lab** focuses on listening and speaking skills, particularly on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Listening Skills:
Objectives
1. To enable students develop their active listening skills
2. To equip students with necessary training in listening, so that they can comprehend the speech of people from different linguistic backgrounds

Speaking Skills:
3. To improve their pronunciation and neutralize accent
4. To enable students express themselves fluently and appropriately
5. To practice speaking in social and professional contexts

Learning Outcomes: Students will be able to:
1. Listen actively and identify important information in spoken texts
2. Interpret the speech and infer the intention of the speaker
3. Improve their accent for intelligibility
4. Speak fluently with clarity and confidence
5. Use the language in real life situations

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:
   a. **Computer Assisted Language Learning (CALL) Lab which focusses on listening skills**
   b. **Interactive Communication Skills (ICS) Lab which focusses on speaking skills**

The following course content is prescribed for the **English Language and Communication Skills Lab**.

Exercise – I
CALL Lab:
Instruction: Speech Sounds-Listening Skill - Importance – Purpose - Types- Barriers- Active Listening
Practice: Listening to Distinguish Speech Sounds (Minimal Pairs) **-** *Testing Exercises*
ICS Lab:
❖ **Diagnostic Test – Activity titled '*Express Your View'*
 Instruction: Spoken and Written language - Formal and Informal English - Greetings - Introducing Oneself and Others
Practice: Any Ice-Breaking Activity

Exercise – II
CALL Lab:
Instruction: Listening vs. Hearing - Barriers to Listening
Practice: Listening for General Information - Multiple Choice Questions - *Listening Comprehension Exercises (It is essential to identify a suitable passage with exercises for practice.)*
ICS Lab:
Instruction: Features of Good Conversation – Strategies for Effective Communication
Practice: Role Play Activity - Situational Dialogues –Expressions used in Various Situations –Making Requests and Seeking Permissions – Taking Leave - Telephone Etiquette

Exercise - III
CALL Lab:
Instruction: Errors in Pronunciation – Tips for Neutralizing Mother Tongue Influence (MTI)
Practice: Differences between British and American Pronunciation –*Listening Comprehension Exercises*
ICS Lab:
Instruction: Describing Objects, Situations, Places, People and Events
Practice: Picture Description Activity – Looking at a Picture and Describing Objects, Situations, Places, People and Events *(A wide range of Materials / Handouts are to be made available in the lab.)*

Exercise – IV
CALL Lab:
Instruction: Techniques for *Effective* Listening
Practice: Listening for Specific Details - Listening - Gap Fill Exercises - *Listening Comprehension Exercises*
(It is essential to identify a suitable passage with exercises for practice.)
ICS Lab:
Instruction: How to Tell a Good Story - Story Star- Sequencing-Creativity
Practice: Activity on Telling and Retelling Stories - Collage

Exercise – V
CALL Lab:
Instruction: Identifying the literal and implied meaning
Practice: Listening for Evaluation - Write the Summary – Listening Comprehension Exercises
(It is essential to identify a suitable passage with exercises for practice.)
ICS Lab:
Instruction: Understanding Non-Verbal Communication
Practice: Silent Speech - Dumb Charades Activity
❖ **Post-Assessment Test on 'Express Your View'**

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:
The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.
System Requirement (Hardware component):
Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

    i)   Computers with Suitable Configuration
    ii)   High Fidelity Headphones

2. **Interactive Communication Skills (ICS) Lab:**
   The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T.V. or LCD, a digital stereo – audio & video system and camcorder etc.

   ✍ **Note: English Language Teachers are requested to prepare Materials / Handouts for each Activity for the Use of those Materials in CALL & ICS Labs.**

Suggested Software:
- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 10th Edition.
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).

REFERENCE BOOKS:
1. Shobha, KN & Rayen, J. Lourdes. (2019). *Communicative English – A workbook.* Cambridge University Press
2. Board of Editors. (2016). *ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities.* Orient BlackSwan Pvt. Ltd.
3. Mishra, Veerendra et al. (2020). *English Language Skills: A Practical Approach.* Cambridge University Press
4. (2022). *English Language Communication Skills – Lab Manual cum Workbook.* Cengage Learning India Pvt. Ltd.
5. Ur, Penny and Wright, Andrew. 2022. *Five Minute Activities – A Resource Book for Language Teachers.* Cambridge University Press.

5ME209ES: ENGINEERING WORKSHOP

B.Tech. I Year II Semester	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Pre-requisites: Practical skill

Course Objectives:

- To Study of different hand operated power tools, uses and their demonstration.
- To gain a good basic working knowledge required for the production of various engineering products.
- To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
- To develop a right attitude, team working, precision and safety at work place.
- It explains the construction, function, use and application of different working tools, equipment and machines.
- To study commonly used carpentry joints.
- To have practical exposure to various welding and joining processes.
- Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

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

- CO 1: Study and practice on machine tools and their operations
- CO 2: Practice on manufacturing of components using workshop trades including pluming, fitting, carpentry, foundry, house wiring and welding.
- CO 3: Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
- CO 4: Apply basic electrical engineering knowledge for house wiring practice.

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

I.	Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
II.	Fitting – (V-Fit, Dovetail Fit & Semi-circular fit)
III.	Tin-Smithy – (Square Tin, Rectangular Tray & Conical Funnel)
IV.	Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
V.	Welding Practice – (Arc Welding & Gas Welding)
VI.	House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
VII.	Black Smithy – (Round to Square, Fan Hook and S-Hook)

2. TRADES FOR DEMONSTRATION & EXPOSURE:

Plumbing, Machine Shop, Metal Cutting (Water Plasma), Power tools in construction and Wood Working

TEXT BOOKS:

1. Workshop Practice /B. L. Juneja / Cengage
2. Workshop Manual / K.Venugopal / Anuradha.

REFERENCE BOOKS:

1. Workshop Manual - P.Kannaiah/ K.L.Narayana/ Scitech
2. Workshop Manual / Venkat Reddy/ BSP

5EC301PC: PROBABILITY THEORY AND STOCHASTIC PROCESSES

B.Tech. II Year I Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Pre-requisite: Mathematics

Course Objectives:
1. This course gives basic understanding of random variables and operations that can be performed on them.
2. To know the spectral and temporal characteristics of Random Process.
3. To learn the basic concepts of Information theory, noise sources and its representation for understanding its characteristics.

Course Outcomes: Upon completing the Course, the students will be able to
1. Describe probability theory basics, random variable basics and apply the knowledge of mathematics to solve problems on Bayes Theorem.
2. Explain distribution and density functions of various single random variable, and apply the knowledge of mathematics to solve problems on mean, variance etc.
3. Discuss multiple random variables and analyze the properties and operations on multiple random variables.
4. Determine the temporal and spectral characteristics of Random Signals.
5. Apply the knowledge of random process for understanding the noise characteristics.

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

UNIT - I
Probability: Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's Theorem, Independent Events.
Random Variables- Definition, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties.

UNIT - II
Operations on single Random Variable
Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable - Monotonic and Non-monotonic Transformations of Continuous and Discrete Random Variable, Generation of a Random Variable of a given PDF/CDF.

UNIT - III
Multiple random variables and Operations on Multiple random variables: Vector Random Variables, Joint Distribution Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density– Point and Interval conditioning, Statistical Independence, Sum of Two and more Random Variables, Central Limit Theorem, Equal and Unequal Distribution (Proof not expected).
Expected Value of a Function of Random Variables- Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT - IV
Random processes – Temporal characteristics: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second- Order and Wide-Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process. Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.

UNIT - V
Random processes – Spectral characteristics: The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.

Noise sources: Resistive / Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties.

TEXT BOOKS:
1. Peyton Z. Peebles - Probability, Random Variables & Random Signal Principles - TMH, 4ed.
2. Murray R Spiegel, John Schiller, R. Alu Srinivasan, Probability and Statistics – Schaum's Outlines, 3ed., McGraw Hill Education.

REFERENCES:
1. P. Ramesh Babu, Probability Theory and Random Processes – McGraw Hill Education.
2. Athanasios Papoulis and S. Unnikrishna Pillai, Probability, Random Variables and Stochastic Processes – McGraw Hill Education, 4ed.
3. K. N. Hari Bhat, K. Anitha Sheela and Jayant Ganguly, Probability Theory and Stochastic Processes for Engineers - Pearson, 1ed., 2011.
4. Taub and Schilling, Principles of Communication systems, TMH, 2008.
5. Y. Mallikarjuna Reddy, Probability Theory and Stochastic Processes, 4ed. Edition, University Press.

5EC302PC: SIGNALS AND SYSTEMS

B.Tech. II Year I Semester	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

Pre-requisite: Mathematics

Course Objectives:

This subject gives the basics of Signals and Systems required for all Electrical Engineering related courses.

The objectives of this subject are to:
1. Understand Fourier series and Fourier Transform and their significance.
2. Classify signals and systems and their analysis in time and frequency domains.
3. Study the concepts of distortion less transmission through LTI Systems, convolution and correlation properties.
4. Understand the concepts of Laplace transforms and their properties.
5. Identify the need for sampling of CT signals, types and merits and demerits of each type.
6. Understand the concepts of Z-transforms and their properties.

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

1. Understand the Characteristics of various signals, systems and their time and frequency domain analysis using transform techniques.
2. Identify the conditions for transmission of signals through systems and conditions for physical realization of systems.
3. Understand the significance of sampling theorem for baseband and band pass signals.
4. Understand the concept of correlation and PSD functions and their applications.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-

UNIT - I

Signal Analysis: Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

UNIT - II

Fourier series: Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

Fourier Transforms: Concept of Fourier Transform from Fourier series, Fourier Transform of arbitrary signal and standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

UNIT - III

Signal Transmission through Linear Systems: Linear System, Impulse response, Response of a Linear System, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution. Extraction of Signal from Noise by Filtering. Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and risetime.

UNIT - IV

Laplace Transforms: Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.

Correlation: Auto Correlation and Cross Correlation Functions, Relation between Convolution and Correlation, Properties of Correlation Functions, Energy Density Spectrum, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density relation, Parseval's Theorem for energy / power signals, Detection of Periodic Signals in the presence of Noise by Correlation.

UNIT - V

Sampling theorem: Sampling Theorem for Base band/Band Limited and Band Pass Signals, Types of Sampling: Impulse Sampling, Natural and Flattop Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing.

Z–Transforms: Concept of Z- Transform of a Discrete Sequence, Comparison of Laplace, Fourier and Z Transforms, Region of Convergence of Z-Transform, Properties of ROC for various classes of signals, Inverse Z-transform, Properties of Z-transform, Application of Z-Transform to solve difference equation.

TEXT BOOKS:

1. B.P. Lathi, Signals, Systems & Communications, BS Publications, 2008.
2. Alan V. Oppenheim, Alan. S. Willsky, S. Hamid Nawab, Signals and Systems, Pearson, 2ed., 2015.

REFERENCES:

1. Simon Haykin, Barry Van Veen, Signals and Systems, Wiley, 2ed.
2. A. Rama Krishna Rao, Signals and Systems, TMH, 2008.
3. Michel J. Roberts, Govind Sharma, Fundamentals of Signals and Systems, McGraw Hill, 2ed.
4. Signals, Systems and Transforms, Charles. L. Philips, John M. Parr and Eve A. Riskin, 4ed., 2008, Pearson Education.
5. A. Anand Kumar, Signals and Systems, PHI, 3ed., 2013.

5EC303PC: ELECTRONIC CIRCUIT ANALYSIS

B.Tech. II Year I Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:

1. To familiarize the students with design and analysis of various amplifiers.
2. To understand the concepts of positive and negative feedback in amplifiers.
3. To familiarize the students with the working various feedback amplifiers, oscillators, power amplifiers.
4. To understand the working of multivibrator circuits and time base generators.

Course Outcomes:

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

1. Analyze and classify multistage amplifier configurations and determine the impact of coupling schemes on amplifier performance and frequency response.
2. Apply the hybrid-π transistor model to evaluate high-frequency behavior of common-emitter amplifiers and calculate gain-bandwidth product.
3. Examine feedback amplifier types and assess the influence of negative feedback on gain stability, bandwidth, and distortion.
4. Design and analyze LC, RC, and crystal oscillators based on the Barkhausen criterion to generate sinusoidal waveforms.
5. Design power amplifiers and multivibrator circuits, and evaluate their performance in terms of efficiency, distortion, and waveform generation.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	1	1	0	0	0	0	0
CO2	3	3	3	2	2	0	0	0	0	0	1
CO3	3	3	3	2	2	1	0	0	0	0	1
CO4	3	3	3	2	2	0	0	0	0	0	1
CO5	3	3	3	2	2	1	0	0	0	0	1

UNIT - I

Multistage Amplifiers: Classification of Amplifiers, Distortion in Amplifiers, Coupling schemes: RC, Transformer, Direct coupling, Frequency response of multistage amplifiers, Transistor configuration choice in cascade amplifiers, Cascade and Cascode amplifiers, Darlington pair amplifier.

High-Frequency Transistor Model: Hybrid-π model, Hybrid-π parameters: Conductances and capacitances, CE short-circuit current gain, Gain with resistive load and gain-bandwidth product.

UNIT - II

Feedback Amplifiers: Concept and need for feedback in amplifiers, Types and classification of feedback amplifiers, Characteristics of negative feedback: Gain stability, bandwidth, noise, distortion, Voltage series, Voltage shunt, Current series, Current shunt configurations.

UNIT - III

Oscillators: Principle of positive feedback, Barkhausen Criterion for oscillations, LC Oscillators: Generalized analysis, Hartley, Colpitts, RC Oscillators: RC phase shift, Wien bridge, Crystal oscillator: Working and advantages.

UNIT - IV

Power Amplifiers and Tuned Amplifiers: Classification: Class A, B, AB, C, Series-fed Class A amplifier, Transformer-coupled Class A amplifier, Class B amplifier: Push-pull, Complementary-Symmetry, Efficiency calculations and Crossover distortion, Concept of Tuned Amplifiers: Single Tuned and Double Tuned Amplifiers.

UNIT - V

Multivibrators: Analysis and design of Bistable, Monostable and Astable multivibrators and Schmitt Trigger using transistors.

Time Base Generators: General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators, Linearity improvement techniques

TEXT BOOKS:

1. Jacob Millman, Christos C. Halkias, Satyabrata Jit - Electronic Devices and Circuits, McGraw-Hill Education, 4ed., 2016.
2. David A. Bell, Electronic Devices and Circuits, Oxford University Press, 5ed., 2008.

REFERENCES:

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson, 11ed., 2015.
2. Jacob Millman and Arvin Grabel, Microelectronics, 2ed., McGraw Hill.
3. Jacob Millman and Herbert Taub, Pulse, Digital, and Switching Waveforms, McGraw Hill Education, 1991.
4. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, 7ed., Oxford University Press, 2015.

5EC304PC: DIGITAL LOGIC DESIGN

B.Tech. II Year I Semester

	L	T	P	C
	3	0	0	3

Course Objectives:

1. To understand common forms of number representation in logic circuits.
2. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
3. To understand the concepts of combinational logic circuits and sequential circuits.
4. To understand the Realization of Logic Gates using diodes and transistors.

Course Outcomes: Upon completion of the Course, the students will be able to:

1. Apply Boolean algebra and minimization techniques to simplify Boolean functions.
2. Design combinational circuits using logic gates.
3. Analyze latches and flip-flops to design sequential logic circuits.
4. Construct synchronous sequential circuits combining flip-flops and logic gates.
5. Utilize programmable logic devices in digital system design.

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

UNIT - I

Number Systems: Number-Base conversion, Binary Arithmetic, Complements of Numbers, Arithmetic operations with Signed numbers, Digital Codes, Error Detection and Correction codes : Parity check and Hamming code.

Boolean algebra and Logic Gates: Basic theorems and properties, Simplification using Boolean Algebra, Canonical and Standard form, Digital Logic Gates Overview.

UNIT - II

Simplification of Boolean Functions: Karnaugh Maps – 2, 3, and 4 variables, Sum-of-products (SOP) and product-of-sums (POS) simplification, NAND and NOR implementation, Don't care conditions.

Combinational Logic Design: Design procedure, Binary Adder and Subtractor, Decimal Adder, Code conversion, Magnitude comparator, Decoders and Encoders, Multiplexers and Demultiplexers, Boolean Function Implementation. Dataflow, Structural and Behavioural modelling of Combinational logic circuits using Verilog HDL.

UNIT - III

Sequential Circuits Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another. Dataflow modelling of Sequential logic circuits using Verilog HDL.

UNIT - IV

Registers and Counters: Shift Registers – Left, Right and Bidirectional Shift Registers, Applications of Shift Registers - Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters. Structural modelling of Sequential logic circuits using Verilog HDL.

UNIT - V

Sequential Machines: Finite State Machines, Synthesis of Synchronous Sequential Circuits - Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo - N Counters. Behavioural modelling of Sequential logic circuits using Verilog HDL.

Programmable Logic Devices: Memory devices - RAM, ROM, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL).

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, Digital Design. With an Introduction to Verilog HDL, Pearson Education, 6ed., 2018.
2. Samir Palnitkar, Verilog HDL, A Guide to Digital Design and Synthesis, Pearson Education, 2ed. 2008.

REFERENCE BOOKS:

1. Zvi Kohavi & Niraj K. Jha, Switching and Finite Automata Theory, Cambridge, 3ed, 2010.
2. R.P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 4ed., 2009.
3. Thomas L. Floyd, "Digital Fundamentals", Pearson, 11ed., 2015.
4. Charles H. Roth Jr., Larry L. Kinney, Fundamentals of Logic Design, Cengage Learning, 6ed.

5EC305PC: CONTROL SYSTEMS ENGINEERING

B.Tech. II Year I Semester

L	T	P	C
2	0	0	2

Pre-requisites: Linear Algebra and Calculus, Ordinary Differential Equations and Multivariable Calculus Laplace Transforms, Numerical Methods and Complex variables

Course Objectives:

1. To introduce the fundamental concepts, classifications, and mathematical modeling of control systems for mechanical and electrical domains.
2. To analyze control system behaviour in time and frequency domains and stability criteria using root locus, Bode plot, Nyquist plot, etc.
3. Design and evaluate compensators and controllers to improve system performance.
4. Explain state-space representation, solution of state equations, and assess system controllability and observability.

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

1. Describe open- and closed-loop systems, and develop mathematical models using block diagrams and signal flow graphs.
2. Analyze time response of second-order systems using time-domain specifications, and assess stability using Routh-Hurwitz criterion and root locus techniques.
3. Analyse frequency response plots including Bode, Polar, and Nyquist plots, and investigate system stability.
4. Design compensators and controllers to meet specific performance criteria in control systems.
5. Apply the state-variable approach and analyze controllability and observability.

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

UNIT - I

Control System fundamentals: Classification of control systems, Open and Closed loop systems. Mathematical modelling of mechanical systems and their conversion into electrical systems. Block diagram reduction and Signal flow graphs.

UNIT - II

Time response Analysis: Transfer function and Impulse response, types of input. Transient response of second order system for step input. Time domain specifications. Types of systems, static error coefficients, Routh - Hurwitz criterion for stability.

Root locus techniques: Analysis of typical systems using root locus techniques. Effect of location of roots on system response.

UNIT - III

Frequency response Analysis: Frequency domain specifications, bode plots, Gain margin and Phase Margin. Polar plot, Nyquist plot, and Nyquist criterion for stability.

UNIT - IV

Compensators and controllers: Introduction to compensators, Lag compensator, Lead compensator, Lag- Lead compensator, Design of compensators using bode plot. Introduction to controllers, P, I, D, PI, PD, PID controllers.

UNIT - V

State space representation: Concept of state and state variables. State models of linear time invariant systems, State transition matrix, Solution of state equations. Controllability and observability.

TEXT BOOKS:

1. I.J. Nagrath and M. Gopal, Control System Engineering, 5ed., New Age Publishers, 2009.
2. Benjamin C. Kuo, Automatic Control Systems, 7ed., PHI, 2010.

REFERENCES:

1. K. Ogata, Modern Control Engineering, 2ed., Prentice Hall, 2010.
2. M. Gopal, Control Systems: Principles and Design, Tata McGraw-Hill, 1997.
3. Norman S. Nise, Control Systems Engineering, 5ed., John Wiley & Sons, 2007.
4. A.K. Jairath, Solutions and Problems of Control Systems, CBS Publishers, 2013.
5. A. Nagoor Kani, Control Systems, 2ed., RBA Publications, 2007.

5MS306HS: INNOVATION AND ENTREPRENEURSHIP

B.Tech. II Year I Semester   **L   T   P   C**
                                                                 2   0   0   2

Course Objectives:
1. To familiarize on the basic concepts of innovation, entrepreneurship and its importance.
2. To Identify and analyze the process of problem-opportunity identification, market segmentation, and idea generation techniques.
3. To initiate prototype development and understand minimum viable product.
4. To develop initial Business and financial planning and Go-to-Market strategies
5. To impart knowledge on establishing startups, venture pitching and IPR

Course Outcomes:
1. Understand the entrepreneurship and the entrepreneurial process and its significance in economic development.
2. Assess the problem from an industry perspective and generate solutions using the design thinking principles.
3. Assess market competition, estimate market size, and develop a prototype.
4. Analyze Business and financial planning models and Go-to-Market strategies.
5. Able to build a start-up, register IP and identify funding opportunities.

Unit I: Fundamentals of Innovation and Entrepreneurship
Innovation: Introduction, need for innovation, Features, Types of innovations, innovations in manufacturing and service sectors, fostering a culture of innovation, planning for innovation.
Entrepreneurship: Introduction, types of entrepreneurship attributes, mindset of entrepreneurial and intrapreneurial leadership, Role of entrepreneurs in economic development. Woman Entrepreneurship, Importance of on-campus startups. Understanding to build entrepreneurial mindset, attributes and networks individuals while on campus.
Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity.

Unit II: Problem and Customer Identification
Identification of gap, problem, analyzing the problem from a industry perspective, real-world problems, market and customer segmentation, validation of customer problem fit, Iterating problem-customer fit, Competition and Industry trends mapping and assessing initial opportunity, Porter's Five Force Model.
 Idea generation, Ideation techniques: Brainstorming, Brain writing, Round robin, and SCAMPER, Design thinking principles, Mapping of solution to problem.
Core Teaching Tool: Several types of activities including: Class, game, Gen AI, 'Get out of the Building' and Venture Activity.

Unit III: Opportunity assessment and Prototype development
Identify and map global competitors, review industry trends, and understand market sizing: TAM, SAM, and SOM. Assessing scope and potential scale for the opportunity.
Understanding prototyping and Minimum Viable Product (MVP). Developing a prototype: Testing, and validation.
Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

Unit IV: Business & Financial Models
Introduction to Business Model and types, Lean Canvas Approach: 9-block lean canvas model, building lean canvas for your startup. Business planning: components of Business plan- Sales plan, People plan and financial plan, Financial Planning: Types of costs, preparing a financial plan for profitability using a financial template, understanding the basics of Unit economics, Economies of

Scale and analyzing financial performance. Go-To-Market (GTM) approach – Selecting the Right Channel, creating digital presence, and building customer acquisition strategy.
Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

Unit V: Startups and IPR
Startup requirements, building founding team members and mentors, pitch preparation, start-up registration process, funding opportunities and schemes, institutional support to entrepreneurs, startup lifecycle, documentation, legal aspects in startup, venture pitching readiness, National Innovation Startup Policy (NISP) and its features.
Patents, Designs, Patentability, Procedure for grants of patents. Indian Scenario of Patenting, International Scenario: International cooperation on Intellectual Property. Patent Rights: Scope of Patent Rights. Copyright, trademark, and GI. Licensing and transfer of technology.
Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

Suggested Readings:
1. John R Bessant, Joe Tidd, Innovation and Entrepreneurship, 4E, Wiley, Latest Edition.
2. Ajay Batra, The Startup Launch Book- A Practical Guide for Launching Customer Centric Ventures, Wiley, 2020. (For Core Teaching Tool).
3. Entrepreneurship Development and Small Business Enterprises, Poornima M Charantimath, 3E, Pearson, 2018.
4. D.F. Kuratko and T.V. Rao, Entrepreneurship: A South-Asian Perspective, Cengage Learning, 2013.
5. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGraw Hill, 11th Edition.
6. NISP -Brochure inside pages - startup_policy_2019.pdf

5EC307PC: MODELLING & SIMULATION LAB

B.Tech. II Year I Semester	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Course Objectives:

1. Understand and analyze various signals and systems concepts, including their generation, transforms, and system response using programming and simulation tools.
2. Apply probability and stochastic process concepts to generate and analyze random signals, noise, and their statistical properties.
3. Design and simulate basic control system models, such as DC motors and PID controllers, and analyze their dynamic behaviour.

Course Outcomes: Upon completion of the Course, the students will be able to:

1. Use a simulation tool for generating, analyzing and performing various operations on signals / sequences both in time and frequency domain.
2. Use a simulation tool for analyzing and characterizing continuous and discrete time systems both in time and frequency domain along with the concept of Sampling.
3. Use a simulation tool for generating different Random Signals; analyze their characteristics by finding different higher order moments and noise removal applications.
4. To use simulink for Control System applications

Note:

- All the experiments are to be simulated using MATLAB or equivalent software
- Minimum of 14 experiments are to be completed / simulated.

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

List of Experiments:

Part -A: Signals and Systems (Minimum 9 Experiments)

1. Write the code / script for generating various signals, viz. Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Sawtooth, Triangular, Sinusoidal, Ramp, Sinc and Nonstandard Signals and Sequences generated from these standard signals /sequences using waveform synthesis.
2. Write the code / script for performing different operations on signals/ sequences, viz. Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power on them.
3. Write the code / script for finding the even and odd parts of signal / sequence and real and imaginary parts of signal.
4. Write the code / script for verifying whether a given continuous / discrete system is Linear, Time Invariant, Stable and Physically Realizable and also find response of LTI system using convolution for signals / sequences.
5. Write the code / script for obtaining sinusoidal response and Impulse response of a given Continuous / Discrete LTI System.
   a) Plot the Real and Imaginary part and
   b) Magnitude and Phase Plot of the response

6. Write the code / script for finding and plotting the magnitude and phase spectrum of any given signal by finding its Fourier Transform by using the properties where ever required.
7. Write the code / script for finding and plotting the magnitude and phase spectrum of any given signal by finding its Laplace Transform by using the properties wherever required. Also plot pole-zero diagram in S-plane.
8. Write the code/ script for finding and plotting the magnitude and phase plots of any given sequence by finding its Z-Transform by using the properties wherever required. Also plot pole – zero diagram in Z-plane.
9. Design a Simulink or equivalent model for
       a) Solving Differential Equations
       b) Finding the response of any RLC Circuit with different initial Conditions for AC and DC inputs and plot the corresponding responses.
10. Gibbs Phenomenon and waveform synthesis.
11. Write the code / script for verifying sampling theorem for different sampling rates, sampling types and duty cycles and for plotting the sampled and reconstructed signals.

Part- B: Probability Theory and Stochastic Processes (Minimum 3 Experiments)

12. Write the code / script for generating various random variables with different CDFs/ PDFs.
13. Write the code / script for generating Gaussian noise and for finding its mean, skewness, kurtosis, PDF and PSD.
14. Write the code / script for finding Auto Correlation and Cross Correlation of signals / sequences.
15. Write the code / script for removal of noise from the signal using Correlation.
16. Write the code / script for extraction of periodic signal masked by noise using Auto Correlation.

Part- C: Control Systems (Minimum 2 Experiments)

17. Build and Simulate a DC Motor using Simulink.
18. Implementation of a PID Controller from equations using Simulink.
19. Time response analysis of second order systems or stability analysis using root locus.
20. Controllability and observability of Linear systems.

Note: For the experiments with code/scripts written in MATLAB or equivalent (1-8, 12-16), the student can design a user interface or app using MATLAB App Designer or equivalent.

<u>Application on Real Time signals</u>

1. Application of Autocorrelation: GPS Synchronization Satellite communication toolbox is required for this experiment.

   Generate the GPS signal. Visualize the GPS signal. Plot of autocorrelation of C/A code and visualize the spectrum of GPS signals. For exact steps, go through the following page:

   https://www.mathworks.com/help/satcom/ug/gps-waveform-generation.html

2. Sampling of Speech Signals

   Record and play speech in MATLAB. For steps, go through the following page:

   https://in.mathworks.com/help/matlab/import_export/record-and-play-audio.html

   Change the sampling rate of the recorded speech signal and play back to see the effect of aliasing. For steps, go through the following page:

   https://in.mathworks.com/help/signal/ug/changing-signal-sample-rate.html

5EC308PC: ELECTRONIC CIRCUIT ANALYSIS LABORATORY

B.Tech. II Year I Semester

L	T	P	C
0	0	2	1

Course Objectives:

1. To provide hands-on experience in designing, building, and analyzing analog electronic circuits.
2. To practically implement amplifiers, oscillators, power amplifiers, multivibrators, and waveform generators using discrete components and simulation tools.

Course Outcomes: Upon completion of the Course, the students will be able to:

1. Design and analyze multistage and power amplifiers and evaluate their frequency response and efficiency.
2. Implement and examine feedback and oscillator circuits and validate theoretical conditions for sustained oscillations.
3. Develop and interpret waveform generation circuits such as multivibrators and time base generators.
4. Perform simulations to validate analog circuit performance using industry-standard software tools.
5. Correlate practical results with theoretical predictions and identify deviations due to real-world constraints.

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

List of Experiments:

PART-A

Hardware Experiments :

Perform practical design, implementation, and waveform analysis of amplifiers, oscillators, power stages, and multivibrators to validate theoretical concepts and observe real-world circuit behavior.

1. Design and analyze a two-stage RC coupled amplifier to demonstrate gain enhancement and study coupling capacitance effects.
2. Design Hartley and Colpitts oscillators for a specified frequency and observe their output waveforms.
3. Design an RC phase shift oscillator and derive the practical gain condition for oscillations at a given frequency.
4. Design a transformer-coupled class A power amplifier, observe input/output waveforms, and calculate efficiency.
5. Design a class B power amplifier, analyze input/output waveforms, and evaluate harmonic distortion.
6. Design a bistable multivibrator, analyze commutating capacitor effects, and record transistor waveforms.
7. Design an astable multivibrator and observe transistor base and collector waveforms.

PART-B

Software Simulation :
Use circuit simulation software to design, analyze, and verify the performance of feedback amplifiers, waveform generators, and power amplifier circuits through virtual experimentation and frequency response evaluation.

1. Simulate four feedback amplifier topologies and compare their frequency responses with and without feedback.
2. Simulate a monostable multivibrator and analyze its input/output waveforms.
3. Simulate a Schmitt trigger for gain values greater than and less than one and analyze response behavior.
4. Simulate a bootstrap time base generator using BJT and observe the output sweep waveform.
5. Simulate a Miller sweep circuit using BJT and observe the time base output waveform.
6. Simulate a complementary symmetry push-pull amplifier and verify elimination of crossover distortion.
7. Simulate a single tuned amplifier and determine the quality factor (Q) of its tuned circuit.

Software Requirements:

Simulation Tools: LTspice / Multisim / PSpice / Proteus / NI Multisim Live or equivalent
Operating System: Windows 10/11 or Linux (Ubuntu preferred)

Hardware Requirements:

1. Dual Power Supply (±15V, 0–30V)
2. Function Generator (up to 1 MHz)
3. CRO / DSO (Dual Channel, 20 MHz or more)
4. Digital Multimeters
5. Breadboards and Connecting Wires
6. BJTs: BC107, BC547, BC557, 2N2222, etc.
7. Resistors, Capacitors (Wide range of values)
8. Transformers (for power amplifiers)
9. Inductors, Crystals (1 MHz, 4 MHz, etc.)
10. Heat sinks, transistors for power stages (e.g., TIP41, TIP42 etc.)

5EC309PC: DIGITAL LOGIC DESIGN LABORATORY

	L	**T**	**P**	**C**
B.Tech. II Year I Semester	**0**	**0**	**2**	**1**

Course Objectives:

1. Learn various techniques for logic minimization.
2. To acquire knowledge of combinational and sequential circuits.
3. Learn the language fundamentals of Verilog HDL and able to simulate and synthesize digital circuits.

Course Outcomes: After completing the course, students will be able to:

1. Analyze and simplify Boolean expressions and implement them using logic gates and ICs.
2. Design and realize combinational and sequential logic circuits using logic gate hardware.
3. Model digital systems in Verilog HDL using dataflow, behavioral, and structural styles.
4. Simulate and verify digital designs using industry-standard EDA tools and testbenches.
5. Build modular and hierarchical designs such as counters, FSMs, and shift registers.

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

PART-A

Realization in Hardware Laboratory (Using Logic ICs)

These are fundamental hands-on experiments conducted using logic ICs such as AND, OR, NOT, NAND, NOR, XOR gates, flip-flops, multiplexers, and decoders.

1. Realize and minimize Boolean functions using basic gates and universal gates (NAND/NOR) in SOP/POS form.
2. Design and implement Half Adder, Full Adder, Half Subtractor, and Full Subtractor using logic gates.
3. Construct and analyze basic logic gates (AND, OR, NOT, XOR, XNOR) using only NAND and NOR gates.
4. Design and implement parity bit generators (even and odd) and a 4-input majority logic circuit.
5. Design and implement code converters such as Binary to Gray, Gray to Binary, and BCD to Excess-3 using gates.
6. Design and implement simple combinational circuits: 2-to-1 multiplexer, 1-bit comparator, and 7-segment decoder logic.

PART-B

Verilog HDL-Based Digital Design Experiments (Simulation-Based)

These experiments are implemented using **Verilog HDL** with different modeling styles (dataflow, behavioral, structural) and simulated using tools like **Vivado, ModelSim, or Equivalent.**

1. Design and simulate a 2-bit comparator using dataflow modeling; extend it to 4-bit using structural modeling.
2. Implement a 2:1 multiplexer using dataflow modeling and design an 8:1 multiplexer using structural modeling.
3. Design a 2-to-4 decoder using dataflow modeling and realize a 3-to-8 decoder using structural modeling.
4. Implement a given Boolean function using a decoder-based approach in behavioural modeling.

5. Design and simulate a universal n-bit shift register (left, right, hold, parallel load) using behavioural modeling.
6. Design a synchronous MOD-n counter using behavioural modeling with D or JK flip-flops.
7. Design and simulate an asynchronous (ripple) counter for a custom sequence using structural modeling.
8. Implement a sequence detector for a given binary pattern using FSM (Moore/Mealy) in behavioural modeling.

\# Realize one of the designs simulated in Part-B using discrete components / ICs.

Required Hardware (for Hardware Lab Experiments)

Component	Description
Digital Trainer Kit	Breadboard with power supply and clock generator
Logic ICs	7400 (NAND), 7402 (NOR), 7408 (AND), 7432 (OR), 7486 (XOR), 7404 (NOT), etc.
Flip-Flop ICs	7474 (D Flip-Flop), 7476 (JK Flip-Flop)
MUX/Decoder ICs	74153, 74138, 74139
LEDs, switches, connecting wires	For I/O interface and testing

Required Software Tools (for Verilog HDL Experiments) (Any one of the tool below)

Software	Purpose
Xilinx Vivado	HDL simulation and synthesis (preferred tool)
ModelSim	Verilog simulation and waveform analysis
Xilinx ISE	Legacy support for simulation and FPGA design

5EC310SD: LINUX AND SHELL SCRIPTING

B.Tech. II Year I Semester   **L   T   P   C**
                                                                             0   0   2   1

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

1. Understand Linux system structure, OS architecture, and command-line environment.
2. Perform Linux installation and basic administration including file, user, and permission management.
3. Develop shell scripts to automate tasks such as backups, monitoring, and data processing.
4. Use Linux tools for software management, networking, and service configuration.
5. Implement backup, recovery, and basic troubleshooting techniques through practical labs.

Week 1: Introduction to OS Concepts
Lab Activity: Linux History, Opensource software basics & Licenses, Why Linux vs windows Identify system and application software on your PC. Differentiate their roles and explain basic OS functions.

Week 2: Linux Architecture & Kernel Types
Lab Activity: Compare Monolithic and Microkernel architectures using diagrams. Discuss how Linux's structure supports device-level control.

Week 3: Installing Linux (Ubuntu/CentOS)
Lab Activity: Install Linux using VirtualBox or WSL. Document each installation step and troubleshoot any permission or hardware issues.

Week 4: Linux Filesystem & Navigation
Lab Activity: Navigate key directories like /home, /etc, and /var. Create folder structures for a team project.

Week 5: File Permissions & Ownership
Lab Activity: Set permissions on project folders so only group members can access/edit them. Verify permissions using multiple users.

Week 6: User and Group Management
Lab Activity: Create users and groups for a coding team. Set up shared access using group permissions and configure hidden config files.

Week 7: Process Management
Lab Activity: Identify and terminate frozen or unresponsive processes during compilation using commands like ps and top.

Week 8: Process Priorities & Memory Tools
Lab Activity: Adjust priority of background jobs using nice and monitor system memory usage with vmstat and free. Display information about the processes using top and kill the applications/processes with the task id

Week 9: Shell Scripting Basics
Use Case: *System Info Script for Lab Login*
Lab Activity:
Create a shell script that automatically displays system uptime, current date/time, available disk space, and active users each time a lab user logs in. Use variables and echo statements to present the information in a readable format.

Week 10: Loops, Functions, and Cron Jobs
Use Case: *Automated Backup Scheduler for Project Folders*
Lab Activity:
Write a shell script that loops through all user folders in /home and backs them up to a predefined backup location. Add functions for logging success/failure. Schedule it to run daily at 2 AM using cron. Handle missing folders gracefully.

Week 11: Package Management & Archiving
Use Case: *Setting Up Developer Environment + Archiving a Project*
Lab Activity:
Use apt (Ubuntu) or yum (CentOS) to install essential tools like vim, curl, or git. Archive a project directory using tar or zip. Use sha256sum to verify archive integrity before transferring it to another system.

Installation of applications using apt, apt-get, yum, dnf, snap, or brew commands. Setup python virtual environment

Week 12: Text Processing & Networking Utilities
Use Case: *Security Log Analysis & Network Check After Intrusion Alert*
Lab Activity:
Analyze /var/log/auth.log or /var/log/secure to detect failed login attempts using grep, awk, cut, and sort. Use ping, traceroute, netstat, nbtstat, arp and scp to check remote system connectivity and transfer reports securely.

Concepts of Linux clusters, Virtual machines (virtual box in chapter 3), creating VMs, allocating resources, interconnection between VMs, Containers concepts

Week 13: Service Management & Disk Mounting
Use Case: *Adding Extra Storage Without Reboot*
Lab Activity:
Create a new virtual disk in VirtualBox. Partition and format it. Mount it to /mnt/data and ensure it auto-mounts on reboot. Enable a required service (like ssh or apache2) using systemctl and check its status.

Week 14: Backup & Recovery
Use Case: *Disaster Recovery After Accidental Deletion*
Lab Activity:
Use a backup script to create a backup of critical folders. Simulate file deletion and restore them using your backup. Analyze /var/log/syslog or equivalent to trace user activity that led to the issue.

Week 15: Mini Project – Tool Development
Use Case: *Custom Shell Tool for New Employee Onboarding or Admin Task*
Lab Activity:
Develop a complete shell-based tool. Examples:

- A user account creation wizard for new employees
- A disk usage monitoring alert system
- A log cleaner tool that archives and clears logs weekly
  Include user prompts, help menu, error checks, and logging features.

Week 16: Final Demo & Viva
Use Case: *Present Your Solution to the Faculty Team*
Lab Activity:
Demonstrate your mini project. Explain your code, how it solves the problem, test cases handled, and improvements you'd make. Submit your code with screenshots, logs, and a short user manual or README

5VA300ES: ENVIRONMENTAL SCIENCE

B.Tech. II Year I Semester   **L   T   P   C**
                                                                 1   0   0   0

Course Objectives:

1. Understand the components, structure, and functions of ecosystems and their relevance to human society.
2. Comprehend classification, sustainable management, and challenges of natural resources including water, minerals, land, forests, and energy.
3. Grasp the significance, value, and conservation approaches for biodiversity, including threats and legislative frameworks.
4. Analyze types, sources, and impacts of environmental pollution, and learn technological and policy measures for pollution prevention and control.
5. Develop awareness about global environmental challenges, international agreements, and the role of policy, law, and Environmental Impact Assessment (EIA) in sustainable development.

Course Outcomes:

1. Understand the structure, function, and significance of ecosystems, including energy flow, biogeochemical cycles, and biodiversity conservation through field experiences.
2. Analyze the classification, utilization, and sustainable management of natural resources, along with alternative energy options.
3. Evaluate biodiversity at genetic, species, and ecosystem levels, its values, threats, and conservation methods under national and international frameworks.
4. Identify types, sources, and impacts of environmental pollution, and apply suitable control technologies while assessing global environmental challenges and protocols.
5. Interpret environmental policies, legislation, and the EIA process to propose management plans addressing contemporary environmental and sustainability issues.

UNIT - I
Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem value, services and carrying capacity, Field visits.

UNIT - II
Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

UNIT - III
Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT - IV
Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.
Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Issues and Global Efforts: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

UNIT - V
Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act-1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio- economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan(EMP). Contemporary Environmental Issues Climate change; Sustainable development goals (SDGs); Global environmental challenges; Environmental policies and international agreements.

TEXT BOOKS:
1. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.
2. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
3. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:
1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.

5MA401BS: NUMERICAL METHODS AND COMPLEX VARIABLES

B.Tech. II Year II Semester	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Pre-requisites: Mathematics courses of first year of study.

Course Objectives:

To learn

1. Expressing periodic function by Fourier series and a non-periodic function by Fourier transforms
2. Various numerical methods to find roots of polynomial and transcendental equations.
3. Concept of finite differences and to estimate the value for the given data using interpolation.
4. Evaluation of integrals using numerical techniques
5. Solving ordinary differential equations of first order using numerical techniques.
6. Differentiation and integration of complex valued functions.
7. Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem.
8. Expansion of complex functions using Taylor's and Laurent's series.

Course Outcomes:

After learning the contents of this course, the student must be able to

1. Express any periodic function in terms of sine and cosine.
2. Find the root of a given polynomial and transcendental equations.
3. Estimate the value for the given data using interpolation
4. Find the numerical solutions for a given first order ODE's
5. Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems.
6. Taylor's and Laurent's series expansions in complex function.

UNIT- I: Fourier Series & Fourier Transforms   8 L

Fourier series – Dirichlet's Conditions – Half-range Fourier series – Fourier Transforms: Fourier Integral Theorem (Only statements), Fourier Sine and Cosine transforms (Elementary illustrations)

UNIT- II: Numerical Methods-I   10 L

Solution of polynomial and transcendental equations: Bisection method – Iteration Method – Newton-Raphson method and Regula-Falsi method. Finite differences: forward differences – backward differences – central differences – symbolic relations – Interpolation using Newton's forward and backward difference formulae – Lagrange's method of interpolation.

UNIT- III: Numerical Methods-II   10 L

Numerical integration: Trapezoidal rule - Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.

Ordinary differential equations: Taylor's series – Euler's method – Runge-Kutta method of fourth order for first order ODE.

UNIT- IV: Complex Differentiation   **10 L**

Differentiation of Complex functions – Analyticity – Cauchy-Riemann equations (without proof) – Harmonic Functions – Finding harmonic conjugate – Milne-Thomson method – Elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

UNIT - V: Complex Integration   **10 L**

Line integral – Cauchy's theorem – Cauchy's Integral formula – Zeros of analytic functions – Singularities – Taylor's series – Laurent's series. Residues – Cauchy Residue theorem (All theorems without Proof).

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

REFERENCES:

1. Murray R. Spiegel, Ph.D., Seymour Lipschutz, Ph.D., John J. Schiller, Ph.D., Dennis Spellman, Ph.D., Complex Variables (Schaum's outline)
2. M. K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computations, New Age International publishers.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9thEdition, John Wiley &Sons, 2006.
4. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Edition, Mc-Graw Hill, 2004

5EC402PC: ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

B.Tech. II Year II Sem   **L   T   P   C**
                                                              3   0   0   3

Pre-requisite: Mathematics

Course Objectives:

1. To learn the Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields and apply them to solve physics and engineering problems.
2. To distinguish between static and time-varying fields and understand the significance and utility of Maxwell's Equations and Boundary Conditions, and gain ability to provide solutions to communication engineering problems.
3. To analyze the characteristics of Uniform Plane Waves (UPW), determine their propagation parameters and estimate the same for dielectric and dissipative media.
4. To analyze the propagation of waves in transmission line and able to solve transmission line problem using Smith Chart.

Course Outcomes: Upon completing the Course, the students will be able to:

1. Acquire knowledge of Basic Laws, concepts and solve problems related to Electrostatic Fields and Magnetostatics Fields.
2. Differentiate the static and time-varying EM fields and apply Maxwell's Equations at different Boundaries.
3. Classify conductors and dielectric materials and analyze the Wave Propagations in those mediums.
4. Solve transmission line problems numerically and using Smith charts.

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

UNIT - I

Electrostatics: Review of Coordinate Systems & Vector Calculus, Coulomb's Law, Electric Field Intensity - Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and its applications, Electric Potential, Relation between E and V, Maxwell's Equations for Electrostatic Fields in differential and integral forms, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitors - Parallel Plate, Coaxial, Spherical, Electric Boundary Conditions.

UNIT - II

Magnetostatics: Biot-Savart's Law, Ampere's Circuit Law and its applications, Magnetic Flux Density, Maxwell's equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law**,** Faraday's Law, Inconsistency in Ampere's Law and Displacement Current Density, Maxwell's Equations for Magnetostatic fields in differential and integral forms, Magnetic Boundary Conditions.

UNIT - III

EM Wave Characteristics: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves - Definitions, Relation between E&H, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics - Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Skin Depth, Surface Impedance, Wave Polarization. Poynting Vector and Poynting Theorem.
Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection,

UNIT - IV

Transmission Lines: Equivalent Circuit, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Condition for Distortion less transmission lines, Input Impedance, SC and OC Lines, Reflection Coefficient, VSWR, Smith Chart- Configuration and Applications, Single Stub Matching.

UNIT - V

Waveguides: Rectangular Waveguides - Solution of Wave Equations in Rectangular Coordinates, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Phase and Group Velocities, Wavelengths and Impedance Relations, Equation of Power Transmission, Impossibility of TEM Mode*.*

TEXT BOOKS:

1. William H. Hayt Jr. and John A. Buck, Engineering Electromagnetics, 8ed.,McGraw Hill, 2014.
2. Matthew N.O. Sadiku and S.V. Kulkarni, Principles of Electromagnetics, 6ed., Oxford University Press, Asian Edition, 2015.

REFERENCES:

1. E.C.Jordan and K.G. Balmain, Electromagnetic Waves and Radiating Systems, 2ed., PHI, 2000.
2. Nathan Ida, Engineering Electromagnetics, Springer(India) Pvt. Ltd., 2ed. New Delhi, 2005.
3. Bhag Guru and Huseyin R. Hiziroglu, Electromagnetic Field Theory Fundamentals, Cambridge University Press, 2ed., 2006.

5EC403PC: ANALOG AND DIGITAL COMMUNICATIONS

B.Tech. II Year II Semester

L T P C
3 0 0 3

Pre-requisite: Signals and Systems

Course Objectives:

1. To develop ability to analyze system requirements of analog and digital communication systems.
2. To understand the generation, detection of various analog and digital modulation techniques.
3. To acquire theoretical knowledge of each block in AM, FM transmitters and receivers.
4. To understand the concepts of baseband transmissions.

Course Outcomes: Upon completion of the Course, the students will be able to:

1. Design and analyze various analog and digital modulation and demodulation techniques.
2. Understand the effect of noise present in continuous wave modulation techniques.
3. Understand the concept of Super heterodyne receiver and Pulse modulation techniques.
4. Analyze and design the various coding techniques and Base band transmission.

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

UNIT I

Amplitude Modulation: Need for modulation, Amplitude Modulation: Time and frequency domain description, Generation - Switching modulator, Detection - Envelope detector, DSB-SC Modulation: Generation - Balanced Modulator, Detection- Synchronous detector, COSTAS Loop, SSB Modulation: Time and frequency domain description, Generation - Phase discrimination Method and Demodulation - coherent detection, Vestigial side band modulation and demodulation.

Angle Modulation: Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis, Carson's Rule, Generation of FM Waves - Armstrong Method, Detection of FM Waves - Phase locked loop, Comparison of FM and AM.

UNIT II

Transmitters & Receivers: Classification of Transmitters, AM Transmitters, FM Transmitters, AM Receiver - Super heterodyne receiver, FM Receivers, Stereo FM multiplex reception, Comparison of AM and FM Receiver, Noise analysis in AM, DSB, SSB and FM Modulation System, Threshold effect in Angle Modulation System, Pre-emphasis and de-emphasis.

Pulse Modulation: Types of Pulse modulation - PAM, PWM and PPM, Comparison of FDM and TDM.

UNIT III

Detection and Estimation: Model of Digital Communication Systems, Geometric Interpretation of Signals, Gram-Schmidt Orthogonalization, Response of Bank of correlators to Noisy Input, Detection of Known Signals in Noise, Probability of error, Optimum Receivers using Coherent Detection: Matched filter Receiver and its Properties, Correlation receiver, Detection of signals with unknown Phase in Noise.

Base Band Shaping for Data Transmission: Requirements of a line encoding format, various line encoding formats - Unipolar, Polar, Bipolar, Discrete PAM signals, Inter symbol interference, Nyquist's criterion, Correlation coding: Duobinary signaling, Modified Duobinary technique, generalized form of correlation coding, Eye pattern.

UNIT IV

Digital Modulation Techniques: PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, DPCM, DM and Adaptive DM, Noise in PCM and DM.

Digital Modulation formats, Coherent binary modulation techniques (BPSK, BFSK), Coherent quadrature modulation techniques (QPSK), Non-Coherent binary modulation techniques (BFSK, DPSK), QAM, M-ary modulation techniques (PSK, FSK, QAM), Comparison of M-ary digital modulation techniques, power spectra, bandwidth efficiency, constellation diagrams.

UNIT V

Information theory: Entropy, Information rate, Mutual information, Channel capacity of discrete channel, Shannon-Hartley law; Trade-off between bandwidth and SNR.
Source coding - Huffman coding, Shannon Fano coding, Channel coding - Linear block codes and cyclic codes.

TEXTBOOKS:

1. Communication System - Simon Haykin and Michael Moher, Wiley, 5ed., 2022.
2. Wayne Tomasi, Electronics Communication Systems - Fundamentals through Advanced, 5ed., PHI, 2009.
3. K. Sam Shanmugam, Digital and Analog Communication System, Wiley, 2019.

REFERENCES:

1. Dennis Roddy and John Coolen, Electronic Communications, 4ed., Pearson, 2008.
2. George Kennedy and Bernard Davis, Electronic Communication Systems, 4ed.,TMH, 2009.
3. Herbert Taub, Donald L. Schiling, Goutam Saha, Principles of Communication Systems, 3ed., McGraw Hill, 2008.

5EC404PC: RISC AND MICROCONTROLLER ARCHITECTURES

B.Tech. II Year II Semester

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

1. To familiarize with the architecture of microprocessor and microcontrollers.
2. To provide the knowledge about interfacing techniques of bus and memory.
3. To understand the concepts of ARM architecture
4. To study the basic concepts of Advanced ARM processors.

Course Outcomes: Upon completion of the Course, the students will be able to:

1. Discuss and compare the internal architecture and organization of 8086 microprocessor and 8051 microcontrollers.
2. Demonstrate programming proficiency using various addressing modes and instructions set of 8051 microcontroller.
3. Illustrate the use of interrupts, serial communication, timers for real time control in 8051 with programming.
4. Illustrate the interfacing of I/O and memory devices with 8051 and understand the various serial communication and bus interface units.
5. Discuss the internal architecture of ARM processors and understand the addressing modes and instruction set of ARM.
6. Outline the architecture of ARM Cortex-M processors.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	-	-	-	-	-	-	2
CO2	3	2	2	2	3	-	-	-	-	-	2
CO3	3	3	3	2	3	-	-	-	-	-	2
CO4	3	3	3	2	3	-	-	-	-	-	2
CO5	2	1	-	1	2	-	-	-	-	-	2
CO6	2	1	-	1	1	-	-	-	-	-	2

UNIT - I

8086 Microprocessor: 8086 Architecture - Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, interrupts of 8086.

8051 Microcontroller: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Counter and Timers, Serial Data Input / Output, Interrupts, Addressing Modes and Instruction set of 8051.

UNIT - II

8051 Real Time Control: Programming 8051 Timers, Programming 8051 Serial port. Programming Timer interrupts, External Hardware Interrupts, Programming the Serial Communication Interrupt. Interfacing of LCD, Keyboard, ADC and DAC, External Memory. Serial Communication standards – RS 232, USB.

UNIT - III

ARM Architecture: RISC Design Philosophy, ARM Design Philosophy, ARM Programmer's model - Registers, CPSR, Pipeline, Exceptions, Interrupts and Vector Table, Architecture Revisions, ARM Processor families.

ARM Instruction Set: Data types, Memory organization, Data processing instructions, branch instructions, load-store instructions, software interrupt instructions, program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

UNIT - IV

ARM Cortex-M Architecture: Introduction to Cortex-M Microcontroller, ARM Instruction Set Architecture (ISA), Register Set, Processor Operating modes.

UNIT - V

ARM Cortex-M Features: Interrupts and Processor Reset Sequence, Pipelined Architecture and Data Path, Memory Address Map, Nested Interrupt Vector Controller (NVIC), Bus System, Memory and Peripherals, Debug System.

TEXT BOOKS:

1. M.A. Mazidi, J.G. Mazidi and Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems using Assembly and C, 2ed., Pearson Education, 2007.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide Designing and Optimizing System software, Elsevier, 2004.
3. Muhammad Tahir and Kashif Javed, ARM Microprocessor System, CRC Press, 2017.

REFERENCES:

1. Kenneth. J. Ayala, The 8051 Microcontroller, Cengage Learning, 3ed., 2004.
2. Steve Furber, ARM System-on-Chip Architecture, 2ed., Pearson Education, 2000.
3. Lyla B. Das, "Architecture, Programming and Interfacing of Low-power Processors - ARM 7, Cortex-M", Cengage, 1ed., 2017.

5EC405PC: LINEAR AND DIGITAL IC APPLICATIONS

B.Tech. II Year II Semester

L	T	P	C
3	0	0	3

Pre-requisite: Switching Theory and Logic Design.

Course Objectives:

1. Impart the concepts of Op-Amp, 555 Timers, IC regulator, data converter and its characteristics.
2. Illustrate the linear and nonlinear applications of operational amplifier.
3. Design combinational and sequential circuits with IC, memories and PLD.

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

1. Understand the basic construction, characteristics and parameters of Op-Amp.
2. Analyze the linear and nonlinear applications of Op-Amp.
3. Explain the concepts of IC555 timer, IC723 regulator, memories and PLD.
4. Design logic functions of Combinational and Sequential circuits with ICs.

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

UNIT - I

Operational Amplifier: Ideal and Practical Op-Amp Characteristics, Features of 741 Op- Amp, Modes of Operation - Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

UNIT - II

Op-Amp, IC-555 & IC565 Applications: Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer - Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL - Block Schematic, Principle and Applications.

UNIT - III

Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT - IV

Logic Families: Digital IC characteristics, TTL logic family, TTL series and TTL output configurations: open collector, Totem pole, Tri state logic. MOS logic family, CMOS logic family and its series characteristics, CMOS transmission gate, CMOS open drain and high impedance outputs, Comparison of TTL and CMOS logic families.

Combinational Logic ICs: Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT - V

Sequential Logic IC's and Memories: Familiarity with commonly available 74XX & CMOS40XX Series ICs– All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.

Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

TEXT BOOKS:

1. Ramakant A. Gayakwad, Op-Amps & Linear Integrated Circuits, PHI, 4ed., 2012.
2. Thomas L. Floyd, Digital Fundamentals, Pearson, 11ed., 2015.

REFERENCES:

1. D. Roy Choudhury and Shail B. Jain, Linear Integrated Circuits, New Age International Publishers, 2ed, 2003.
2. John. F. Wakerly, Digital Design Principles and Practices, Pearson, 3ed., 2009.
3. S. Salivahanan and V.S. Kanchana Bhaaskaran, Linear Integrated Circuits, 3ed., McGraw Hil Education, 2018.
4. William D. Stanley, Operational Amplifiers with Linear Integrated Circuits, 4ed., Pearson Education, 2009.

5MA406BS: COMPUTATIONAL MATHEMATICS LAB

(Using Python / MATLAB software)

B.Tech. II Year II Semester	L	T	P	C
	0	0	2	1

Pre-requisites: Matrices, Iterative methods and ordinary differential equations

Course Objectives:

To learn

1. Solve problems of Eigen values and Eigen Vectors using Python/MATLAB.
2. Solution of Algebraic and Transcendental Equations using Python/MATLAB.
3. Solve problems of Linear system of equations.
4. Solve problems of First-Order ODEs Higher order linear differential equations with constant coefficients.

Course Outcomes:

After learning the contents of this course, the students must be able to:

1. Develop the code to find the Eigen values and Eigen Vectors using Python/MATLAB.
2. Develop the code find solution of Algebraic and Transcendental Equations and Linear system of equations using Python/MATLAB.
3. Write the code to solve problems of First-Order ODEs Higher order linear differential equations with constant coefficients.

* Visualize all solutions Graphically through programmes

UNIT- I : Eigen values and Eigenvectors: **6P**

Programs:

- Finding real and complex Eigen values.
- Finding Eigen vectors.

UNIT-II: Solution of Algebraic and Transcendental Equations   **6P**

Bisection method, Newton Raphson Method

Programs:

- Root of a given equation using Bisection method.
- Root of a given equation Newton Raphson Method.

UNIT-III: Linear system of equations: **6P**

Jacobi's iteration method and Gauss-Seidal iteration method

Programs:

- Solution of given system of linear equations using Jacobi'smethod
- Solution of given system of linear equations using Gauss-Seidal method

UNIT-IV: First-Order ODEs   **8P**

Exact and non exact equations, Applications: exponential growth/decay, Newton's law of cooling.

Programs:

- Solving exactand non-exactequations
- Solving exponential growth/decay and Newton's law of cooling problems

UNIT-V: Higher orderlinear differential equations with constant coefficients   6P

Programs:

- Solving homogeneous ODEs
- Solving non homogeneous ODEs

TEXT BOOKS:

1. MATLAB and its Applications in Engineering, Rajkumar Basal, Ashok Kumar Geo, Manoj Kumar Sharama, Pearson publication.
2. Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.
3. Think Python First Edition, by Allen B. Downey, Orielly publishings.
4. Introduction to Python Programming, William Mitchell, Povel Solin, Martin Novak et al., NCLab Public Computing, 2012.
5. Introduction to Python Programming, ©Jacob Fredslund, 2007.

REFERENCES:

1. An Introduction to Python, John C. Lusth, The University of Alabama, 2011.
2. Introduction to Python, ©Dave Kuhlman, 2008.

5EC407PC: ANALOG AND DIGITAL COMMUNICATIONS LABORATORY

B.Tech. II Year II Semester

	L	T	P	C
	0	0	2	1

Course Objectives:

1. Implement analog modulation techniques such as AM and FM using hardware and simulation tools.
2. Analyze pulse modulation techniques and verify the sampling theorem through practical observations.
3. Implement and evaluate digital modulation techniques and system performance using constellation diagrams, eye diagrams, matched filters, and source coding.

Course Outcomes: Upon completion of the Course, the students will be able to:

1. Design and implement various Analog modulation and demodulation techniques and observe the time and frequency domain characteristics of these modulated signals.
2. Design and implement various Pulse modulation and demodulation techniques and observe the time and frequency domain characteristics of these modulated signals.
3. Understand the concept of aliasing and different types of sampling with various sampling rates and duty cycles by implementing practically.
4. Design and implement various Digital modulation and demodulation techniques and observe the waveforms of these modulated signals practically.

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

Note:
- Minimum 12 experiments should be conducted.
- All these experiments are to be simulated first either using MATLAB, Commsim or any other simulation package and then to be realized in hardware.

Cycle 1:

Amplitude modulation, Pulse modulation, Sampling and Multiplexing (Minimum 6 experiments need to be carried out)

1. Generate Amplitude modulated signal and perform demodulation for different modulation indices. Plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically. Plot the effect of modulating signal frequency and amplitude on the modulation index.
2. Generate Frequency modulated signal and perform demodulation for different modulation indices. Plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically. Plot the effect of modulating signal frequency and amplitude on the modulation index.
3. Generate modulated and demodulated DSB-SC Signal for different modulation indices and plot the corresponding waveforms and their spectrum. Compare the modulation index theoretically and practically.
4. Generate modulated and demodulated SSB-SC Signal (Phase Shift Method) for different modulation indices and plot the corresponding waveforms and their spectrum. Also calculate

theoretically and practically the modulation index in each case.

5. Demonstrate the Frequency Division Multiplexing & De multiplexing practically by transmitting atleast 4 different signals simultaneously with respect to time and recovering without distortion.
6. Verify Sampling theorem for different sampling rates, sampling types and duty cycles and Plot the sampled and reconstructed signals. Write the conclusions, based on practical observations.
7. Design and implement a Pulse Amplitude Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations.
8. Design and implement a Pulse Width Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations.
9. Design and implement a Pulse Position Modulator & Demodulator Circuit using 555 timer and plot the corresponding waveforms from the practical observations.

Cycle 2:

Digital Modulation, Signal Analysis & Source Coding (Minimum 6 experiments need to be carried out)

10. Generate PCM Modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
11. Generate Delta Modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
12. Generate FSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
13. Generate Binary PSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
14. Generate DPSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
15. Generate QPSK modulated Signal and demodulate it by designing and implementing the corresponding Demodulator. Plot the corresponding waveforms from practical observations.
16. Plot and Analyze the performance of BPSK, BFSK and QPSK under noisy environment through constellation diagram**.**
17. Demonstrate ISI through eye diagram.
18. Simulate raised cosine signal and duo binary signals.
19. Encode data using Shannon Fano /Huffman Coding through Hardware / Simulator
20. Analyze the performance of a Matched filter

5EC408PC: RISC AND MICROCONTROLLER INTERFACING LABORATORY

B.Tech. II Year II Semester	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Course Objectives:

1. Develop the programming knowledge of 8051 and ARM Cortex M3 Microcontrollers.
2. Understand the usage of Integrated Development Environment (Keil and Flash Magic).
3. Control the operation of various peripherals using 8051 and ARM Cortex M3 microcontroller.

Course Outcomes: Upon completion of the Course, the students will be able to:

1. Develop the programs of 8051 and ARM Cortex-M3 microcontrollers using their respective instruction set.
2. Understand the usage of various debugging tools available to program different microcontrollers.
3. Build code for 8051 and ARM Cortex microcontrollers to interface various input/output modules.
4. Analyze the hardware and software interaction and integration.
5. Design and develop the 8051 and ARM Cortex based embedded systems for various applications.

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

Cycle 1:

Using 8051 Microcontroller Kit

- Introduction to IDE
1. Assembly Language Programs to Perform: Arithmetic (Both Signed and Unsigned), 16 Bit Data Operations, Logical Operations (Byte and Bit Level Operations), Rotate, Shift, Swap and Branch Instructions.
2. Time delay Generation using Timers of 8051.
3. Serial Communication from / to 8051 to / from I/O devices.
4. Program using Interrupts to Generate Square Wave 10 KHz Frequency on P2.1 using Timer 0 8051 in 8-bit Auto reload mode and Connect a 1 Hz Pulse to INT1 pin and Display on Port 0. Assume Crystal Frequency as 11.0592 MHz.

Cycle 2:

Interfacing I/O Devices to 8051

1. 7 Segment Display to 8051.
2. Matrix Keypad to 8051.
3. Sequence Generator Using Serial Interface in 8051.
4. 8-bit ADC Interface to 8051.
5. Triangular Wave Generator through DAC interfaces to 8051.

Cycle 3

Experiments to be carried out on Cortex-M3 development board and using GNU toolchain

1. Blink an LED with software delay, delay generated using the SysTick timer.
2. System clock real time alteration using the PLL modules.
3. Control intensity of an LED using PWM implemented in software and hardware.
4. Control an LED using switch by polling method, by interrupt method and flash the LED once every five switch presses.

5EC405PC: LINEAR AND DIGITAL IC APPLICATIONS LABORATORY

B.Tech. II Year II Semester	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Course Objectives:

1. Know and verify the concepts of 741 Op-Amp, IC555 timer, IC723 and data converters.
2. Know the various characteristics of TTL and CMOS gates and implement the circuits with Digital ICs.
3. Contrast the differences between linear and digital ICs.

Course Outcomes: Upon completion of the Course, the students will be able to:

1. Design and implementation of various analog circuits using 741 ICs.
2. Design and implementation of various Multivibrators using 555 timer.
3. Design and implement ADC, DAC and voltage regulators.
4. Design various combinational circuits and sequential circuits using digital ICs.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	0	3	3	3	-	-	-	3	3	-
CO2	1	0	3	3	3	-	-	-	3	3	-
CO3	1	0	3	3	3	-	-	-	3	3	-
CO4	1	0	3	3	3	-	-	-	3	3	-

List of Experiments

PART-A

Linear IC Applications (Minimum of Eight experiments to be performed)

1. Design an Inverting and Non-inverting Amplifier using Op Amp and calculate gain.
2. Design Adder and Subtractor using Op Amp and verify addition and subtraction process.
3. Design a Comparator using Op-Amp and draw the comparison results of A=B, A<B, A>B.
4. Design an Integrator and a Differentiator Circuit using IC741 and derive the required condition practically.
5. Design a Active LPF, HPF cutoff frequency of 2 KHz and find the roll off of it.
6. Design a Circuit using IC741 to generate sine / square / triangular wave with a period of 1 KHz and draw the output waveform.
7. Construct Monostable Multivibrator using IC555 and draw its output waveform.
8. Construct Astable Multivibrator using IC 555 and draw its output waveform and also find its duty cycle.
9. Design a Schmitt Trigger Circuit and find its LTP and UTP.
10. Design Frequency modulator and demodulator circuit and draw the respective waveforms.
11. Design Voltage Regulator using IC723, IC 7805 / 7809 / 7912 and find its load regulation factor.
12. Design R-2R ladder DAC and find its resolution and write a truth table with respective voltages.
13. Design Parallel comparator type / counter type / successive approximation ADC and find its efficiency.

PART-B

Digital IC Applications (Minimum of Six experiments to be performed)

14. Design a Gray code converter and verify its truth table.
15. Design an even priority encoder using IC74xx and verify its truth table.
16. Design a 8x1multiplexer using digital ICs.
17. Design a 4-bit Adder / Subtractor using digital ICs and Add / Subtract the following bits.
    (i) 1010   (ii) 0101   (iii) 1011
       0100   0010   1001.
18. Design a Decade counter and verify its truth table and draw respective waveforms.
19. Design a Up/down counter using IC74163 and draw read/write waveforms.
20. Design a Universal shift register using IC74194 / 195 and verify its shifting operation.
21. Design a 16x4 RAM using 74189 and draw its read /write operation.
22. Design a 8x3 encoder / 3x8 decoder and verify its truth table.

5EC410SD: WEB AND MOBILE APPLICATIONS

B.Tech. II Year II Semester   **L   T   P   C**
                                                                          0   0   2   1

Course Objectives:

1. Understand and apply core web technologies (HTML, CSS, JavaScript) for structured, styled, and interactive webpages.
2. Build responsive websites using frameworks like Bootstrap and manage code using Git/GitHub.
3. Create simple server-side functionality using Node.js and store/retrieve data from basic databases.
4. Design and develop mobile applications using Flutter for Android and iOS.
5. Integrate web and mobile development into a functional mini-project with deployment.

Week 1: Introduction to the Web
Understand web architecture, clients, servers, and workflows. Explore an existing website's structure and elements using browser DevTools.

Week 2: HTML Basics
Learn about different markup languages and their significance. Create a homepage for a static site using paragraphs, headings, lists, links, and images.

Week 3: CSS – Layout & Design Foundations
Apply colors, spacing, and layouts using CSS. Practice Flexbox and Grid techniques by cloning a simple website layout.

Week 4: Introduction to JavaScript
Understand the Document Object Model (DOM) and basic JavaScript constructs. Add interactivity to a webpage with a 'Contact Us' form that dynamically displays/hides details.

Week 5: Combining HTML, CSS, and JavaScript
Integrate skills from previous weeks to start building a personal portfolio website.

Week 6: Responsive Design using Bootstrap
Make your site adapt to different screen sizes (mobile, tablet, desktop) using Bootstrap's grid system and components.

Week 7: Deployment using GitHub
Learn version control basics with Git and GitHub. Publish your portfolio online via GitHub Pages and collaborate with classmates for code reviews.

Week 8: Basic Server Concepts & Node.js
Set up a basic Node.js server to serve web content. Understand server-side fundamentals and simple routing.

Week 9: Introduction to Databases
Learn to store and retrieve data using JSON or SQLite. Save contact form submissions from your portfolio into a database.

Week 10: Introduction to Flutter
Understand Flutter's widget structure and framework basics. Design a simple login and landing page for a mobile app.

Week 11: Mobile App Interactivity
Create a Flutter app that displays a list of events. Add RSVP functionality with confirmation messages.

Week 12: Full-Stack Integration
Build a registration page that saves new members to a database and displays a welcome message. Connect your Flutter app to a database for data-driven functionality.

Week 13: Project Work
Apply all learned skills to build a real-world project such as a club/college event management application integrating both web and mobile interfaces.

Week 14: Final Presentations
Present your completed project to classmates, highlighting key features, responsive design, and integration. Gather peer feedback for improvement.

Mini-Project Example Themes
- Event registration & tracking for college clubs
- Simple inventory tracking system
- Student feedback & announcement portal
- IoT project dashboards (linking to electronics projects)

REFERENCE BOOKS:

1. Web Technologies: HTML, CSS, JavaScript – *Uttam K. Roy* (Oxford University Press).
2. Web Technology: Theory and Practice – *M.N. Rao & P.S. Rao* (Pearson).
3. Web Technologies: TCP/IP, Web/HTTP, Web Servers, Web Applications, and Cloud Computing – *Achyut S. Godbole & Atul Kahate* (McGraw-Hill Education).
4. Mobile Application Development – *Debasis Samanta & Goutam Kumar Panda* (Prentice Hall India).
5. Full Stack Web Development – *V. Srinivasa Rao* (Notion Press).