JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
(JNTUH University Constituent Engineering Colleges)
B.Tech. in Electrical and Electronics Engineering
COURSE STRUCTURE & SYLLABUS (R25 Regulations)
Applicable from AY 2025-26 Batch

I Year I Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Matrices and Calculus	3	1	0	4
2	BSC	Engineering Chemistry	3	0	0	3
3	CSC	C and Data Structures	3	0	0	3
4	ESC	Analog Electronics	2	0	0	2
5	ESC	Electrical Circuits - I	3	0	0	3
6	HSC	English for Skill Enhancement	3	0	0	3
7	BSC	Engineering Chemistry Laboratory	0	0	2	1
8	CSC	C and Data Structures Laboratory	0	0	2	1
9	HSC	English Language and Communication Skills Laboratory	0	0	2	1
10		Induction Program				
		Total Credits	**16**	**01**	**08**	**21**

I Year II Semester

S. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Ordinary Differential Equations and Vector Calculus	3	0	0	3
2	BSC	Applied Physics	3	0	0	3
3	ESC	Electromagnetic fields	2	0	0	2
4	MEC	Engineering Graphics and Computer Aided Drafting	2	0	2	3
5	Dept. Core	Electrical Circuits - II	3	0	0	3
6	MEC	Engineering Workshop	0	0	2	1
7	CSC	IoT and Python Programming Laboratory	1*	0	2	2
8	BSC	Applied Physics Laboratory	0	0	2	1
9	ESC	Analog Electronics Laboratory	0	0	2	1
10	ESC	Electrical Circuits Laboratory	0	0	2	1
		Total Credits	**15**	**0**	**10**	**20**

*****IoT and Python Programming: Only Internal and External Practical examination should be conducted.

II YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	Dept. Core	Control Systems	3	0	0	3
2	Dept. Core	Electrical Machines - I	3	0	0	3
3	Dept. Core	Digital Electronics	3	0	0	3
4	Dept. Core	Power Systems - I	3	0	0	3
5	Dept. Core	Electrical Measurements and Sensors	3	0	0	3
6		Innovation and Entrepreneurship	2	0	0	2
7	Dept. Core Laboratory	Electrical Machines - I Laboratory	0	0	2	1
8	Dept. Core Laboratory	Electrical Measurements and Sensors Laboratory	0	0	2	1
9	Dept. Core Laboratory	Digital Electronics Laboratory	0	0	2	1
10	SDC (Skill Development Course – 1)	Design of Electrical Systems using AutoCAD	0	0	2	1
11	MC	Environmental Science	1	0	0	0
		Total Credits	**17**	**0**	**08**	**21**

II YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Numerical Methods and Complex Variables	3	1	0	4
2	Dept. Core	Electrical Machines - II	3	0	0	3
3	Dept. Core	Power Systems - II	3	0	0	3
4	Dept. Core	Power Electronics	3	0	0	3
5	Dept. Core	Microprocessors and Microcontrollers	3	0	0	3
6	Dept. Core Laboratory	Electrical Machines - II Laboratory	0	0	2	1
7	Dept. Core Laboratory	Control Systems Laboratory	0	0	2	1
8	Dept. Core Laboratory	Microprocessors and Microcontrollers Laboratory	0	0	2	1
9	SDC (Skill Development Course – 2)	PCB Design / FPGA Fundamentals	0	0	2	1
		Total Credits	**15**	**0**	**10**	**20**

III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	Dept. Core	Power Semiconductor Drives	3	0	0	3
2	Dept. Core	Power System Protection	3	1	0	4
3	Dept. Core	Power Electronics for Renewable Energy Systems	3	0	0	3
4		Professional Elective-I	3	0	0	3
5		Open Elective-I	2	0	0	2
6	Dept. Core Laboratory	Power System Laboratory	0	0	2	1
7	Dept. Core Laboratory	Power Electronics Laboratory	0	0	2	1
8	Dept. Core Laboratory	Machine Learning & Deep Learning Applications Laboratory	0	0	2	1
9		Field-Based Project/Internship	0	0	4	2
10	SDC (Skill Development Course – 3)	Robotics and Automation/ Web and Mobile Development Applications	0	0	2	1
11	MC	Indian Knowledge System	1	0	0	0
		Total Credits	**15**	**0**	**12**	**21**

III YEAR II SEMESTER

S.No	Course Code	Course Title	L	T	P	Credits
1	Dept. Core	Power System Operation and Control	3	1	0	4
2	Dept. Core	Hybrid Electric Vehicles	3	0	0	3
3		Fundamentals of Management/ Business Economics and Financial Analysis/ Organisational Behaviour	3	0	0	3
4		Professional Elective-II	3	0	0	3
5		Open Elective - II	2	0	0	2
6	Dept. Core Laboratory	Power System Simulation Laboratory	0	0	2	1
7	Dept. Core Laboratory	Electrical Drives Laboratory	0	0	2	1
8	Dept. Core Laboratory	Power Electronics for Renewable Energy Systems Laboratory	0	0	2	1
9	HSC	English for Employability Skills Laboratory	0	0	2	1
10	SDC (Skill Development Course – 4)	Design of Solar Power System/ Battery Technologies	0	0	2	1
11	MC	Gender Sensitization Lab*/ Human Values and Professional Ethics*	1	0	0	0
		Total Credits	**15**	**0**	**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 Constitution of India will be conducted in the following week.

IV YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	Dept. Core	Smart Metering and Communication Protocols	3	0	0	3
2	Dept. Core	EV Charging Infrastructure	3	0	0	3
3		Fundamentals of Management/ Business Economics and Financial Analysis/ Organisational Behaviour	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	Dept. Core Laboratory	Electric Vehicles Laboratory	0	0	2	1
8	Dept. Core Laboratory	Smart Metering and Communication Protocols Lab	0	0	2	1
9		Industry Oriented Mini Project/ Summer Internship	0	0	4	2
		Total Credits	**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		Project Work	0	0	28	14
		Total Credits	**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

1	Machine Learning & Deep Learning and Its Applications
2	Renewable Energy Systems
3	VLSI Design
4	Digital Signal Processing

Professional Elective - II

1	Signals and Systems
2	High Voltage Engineering
3	Utilization of Electrical Energy
4	Optimization Techniques

Professional Elective-III

1	Energy Storage Systems
2	Smart Grid Technologies
3	Programmable Logic Controllers
4	Robotics and Automation

Professional Elective-IV

1	Battery Management Systems
2	HVDC Transmission
3	Embedded Systems
4	Digital Control Systems

Professional Elective-V

1	Computer Vision and Image Processing
2	Electrical Distribution and Automation
3	Switched Mode Power Conversion
4	Autonomous and Connected Vehicles

Professional Elective-VI

1	Drone Technology
2	Power Quality Techniques
3	Energy Conservation and Audit
4	Cyber-Physical Systems

Open Elective-I:

1	Fundamentals of Electric Vehicles
2	Industrial Automation and Control
3	Electrical Design, Estimation and Costing

Open Elective-II:

1	Digital Energy Systems
2	Energy Audit and Policies
3	Applications of Electrical Energy

Open Elective-III:

1	Sustainable Energy Technologies
2	Electrical Safety
3	Instrumentation

MATRICES AND CALCULUS

B.Tech. I Year I Sem.

L	T	P	C
3	1	0	4

Prerequisites: Mathematical Knowledge at pre-university level

Course Objectives:

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

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

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

UNIT-I: Matrices

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

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

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)

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)

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, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

ENGINEERING CHEMISTRY

B.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites:

Course Objectives:

- To develop adaptability to new advances in Engineering Chemistry and acquire the essential skills to become a competent engineering professional.
- 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.
- To impart foundational knowledge of various energy sources and their practical applications in engineering.
- To equip students with an understanding of smart materials, biosensors, and analytical techniques applicable in engineering, industrial, environmental, and biomedical fields.

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

- Students will be able to understand the fundamental properties of water and its applications in both domestic and industrial purposes. (SDG 4, 6)
- Students will gain basic knowledge of electrochemical processes and their relevance to corrosion and its control methods. (SDG 4)
- 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)
- Students will learn the basic concepts and properties of polymers and other engineering materials. (SDG 4, 9)
- 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:

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:

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:

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 use.

Synthetic Fuels: Fischer-Tropsch process, Introduction and applications of Hythane and Green Hydrogen.

UNIT - IV: Polymers:

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:

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.

REFERENCES:

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
7. E-Content- https://doi.org/10.1142/13094 | October 2023

C AND DATA STRUCTURES

B.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites:

- Basic knowledge of mathematics and logical reasoning.
- Familiarity with problem-solving techniques.
- Fundamental understanding of computer usage and operating systems.

Course Objectives:

- To introduce the fundamentals of computer systems, environments, and programming concepts.
- To develop problem-solving skills using C language constructs like variables, control structures, and functions.
- To impart knowledge of advanced C concepts such as pointers, strings, and memory management.
- To familiarize students with derived data types, file handling, and structured programming approaches.
- To provide practical experience in implementing sorting, searching, and basic data structures.

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

- Describe the basic structure of a computer program and apply fundamental C programming constructs.
- Implement control flow statements, functions, and arrays for solving computational problems.
- Use pointers and strings effectively for memory management and data manipulation.
- Apply derived data types and file I/O operations in developing modular programs.
- Implement and analyze sorting, searching algorithms, and simple data structures in C.

UNIT - I:
Basics of Computers and C Language: Introduction to computer systems, environments, languages, and software development.
Basics of C: simple programs, variables, data types, constants, and identifiers. C program structure, input/output, operators, expressions, and statements.

UNIT - II:
Control Flow, Functions, and Arrays: Conditional statements (if, switch), loops (while, for, do-while), and recursion.
Functions: User-defined, standard, and inter-function communication.
Arrays: Single, multi-dimensional arrays, and their applications.

UNIT - III:
Pointers and Strings: Basics of pointers, pointer arithmetic, and pointer usage in functions. Memory allocation, array of pointers, and pointer to pointer concepts.
Strings: Input/output, manipulation, arrays of strings, and conversions.

UNIT - IV:
Derived types: Typedef, enums, structures, and unions.
File I/O: Text vs binary files, file functions, and programs like copy and merge.

UNIT - V:
Sorting: Selection, bubble, and insertion sort.
Searching: Linear and binary search.
Data structures: Linked lists, stacks, and queues with array and linked implementations.

TEXT BOOKS:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

REFERENCES:

1. C & Data structures – P. Padmanabham, 3rd Edition, B.S. Publications.
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3. Programming in C – Stephen G. Kochan, III Edition, Pearson Education.
4. C for Engineers and Scientists, H. Cheng, McGraw-Hill International Edition.
5. Data Structures using C – A. M. Tanenbaum, Y. Langsam, and M.J. Augenstein, Pearson Education / PHI
6. C Programming & Data Structures, E. Balagurusamy, 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 Venkateswarlu, S. Chand & Co.

ANALOG ELECTRONICS

B.Tech. I Year I Sem.

L	T	P	C
2	0	0	2

Prerequisites:

Course Objectives:

- To introduce the basic semiconductor devices such as diodes, transistors, their characteristics and applications.
- To familiarize the students with the working of transistor amplifier circuits and examine the frequency response of an amplifier.
- To familiarize the students with the working of feedback amplifiers and oscillators.
- Impart the concepts of Op-Amp, its characteristics and study the basic applications of Op-Amp.

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

- Describe the working of diode, BJT and FET, and give the expressions for device parameters/ current/ and current-voltage relationships.
- Discuss and analyze the various diode circuits such as rectifiers, filters, clippers and clampers.
- Understand the working of appropriate biasing circuits using BJT and Discuss the various transistor (BJT) amplifier circuits.
- Understand the concept of feedback, and the working of feedback amplifiers and oscillators.
- Understand the basic construction, characteristics and parameters of Op-Amp and its basic applications.

UNIT - I:

Diode and its Applications: PN junction diode, V-I characteristics, Diode resistance and capacitance, Rectifiers - Half-wave, Full-wave (center-tap and bridge), Capacitor filter for rectifiers, Clippers and clampers, Simple Problems.

UNIT - II:

Bipolar Junction Transistor (BJT) and its Biasing: Working principle, Common Base (CB), Common Emitter (CE), Common Collector (CC) configurations, Input and output characteristics, Transistor as an Amplifier, Load line and operating point, Biasing techniques: Collector-to-base bias, Self bias, Thermal runaway.

Field Effect Transistor: Junction FET: Structure, operation, and characteristics, Comparison of BJT and FET, Introduction to MOSFET.

UNIT - III:

Single Stage and Multistage Amplifiers (Qualitative Treatment): Single stage CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, Classification of Amplifiers, Distortion in Amplifiers, Coupling schemes: RC, Transformer, Direct coupling, Frequency response of single stage and two-stage CE Amplifier.

UNIT - IV:

Feedback Amplifiers: Concept and need for feedback in amplifiers, Types and classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Simple Problems.

Oscillators (Qualitative Treatment): Barkhausen criteria, RC type Oscillators - RC phase shift and Wien-bridge Oscillators, LC type Oscillators – Hartley and Colpitts Oscillators, Crystal oscillator.

UNIT-V:

Operational Amplifiers: Ideal Op-amp, output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product, Inverting and non-inverting amplifier, Differentiator, integrator, Square-wave and triangular-wave generators.

TEXT BOOKS:

1. Jacob Millman, Christos C Halkias, Integrated Electronics, McGraw Hill Education, 2ed., 2010.
2. Ramakanth A. Gayakwad, Op-Amps and Linear Integrated Circuits, PHI, 4ed., 2012.

REFERENCE BOOKS:

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson, 11ed., 2015.
2. Jacob Millman and Herbert Taub, Pulse, Digital, and Switching Waveforms, McGraw Hill Education, 1991.
3. D. Roy Choudhury and Shail B. Jain, Linear Integrated Circuits, New Age International Publishers, 2ed, 2003.
4. G.K. Mithal, Electronic Devices and Circuits, Khanna Publishers, 23ed., 2017

ELECTRICAL CIRCUITS – I

B.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: Mathematics

Course Objectives:

- To understand the basic elements of electrical networks and their properties.
- To learn methods for analyzing AC and DC circuits.
- To apply network theorems for solving electrical circuits.
- To study single-phase, poly-phase, and resonance concepts.
- To understand coupled circuits and mutual inductance effects.

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

- Identify and explain active, passive, independent, and dependent elements in electrical circuits.
- Analyze AC and DC circuits using mesh, nodal, and source transformation methods.
- Apply network theorems to simplify and solve electrical networks.
- Perform analysis of single-phase, three-phase balanced and unbalanced circuits.
- Analyze coupled circuits with mutual inductance using dot conventions.

UNIT-I: Network Elements & Laws: Active elements, Independent and dependent sources. Passive elements — R, L and C, Energy stored in inductance and capacitance, Kirchhoff's laws, Source transformation, Node voltage method, Mesh current method including super node and super mesh analysis and Star-delta transformation.

UNIT-II: Single-Phase Circuits: RMS and average values of periodic sinusoidal and non-sinusoidal waveforms, Phasor representation, J-Notation, Steady-state analysis of series, parallel and series-parallel circuits. Impedance, Active and Reactive Powers, Complex Power, Admittance.

UNIT-III: Network theorems (AC & DC): Superposition theorem, Thevinin's theorem, Norton's theorem, Maximum power transfer theorem, Milliman's theorem and Reciprocity theorem.
Resonance: Series and parallel circuits, Bandwidth and Q-factor.

UNIT-IV: Poly-phase Circuits: Analysis of balanced and unbalanced 3-phase circuits, Star and delta connections, Measurement of three-phase power for balanced and unbalanced loads.

UNIT-V: Coupled circuits: Concept of self and mutual inductance, Dot convention, Coefficient of coupling, Analysis of circuits with mutual inductance.

TEXT BOOKS:

1. Van Valkenburg M.E, "Network Analysis", Prentice Hall of India, 3rd Edition, 2000.
2. Ravish R Singh, "Network Analysis and Synthesis", McGrawHill, 2nd Edition, 2019.

REFERENCES:

1. B. Subramanyam, "Electric Circuit Analysis", Dreamtech Press & Wiley, 2021.
2. James W.Nilsson, Susan A.Riedel, "Electric Circuits", Pearson, 11th Edition, 2020.
3. A Sudhakar, Shyammohan S Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 5th Edition, 2017.
4. Jagan N.C, Lakshrninarayana C., "Network Analysis", B.S. Publications, 3rd Edition, 2014.
5. William Hayt H, Kimmerly Jack E. and Steven Durbin M, "Engineering Circuit Analysis", McGraw Hill, 6th Edition, 2002.
6. Chakravarthy A., "Circuit Theory", Dhanpat Rai & Co., First Edition, 1999.

ENGLISH FOR SKILL ENHANCEMENT

B.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites:

Course Objectives:

- Improve their vocabulary.
- Use appropriate sentence structures in their oral and written communication.
- Develop their reading and study skills.
- Equip students to write paragraphs, essays, précis and draft letters.
- Acquire skills for technical report writing.

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

- Choose appropriate vocabulary in their oral and written communication.
- Demonstrate their understanding of the rules of functional grammar and sentence structures.
- Develop comprehension skills from known and unknown passages.
- Write paragraphs, essays, précis and draft letters.
- Write abstracts and reports in various contexts.

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.

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 BlackSwan 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 BOOKS:

1. Board of Editors. 2025. English for the Young in the Digital World. Orient BlackSwan Pvt. Ltd.

REFERENCES:

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 Univeristy 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.

ENGINEERING CHEMISTRY LABORATORY

B.Tech. I Year I Sem.

L	T	P	C
0	0	2	1

Prerequisites: Engineering Chemistry

Course Objectives:

- Students will understand and perform experiments based on core chemical principles relevant to engineering applications.
- Students will learn to estimate the hardness of water to assess its suitability for drinking purposes.
- Students will acquire the ability to perform acid-base titrations using instrumental methods such as conductometry, potentiometry, and pH metry.
- Students will gain hands-on experience in synthesizing polymers like Bakelite and Nylon – 6, 6 in the laboratory.
- Students will learn to determine the unknown concentration of potassium permanganate (KMnO4) using a calibration curve.

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

- Students will develop practical skills through hands-on chemistry experiments relevant to engineering. (SDG 4, 9)
- Students will learn to determine important parameters such as water hardness and the corrosion rate of mild steel under various conditions. (SDG 6, 12)
- 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)
- Students will gain experience in synthesizing polymers such as Bakelite and Nylon-6,6. (SDG 9, 12)
- 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.

REFERENCES:

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).

C AND DATA STRUCTURES LABORATORY

B.Tech. I Year I Sem.

L	T	P	C
0	0	2	1

Prerequisites:

- Basic understanding of computers and operating systems.
- Knowledge of problem-solving techniques and algorithms.
- Familiarity with basic mathematics and logical reasoning.

Course Objectives:

- To introduce the use of C language for solving simple computational problems.
- To develop skills in writing, compiling, and debugging C programs.
- To implement different control structures, functions, arrays, and strings.
- To provide hands-on experience with pointers, file handling, and data structures.
- To apply sorting, searching, and basic data structure techniques in programming.

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

- Write and execute C programs using basic syntax and structure.
- Apply loops, conditional statements, functions, and arrays in program design.
- Use pointers, strings, and dynamic memory allocation in solving problems.
- Implement file operations and work with structures and unions.
- Develop programs for sorting, searching, and basic data structures like linked lists, stacks, and queues.

Week 1 – Basics of C (UNIT I)

1. **Introduction to Lab & GCC/IDE Setup** – Familiarization with compiler, execution process, and writing first program.
2. **Display "Hello World" & Basic I/O** – Printing messages and reading user inputs.
3. **Sum of Digits** – Calculate the sum of digits of a positive integer.

Week 2 – Variables & Expressions (UNIT I)

4. **Arithmetic Operations** – Using operators (+, −, ×, ÷, %) on integers and floating-point numbers.
5. **Roots of Quadratic Equation** – Implement formula to find real and complex roots.

Week 3 – Conditional Statements (UNIT II)

6. **Calculator using Switch-Case** – Perform arithmetic operations based on user choice.
7. **Largest & Smallest Number** – Read a list and find maximum and minimum values.

Week 4 – Loops (UNIT II)

8. **Factorial (Iterative)** – Calculate factorial using loops.
9. **Armstrong Number** – Check if a number equals sum of cubes of its digits.

Week 5 – Recursion (UNIT II)

10. **Fibonacci Series** – Generate first *n* terms (iterative & recursive).
11. **Factorial (Recursive)** – Compute factorial using a recursive function.

Week 6 – Arrays (1D) (UNIT II)

12. **Prime Numbers** – Display all prime numbers between 1 and *n*.
13. **Student Marks Processing** – Calculate total, average, and grade using arrays.

Week 7 – Arrays (2D) (UNIT II)

14. **Matrix Addition & Transpose** – Perform addition and transpose of matrices.
15. **Matrix Multiplication** – Multiply two matrices using nested loops.

Week 8 – Strings (Basics) (UNIT III)

16. **Palindrome Check** – Verify if a string reads the same forwards and backwards.
17. **Substring Position** – Find index where one string occurs within another.

Week 9 – Strings (Advanced) (UNIT III)

18. **Insert Substring** – Insert a smaller string at a given position in a main string.
19. **Delete Characters** – Remove *n* characters from a given position.
20. **Text Count** – Count lines, words, and characters in given text.

Week 10 – Pointers & Strings (UNIT III)

21. **Basic Pointer Operations** – Swap variables and traverse arrays using pointers.
22. **Array of Strings** – Read and sort list of names using pointers.

Week 11 – Structures (UNIT IV)

23. **Complex Numbers** – Read, display, add, and multiply complex numbers using structures.
24. **Student Record Management** – Store and display details of students using structures.

Week 12 – File Handling (Basics) (UNIT IV)

25. **File Copy** – Copy contents from one file to another.
26. **Display File Contents** – Read and display contents of a text file.

Week 13 – File Handling (Advanced) (UNIT IV)

27. **Merge Files** – Combine two files into a third file.
28. **File Word/Character Count** – Count words, lines, and characters in a file.

Week 14 – Sorting & Searching (UNIT V)

29. **Bubble & Selection Sort** – Sort array of integers in ascending order.
30. **Insertion Sort** – Insert elements in correct order.
31. **Linear & Binary Search (Iterative)** – Search for an element in a list.

Week 15 – Linked List (UNIT V)

32. **Singly Linked List** – Create nodes, insert new nodes, delete nodes, and traverse list.

Week 16 – Stack & Queue (UNIT V)

33. **Stack** – Implement push and pop using arrays and pointers.
34. **Queue** – Implement enqueue and dequeue using arrays and pointers.

TEXT BOOKS:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

REFERENCES:

1. C & Data structures – P. Padmanabham, 3rd Edition, B.S. Publications.
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3. Programming in C – Stephen G. Kochan, III Edition, Pearson Education.
4. C for Engineers and Scientists, H. Cheng, McGraw-Hill International Edition.
5. Data Structures using C – A. M. Tanenbaum, Y. Langsam, and M.J. Augenstein, Pearson Education / PHI
6. C Programming & Data Structures, E. Balagurusamy, 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 Venkateswarlu, S. Chand & Co.

Online Learning Resources:

Structured Learning Platforms

- **NPTEL (IIT Kharagpur)** – Programming in C – Video lectures, assignments, and notes.
- **Coursera** – C for Everyone: Programming Fundamentals – University of California, Santa Cruz.
- **edX** – Introduction to C Programming – Rice University.

Documentation & Tutorials

- **GeeksforGeeks C Programming** – https://www.geeksforgeeks.org/c-programming-language/ – Concept explanations with code snippets.
- **TutorialsPoint C Tutorial** – https://www.tutorialspoint.com/cprogramming/ – Beginner-friendly structured lessons.
- **W3Schools C Tutorial** – https://www.w3schools.com/c/ – Short and interactive C basics.

Practice & Problem Solving

- **HackerRank C Track** – https://www.hackerrank.com/domains/c – Hands-on coding challenges.
- **CodeChef** – https://www.codechef.com/practice/tags/c – Problem sets sorted by difficulty.
- **LeetCode (Easy Section)** – https://leetcode.com/problemset/all/ – Logical and algorithmic practice.

YouTube Channels

- **Neso Academy – C Programming** – https://www.youtube.com/playlist?list=PLBlnK6fEyqRgLLlzdgiTUKULKJPYc0r2s – Detailed lectures for UG-level students.
- **Jenny's Lectures** – https://www.youtube.com/@JennyslecturesCSIT – Practical and easy-to-follow C topics.

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY

B.Tech. I Year I Sem.

L	T	P	C
0	0	2	1

Prerequisites:

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.

Course Objectives:

Listening Skills:

- To enable students, develop their active listening skills
- To equip students with necessary training in listening, so that they can comprehend the speech of people from different linguistic backgrounds

Speaking Skills:

- To improve their pronunciation and neutralize accent
- To enable students express themselves fluently and appropriately
- To practice speaking in social and professional contexts

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

- Listen actively and identify important information in spoken texts
- Interpret the speech and infer the intention of the speaker
- Improve their accent for intelligibility
- Speak fluently with clarity and confidence
- 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).

REFERENCES:

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.

ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

B.Tech. I Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: Mathematical Knowledge at pre-university level

Course Objectives:

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

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

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

UNIT-I: First Order Ordinary Differential Equations

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

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

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

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

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

APPLIED PHYSICS

B.Tech. I Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: 10+2 Physics

Course Objectives:

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

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

- Students will be able to analyze crystal structures, apply Bragg's law, and explain the synthesis and characterization of nanomaterials. *(SDG 9)*
- Students will demonstrate proficiency in quantum mechanical principles, such as the Schrödinger equation and wave function analysis. *(SDG 4, 9)*
- Students will understand and apply the foundational elements of quantum computing, including quantum gates, measurement, and computation. *(SDG 9)*
- Students will classify various magnetic and dielectric materials and explain the physics of superconductivity and polarization mechanisms. *(SDG 9)*
- 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

REFERENCES:

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.

ELECTROMAGNETIC FIELDS

B.Tech. I Year II Sem.

L	T	P	C
2	0	0	2

Prerequisites: Vector calculus and differential equations & Applied Physics.

Course Objectives:

- Learn the basics of static electric fields, electric potential, and charge distribution.
- Use Gauss's law and potential theory to solve electrostatic problems.
- Understand conductors, dielectrics, capacitance, and related conditions.
- Learn about static magnetic fields, magnetic forces, and inductance.
- Study time-varying fields, Maxwell's equations, and electromagnetic waves.

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

- Describe electric fields and find field strength for different charge arrangements.
- Use Gauss's law to find electric potential in various cases.
- Explain how conductors and dielectrics work, calculate capacitance, and solve related equations.
- Apply Biot-Savart and Ampere's laws to find magnetic fields, forces, and inductance.
- Understand Maxwell's equations and derive wave equations for changing fields.

UNIT-I:

STATIC ELECTRIC FIELD: Introduction to coordinate systems, Coulomb's law, Electricfield intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions.

UNIT-II:

Gauss law andits applications. Absolute Electric potential, potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

UNIT-III:

CONDUCTORS, DIELECTRICS AND CAPACITANCE: Current and current density, Ohms Law in Point form, Continuity equation, Boundary conditions of conductors and dielectric materials. Capacitance, Poisson's equation, Laplace's equation.

UNIT-IV:

STATIC MAGNETIC FIELDS AND MAGNETIC FORCES: Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions, Magnetic circuits, Self-inductances and mutual inductances.

UNIT-V:

TIME VARYING FIELDS AND MAXWELL'S EQUATIONS: Faraday's laws of Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Derivation of Wave Equation.

TEXT BOOKS:

1. M. N. O. Sadiku, “Elements of Electromagnetics”, Oxford University Publication, 2014.
2. W. Hayt, “Engineering Electromagnetics”, McGraw Hill Education, 2012.

REFERENCES:

1. A. Pramanik, “Electromagnetism-Problems with solution”, Prentice Hall India, 2012.
2. G. W. Carter, “The electromagnetic field in its engineering aspects”, Longmans, 1954.
3. W. J. Duffin, “Electricity and Magnetism”, McGraw Hill Publication, 1980.
4. W. J. Duffin, “Advanced Electricity and Magnetism”, McGraw Hill, 1968.
5. E. G. Cullwick, “The Fundamentals of Electromagnetism”, Cambridge University Press, 1966.
6. B. D. Popovic, “Introductory Engineering Electromagnetics”, Addison-Wesley Educational Publishers,International Edition, 1971.
7. A. Pramanik, “Electromagnetism - Theory and applications”, PHI Learning Pvt. Ltd, New Delhi, 2009.

ENGINEERING GRAPHICS AND COMPUTER AIDED DRAFTING

B.Tech. I Year II Sem.

L	T	P	C
2	0	2	3

Prerequisites:

Course Objectives:

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

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

- Apply computer aided drafting tools to create 2D and 3D objects
- sketch conics and different types of solids
- Appreciate the need of Sectional views of solids and Development of surfaces of solids
- Read and interpret engineering drawings
- 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 andVikas: S. Chand and company Ltd., 3rdEdition,2010.

REFERENCES:

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.

ELECTRICAL CIRCUITS – II

B.Tech. I Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: Matrices and Calculus, Electrical Circuits - I

Course Objectives:

- To understand transient behavior of electrical circuits with different excitations.
- To apply Laplace transform techniques for analyzing electrical networks.
- To learn network topology concepts for describing and analyzing circuits.
- To study two-port network parameters and their interrelationships.
- To understand the basics of different types of filters and their applications.

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

- Analyze transient responses of RL, RC, and RLC circuits for step and sinusoidal inputs.
- Use Laplace transforms to solve network problems for various excitations.
- Apply network topology methods like tie-set and cut-set analysis.
- Determine two-port network parameters and analyze their connections.
- Identify and describe the characteristics of low-pass, high-pass, band-pass, and band-stop filters

UNIT-I:

Transient analysis: Transient response of R, L & C circuits, Formulation of integral differential equations, Initial conditions, Transient Response of RL, RC and RLC (series and parallel) networks-Response to step and sinusoidal excitations.

UNIT-II:

Applications of Laplace Transforms: Introduction**,** RL, RC and RLC (series and parallel) Networks for impulse, step, ramp, exponential and sinusoidal excitations.

UNIT-III:

Topological Description of Networks: Graph, tree, chord, Tie-set, cut-set, incident matrix, Problems on Tie-set and cut-set.

UNIT-IV:

Two port network parameters: Open circuit impedance, short-circuit admittance, Transmission, Hybrid parameters & inter-relationships, Series, parallel and cascade connection of two port networks, System function, Impedance and admittance functions.

UNIT-V:

Filters: Classification of filters – Low pass, High pass, Band pass and Band Elimination, Constant-k and M-derived filters-Low pass and High pass Filters, Band pass and Band elimination filters (Elementary treatment only).

TEXTBOOKS:

1. Van Valkenburg M.E, “Network Analysis”, Prentice Hall of India, 3rd Edition, 2000.
2. Ravish R Singh, “Network Analysis and Synthesis”, McGrawHill, 2nd Edition, 2019.

REFERENCES:

1. B. Subramanyam, “Electric Circuit Analysis”, Dreamtech Press & Wiley, 2021.
2. James W. Nilsson, Susan A.Riedel, “Electric Circuits”, Pearson, 11th Edition, 2020.
3. A Sudhakar, Shyammohan S Palli, “Circuits and Networks: Analysis and Synthesis”, McGraw Hill, 5th Edition, 2017.
4. Jagan N.C, Lakshrninarayana C., “Network Analysis”, B.S. Publications, 3rd Edition, 2014.
5. William Hayt H, Kimmerly Jack E. and Steven Durbin M, “Engineering Circuit Analysis”, McGraw Hill, 6th Edition, 2002.
6. Chakravarthy A., “Circuit Theory”, Dhanpat Rai & Co., First Edition, 1999.

ENGINEERING WORKSHOP

B.Tech. I Year II Sem.

L	T	P	C
0	0	2	1

Prerequisites: 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, equipment 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 this course, students will be able to

- Study and practice on machine tools and their operations
- Practice on manufacturing of components using workshop trades including pluming, fitting, carpentry, foundry, house wiring and welding.
- Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
- 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.

REFERENCES:

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

IOT AND PYTHON PROGRAMMING LABORATORY

B.Tech. I Year II Sem.

L	T	P	C
1	0	2	2

Prerequisites:

Course Objectives:

- Install and configure Python and IoT-related packages for sensor interfacing.
- Write Python programs to handle data, implement functions, and perform simulations for IoT applications.
- Interface ESP32 microcontroller with sensors and actuators using Python.
- Collect, log, and analyze sensor data using Python packages such as numpy, scipy, and matplotlib.
- Develop small IoT projects integrating multiple sensors and actuators with Python-based automation

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

- Demonstrate Python programming skills for solving numerical and sensor-related problems.
- Interface and control digital and analog devices through ESP32 using Python.
- Simulate, visualize, and analyze sensor data using Python packages.
- Design threshold-based automation systems and simple IoT applications.
- Integrate multiple IoT components into mini-projects demonstrating real-world applications.

LIST OF EXPERIMENTS:

1. Python Installation and Module Setup

- Python 3 on Linux – Guide
- Python 3 on Windows – Guide
- pip3 on Windows/Linux – Guide
- Install Python packages: numpy, scipy, matplotlib, jupyterlab
- IoT packages: RPi.GPIO, serial, paho-mqtt, requests

2. Python Basics for IoT Applications

- Printing biodata on screen
- Printing all primes less than a given number
- Finding all factors of a number and checking for perfect number
- Simulate IoT sensor values (temperature, light, distance)

3. Functions and IoT Integration

- Function to read sensor data from file or serial port
- Boolean function is_palindrome(<input>)
- Collatz function: steps to reach 1
- Normal distribution function N(m, s) to model sensor noise

4. Python Packages for IoT Data Handling

- **numpy**: matrix operations, solving linear equations, random sensor data
- **scipy & matplotlib.pyplot**: dataset statistics, curve fitting, plotting histograms
- **Strings & file handling**: analyze sensor logs, extract patterns

5. IoT Communication and Control Basics

- Serial communication with ESP32
- Reading digital/analog sensor data using Python
- Controlling LEDs, buzzers, and relays from Python
- Threshold-based alerts for sensors

Cycle – 2: Experiments

1. Basic Electronics & Sensor Experiments (I/O Control)

- Blink LED – ON/OFF and blink patterns
- Multiple LED patterns – loop & timing control
- Push Button LED control – reading button input
- Buzzer control – PWM tones and sound patterns
- Light intensity measurement – LDR analog input readout
- Temperature monitoring – LM35 / DHT11 sensor data acquisition
- Flame detection – digital trigger response
- Sound-activated LED – threshold-based control
- Obstacle detection – IR sensor interfacing
- Motion detection alarm – PIR sensor with buzzer activation

2. Intermediate Sensor Data Processing & Automation

- Distance measurement – ultrasonic sensor-based calculation
- Gas leak alert – MQ2 / MQ135 sensor with alarm/notification
- Water level indicator – liquid detection with visualization
- Digital thermometer with OLED/LCD display – DHT11 integration
- Traffic light simulation – LEDs and push buttons with state machine logic
- Clap-to-turn-on light – sound sensor with relay control
- Smart night lamp – LDR-controlled LED automation
- Digital speedometer – rotary encoder with speed calculation
- Soil moisture alarm – sensor-based water need detection
- Color detection – RGB sensor with classification/display

3. Integrated Practical Exercises

- Real-time plotting of sensor data
- Logging and analyzing sensor readings with data processing tools
- Implementing threshold-based automation using LEDs, buzzer, and relays
- Simulation of IoT device functions and alerts

TEXTBOOKS:

1. "Python Programming and Its Applications", John Zelle, 3rd Edition, Franklin, Beedle & Associates, 2017
2. "Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux", Derek Molloy, 2nd Edition, Wiley, 2016
3. "Python for Data Analysis", Wes McKinney, 2nd Edition, O'Reilly Media, 2017

REFERENCES:

1. "Internet of Things: A Hands-On Approach", Arshdeep Bahga & Vijay Madisetti, 1st Edition, Universities Press, 2014
2. "Programming the Raspberry Pi: Getting Started with Python", Simon Monk, 3rd Edition, McGraw-Hill Education, 2016
3. Raspberry Pi Official Documentation, Raspberry Pi Foundation, https://www.raspberrypi.com/documentation

ONLINE RESOURCES:

- Python Official: https://www.python.org/
- Jupyter Notebook: https://jupyter.org/
- GPIO Zero Library: https://gpiozero.readthedocs.io/
- Raspberry Pi Tutorials: https://randomnerdtutorials.com/
- DHT Sensor Guide: https://learn.adafruit.com/dht

APPLIED PHYSICS LABORATORY

B.Tech. I Year II Sem.

L	T	P	C
0	0	2	1

Prerequisites: Applied Physics

Course Objectives:

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

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

- Analyze magnetic hysteresis behavior and determine material characteristics using the B-H curve. *(SDG 9)*
- Experimentally determine physical constants such as the dielectric constant, Planck's constant, and work function. *(SDG 4, 9)*
- Measure and interpret the optical properties of laser and fiber optics including wavelength, acceptance angle, and losses. *(SDG 7, 9)*
- Evaluate the performance parameters of semiconductor and optoelectronic devices such as energy gap, Hall coefficient, and LED/Solar cell characteristics. *(SDG 7, 13)*
- 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.

ANALOG ELECTRONICS LABORATORY

B.Tech. I Year II Sem.

L	T	P	C
0	0	2	1

Prerequisites: Analog Electronic Circuits

Course Objectives:

- To introduce components such as diodes, BJTs and FETs, and plot their characteristics.
- To practically implement amplifiers, feedback amplifiers and oscillator circuits.
- To practically implement basic Op-Amp circuits and verify the operation.

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

- Demonstrate the characteristics of PN junction diode, clippers and clampers.
- Implement various rectifier circuits with and without filter.
- Examine the input and output characteristics of BJT and FET in various configurations and compute the various performance parameters.
- Implement BJT amplifiers and obtain their frequency response.
- Implement various analog circuits using 741 ICs.

List of Experiments:

1. Forward and reverse bias characteristics of PN junction diode.
2. Full-wave rectifiers (center-tap and bridge) with and without capacitor filters.
3. Types of Clippers at different reference voltages.
4. Types of Clampers at different reference voltages.
5. Input and output characteristics of BJT in common base configuration.
6. Input and output characteristics of BJT in common emitter configuration.
7. Frequency response of Common Emitter Amplifier.
8. JFET Characteristics.
9. Inverting and Non-inverting Amplifiers using Op Amp.
10. Adder and Subtractor using Op Amp.
11. Integrator and Differentiator Circuit using IC741.
12. Voltage Series and Current Shunt Feedback amplifier.
13. RC phase shift oscillator.
14. Hartley and Colpitts oscillators

TEXT BOOKS:

1. Integrated Electronics, Jacob Millman, Christos C Halkias, McGraw Hill Education, 2nd edition 2010
2. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 2003.

REFERENCES:

1. Electronic Devices Conventional and current version -Thomas L. Floyd 2015, pearson.
2. J. Millman and A. Grabel, “Microelectronics”, McGraw Hill Education, 1988.
3. P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.
4. P. R. Gray, R. G. Meyer and S. Lewis, “Analysis and Design of Analog IntegratedCircuits”, John Wiley & Sons, 2001.

ELECTRICAL CIRCUITS LABORATORY

B.Tech. I Year II Sem.

L	T	P	C
0	0	2	1

Prerequisites: Electrical Circuits-I&II

Course Objectives:

- To give practical exposure to the behavior of electrical circuits.
- To verify electrical laws, theorems, and circuit parameters experimentally.
- To use simulation tools for circuit analysis and design.
- To study resonance, filters, and transient response of circuits.
- To measure and analyze power in single-phase and three-phase systems.

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

- Verify circuit laws, theorems, and resonance using experiments or simulation tools.
- Determine transient and steady-state response of RL and RC circuits.
- Find parameters of two-port networks.
- Measure power in single-phase and three-phase circuits.
- Analyze filter characteristics and coupled circuits.

The following experiments are required to be conducted compulsory:

1. Verification of Series and Parallel Resonance using any circuit simulation software (LT Spice etc..).
2. Determination of Time response of first order RL and RC circuit for periodic non – sinusoidal inputs – Time Constant and Steady-state error using any circuit simulation software (LT Spice etc..).
3. Determination of Two port network parameters – Z, Y, Transmission and Hybrid parameters.
4. Measurement of 3-phase power in Balanced Star connected load using Two-Wattmeter method.
5. Determination of Co-efficient of coupling, Self and Mutual inductance in Coupled Circuits.
6. Frequency domain analysis of Low-pass filter and High-pass filters using circuit simulation software (LT Spice etc..).
7. Verification of Superposition and Maximum Power Transfer theorems using any circuit simulation software (LT Spice etc..).
8. Verification of Thevenin's and Norton's theorems using any circuit simulation software (LT Spice etc..).

In addition to the above eight experiments, at least any two of the experiments from the following list arerequired to be conducted

1. Measurement of Active Power for Delta connected balanced loads.
2. Measurement of Reactive Power for Star and Delta connected balanced loads.
3. Frequency domain analysis of Band-pass filter.
4. Determination of Two port network parameters -Hybrid parameters.
5. Determination of Time response of first order RL, RC circuit for periodic non – sinusoidal inputs – Time Constant and Steady state error.

TEXTBOOKS:

1. Van Valkenburg M.E, "Network Analysis", Prentice Hall of India, 3rd Edition, 2000.
2. Ravish R Singh, "Network Analysis and Synthesis", McGrawHill, 2nd Edition, 2019.

REFERENCES:

1. B. Subramanyam, “Electric Circuit Analysis”, Dreamtech Press & Wiley, 2021.
2. James W.Nilsson, Susan A. Riedel, “Electric Circuits”, Pearson, 11th Edition, 2020.
3. A Sudhakar, Shyammohan S Palli, “Circuits and Networks: Analysis and Synthesis”, McGraw Hill, 5th Edition, 2017.
4. Jagan N.C, Lakshrninarayana C., “Network Analysis”, B.S. Publications, 3rd Edition, 2014.
5. William Hayt H, Kimmerly Jack E. and Steven Durbin M, “Engineering Circuit Analysis”, McGraw Hill, 6th Edition, 2002.
6. Chakravarthy A., “Circuit Theory”, Dhanpat Rai & Co., First Edition, 1999.

CONTROL SYSTEMS

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: Differential equations and Laplace transforms.

Course objectives:

- To understand modeling of physical systems and feedback concepts.
- To analyze time-domain responses and stability of control systems.
- To study frequency-domain analysis techniques.
- To learn the working of controllers and compensators.
- To introduce state-space modeling and analysis methods.

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

- Model mechanical and electrical systems and represent them using transfer functions and block diagrams.
- Analyze time-domain responses, errors, and stability using Routh-Hurwitz and Root-Locus methods.
- Perform frequency-domain analysis using Bode plots, Polar plots, and Nyquist criterion.
- Explain and design PI, PD, PID controllers and lead/lag compensators.
- Apply state-space methods to analyze controllability, observability, and system response.

UNIT-I: Mathematical modelling of physical systems: Open – loop and Closed loop Systems, Linear, Non-Linear, Time Variant and Time Invariant systems, Mechanical and Electrical Systems. Transfer function, Block-diagram Techniques, Signal flow graph. Concept of Feedback Control, Benefits of Feedback and Effects of feedback. Controller Components: DC Servo motors, AC Servomotors, Synchros.

UNIT -II:

Time-Domain Analysis with Input-Output Models: Time response of first and second order systems for standard test inputs. Analysis of standard Second order systems with step input, Types of System, Error Analysis for Linear time Invariant Systems, Design specifications for second-order systems based on the time-response.

Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

UNIT -III:

Frequency Domain Analysis: Introduction to frequency response, Relationship between time and frequency response, Concept of Bode plots and construction. Polar plots, Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin-Stability.

UNT-IV:

Classical Controllers and Compensators: Proportional, Integral and Derivative Controllers- PI, PD and PID controllers, -Lead, Lag and Lead-Lag compensators.

UNT-V:

State Variable Analysis and Design: Concept of State, State variables and State model. State Representation, Transformation of State variables, State Transition Matrix and its properties, Solution of state equations and Complete response of the Systems. Concept of controllability and observability.

TEXT BOOKS:

1. I. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International, 2009.
2. B. C. Kuo, “Automatic Control System”, Prentice Hall, 1995.

REFERENCES:

1. K. Ogata, “Modern Control Engineering”, Prentice Hall, 1991.
2. K. R. Varmah, “Control Systems”, McGraw Hill Education, 2010.
3. Norman S Nise, “Control Systems Engineering”, Wiley, 2019 8th Edition.

ELECTRICAL MACHINES - I

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: Electrical Circuits -I & II

Course Objectives:

- Learn the working and construction of DC generators and motors.
- Understand characteristics, testing, and efficiency of DC machines.
- Study the construction and operation of single-phase transformers.
- Learn transformer testing, losses, efficiency, and regulation.
- Understand parallel operation and special transformer connections.

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

- Explain the working of DC generators and motors.
- Analyze performance, speed control, and testing methods of DC machines.
- Describe single-phase transformer operation and draw phasor diagrams.
- Calculate losses, efficiency, and regulation of transformers.
- Perform parallel operation and identify special transformer connections.

UNIT-I:

D.C. GENERATORS: Principle of operation – Action of commutator – constructional features – armature windings - lap and wave windings - simplex and multiplex windings (elementary treatment only) – use of laminated armature – E. M.F Equation.

Concept of Armature reaction and commutation – Cross magnetizing and de-magnetizing AT/pole. Methods of Excitation - separately excited and self-excited generators - build-up of E.M.F - critical field resistance and critical speed. Performance Characteristics of shunt, series and compound generators and applications.

UNIT-II:

D.C MOTORS: Principle of operation – Back E.M.F. - Torque equation – characteristics and application of shunt, series and compound motors.

3-point starter, Speed control of D.C. shunt and series motors - Armature voltage and field flux control methods. Losses – Constant & Variable losses -calculation of efficiency – condition for maximum efficiency.

TESTING OF DC MACHINES: Methods of Testing - direct, indirect, and regenerative testing - Brake test - Swinburne's test - Hopkinson's test.

UNIT-III:

SINGLE PHASE TRANSFORMERS: Types - constructional details-minimization of hysteresis and eddy current losses- EMF equation - operation on no-load and on load - phasor diagrams and Applications.

UNIT-IV:

Equivalent circuit - losses and efficiency – regulation - All day efficiency - effect of variations of frequency & supply voltage on iron losses.

TESTING OF TRANSFORMERS: Open Circuit and Short Circuit tests - Sumpner's test - predetermination of efficiency and regulation-separation of losses test.

UNIT-V:

Parallel operation with equal and unequal voltage ratios - auto transformers-equivalent circuit - comparison with two winding transformers.

Poly-phase transformers – Poly-phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ, Scott connection and Applications.

TEXT BOOKS:

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, Revised Edition, 2021.
2. I.J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

REFERENCES:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, “Electrical Machines”, Oxford, 2017.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.
4. A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.

DIGITAL ELECTRONICS

B.Tech. II Year I Sem.

L	T	P	C
2	0	0	2

Prerequisites: Analog Electronics

Course Objectives:

- Learn the basics of digital signals, logic gates, and Boolean algebra.
- Understand number systems and binary arithmetic.
- Design and analyze combinational and sequential circuits.
- Study different types of memory and programmable logic devices.
- Apply digital logic concepts to practical problems.

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

- Explain digital logic concepts, number systems, and binary arithmetic.
- Simplify logic functions and design combinational circuits.
- Design adders, subtractors, encoders, decoders, and multiplexers.
- Describe flip-flops, counters, and shift registers.
- Explain memory organization and programmable logic devices.

UNIT-I:

Fundamentals of Digital Systems and Logic Families: Digital signals, Digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, Examples of IC gates, Number systems-binary, Signed binary, Octal hexadecimal number, Binary arithmetic, One's and Two's complements arithmetic.

UNIT-II:

Combinational Circuits-I: Standard representation for logic functions, K-map representation and simplification of logic functions using K- map, Minimization of logical functions, Don't care conditions, Multiplexer, De-Multiplexer

UNIT-III:

Combinational Circuits-II: Adders, Subtractors, Carry look ahead adder, Digital comparator, Parity checker/generator, Code converters, Priority encoders, Decoders/Drivers for display devices, Q-M method of function realization.

UNIT-IV:

Sequential Circuits: Introduction to flip-flops, SR, JK, T and D type's flip-flops, Shift registers, Conversion of flip-flops, Ring counter, Ripple (Asynchronous) counters, Synchronous counters.

UNIT-V:

Semiconductor Memories and Programmable Logic Devices: Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read-only memory (ROM), ROM types, Read and write memory (RAM) types, Programmable logic array, Programmable array logic, Field Programmable Gate Array (FPGA).

TEXT BOOKS:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

REFERENCES:

1. R.S. Sedha, "A Textbook of Digital Electronics", S.Chand, 2005
2. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

POWER SYSTEMS – I

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Electrical Circuits-I &II

Course Objectives:

- Learn the working and layout of different power plants.
- Understand substation types, layouts, and equipment.
- Study underground cables and their construction.
- Learn AC distribution systems and voltage drop calculations.
- Understand the economics and tariffs in power generation.

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

- Explain the operation and layout of thermal, hydro, nuclear, gas, solar, and wind plants.
- Describe air-insulated and gas-insulated substations with layouts.
- Understand cable types, construction, and applications.
- Calculate voltage drops in AC distribution systems.
- Analyze load factors, cost of generation, and tariff structures.

UNIT-I:

GENERATION OF ELECTRIC POWER

Operation of Hydel, Thermal, Nuclear and Gas Power plant with layouts - Description of components- Choice of site - advantages and disadvantages, Introduction and description of components- renewable energy sources and plants (solar and wind).

UNIT-II:

SUBSTATIONS (AIS & GIS): Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment. Bus bar arrangements in the Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams. **(GIS):** Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, bus bar, construction aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT-III:

CABLES

Types of cables: Low-voltage, high-voltage, and extra high-voltage cables., Constructional features: Conductors, insulation, metallic sheath, bedding, armouring, serving., Materials used for insulation and sheathing. Classification based on voltage and insulation type. Capacitance of single-core cable – derivation and numerical problems. Grading of cables – capacitance grading and inter-sheath grading. Thermal resistance of cables – calculation of current carrying capacity. Laying of cables: Methods of laying for LT and HT cables. Testing of cables: High voltage test, insulation resistance test, sheath test.

UNIT-IV:

AC DISTRIBUTION

Introduction, AC distribution, Single phase, 3-phase 3 wire, 3-phase 4 wire system, bus bar arrangement, Selection of site for substation. Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

UNIT-V:

ECONOMICS OF POWER GENERATION

Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load curve, Load duration curve, number and size of generator units. Base load and peak load plants.

Cost of electrical energy-fixed cost, running cost, Tariffs.

TEXT BOOKS:

1. C. L. Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", 2nd Edition, New Age International, 2009.
2. A. Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, "A Text book on Power System Engineering", Dhanpat Rai Publishing Company (P) Ltd, 2008.
3. J. B. Gupta, A Course in Power Systems" Katson Books, 11th Edition, 2016.

REFERENCES:

1. C.L. Wadhwa, "Electrical Power Systems", 5th Edition, New Age International, 2009.
2. M.V. Deshpande, "Elements of Electrical Power Station Design", 3rd Edition, Wheeler Pub. 1998.
3. H. Cotton & H. Barber, "The Transmission and Distribution of Electrical Energy", 3rd Edition, 1970.
4. W. D. Stevenson, "Elements of Power System Analysis", 4th Edition, McGraw Hill, 1984.
5. V. K. Mehta and Rohit Mehta, "Principles of Power Systems", S. Chand & Company Ltd, New Delhi, 2004.

ELECTRICAL MEASUREMENTS AND SENSORS

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: Electrical Circuit Analysis-I & II, Analog & Digital Electronics

Course Objectives:

- Learn how electrical measuring instruments work.
- Understand methods to measure voltage, current, power, and energy.
- Study ways to measure resistance, inductance, and capacitance.
- Learn about different types of sensors and transducers.
- Understand smart instruments and modern metering systems.

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

- Explain and use different electrical measuring instruments.
- Measure electrical quantities accurately using standard methods.
- Select and apply suitable sensors for various measurements.
- Analyze the working of smart meters and intelligent instruments.
- Apply measurement techniques in practical electrical systems.

UNIT - I:

INTRODUCTION TO MEASURING INSTRUMENTS: Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of rangeusing shunts and series resistance. Electrostatic Voltmeters-electrometer type and attracted disc type – extension of range of E.S. Voltmeters.

UNIT-II:

POTENTIOMETERS & INSTRUMENT TRANSFORMERS: Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate type's standardization – applications. CT and PT – Ratioand phase angle errors (Qualitative approach).

UNIT-III:

MEASUREMENT OF POWER & ENERGY: Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamometer wattmeter, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers – Measurement of active and reactive powers in balanced and unbalanced systems.

Single phase induction type energy meter – driving and braking torques – errors and compensations – testing by phantom loading using R.S.S. meter. Three phase energy meter – tri-vector meter, maximum demand meters (Qualitative approach).

UNIT-IV:

DC & AC BRIDGES: Method of measuring low, medium and high resistance – sensitivity of Wheat-stone's bridge – Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of charge method.

Measurement of inductance- Maxwell's bridge, Hay's bridge, Anderson's bridge. Measurement of capacitance and loss angle -De-Sauty's Bridge - Wien's bridge – Schering Bridge. (Qualitative approach)

UNIT-V:

Sensors- Classification of transducers- Temperature sensors- Proximity sensor- Pressure sensor- IR sensors- Motion detection sensors- Ultrasonic sensors- Rotor Position Sensors, Operation of Strain Gauge- Thermocouples, construction and working of LVDT, Piezo electric transducers, photovoltaic, photo conductive cells, and photo diodes-Applications.

Smart instruments: Intelligent transducer, self-diagnosis and remote calibration features, HART communication, MEMS, non-linearity compensation; smart energy meter components, working principle; Automatic Meter Reading (AMR), Advanced Metering Infrastructure (AMI) environments.

TEXTBOOKS:

1. A. K. Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co. Publications,2005.
2. Dr. Rajendra Prasad, "Electrical Measurements & Measuring Instruments", Khanna Publishers 1989.

REFERENCES:

1. G. K. Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition, 2016.
2. R. K. Rajput, "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd.,2007.
3. S. C. Bhargava, "Electrical Measuring Instruments and Measurements", BS Publications, 2012.
4. Buckingham and Price, "Electrical Measurements", Prentice – Hall, 1988.
5. Reissland, M. U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition 2010.
6. E.W. Golding and F. C. Widdis, "Electrical Measurements and measuring Instruments", fifth Edition,Wheeler Publishing, 2011.

INNOVATION AND ENTREPRENEURSHIP

B.Tech. II Year I Sem.

L	T	P	C
2	0	0	2

Prerequisites:

Course Objectives:

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

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

- Understand the entrepreneurship and the entrepreneurial process and its significance in economic development. (SDG – 8, 9, 10, 17)
- Assess the problem from an industry perspective and generate solutions using the design thinking principles. (SDG – 9, 12, 17)
- Assess market competition, estimate market size, and develop a prototype. (SDG – 9, 10, 16)
- Analyze Business and financial planning models and Go-to-Market strategies. (SDG – 4, 8, 9)
- Able to build a start-up, register IP and identify funding opportunities. (SDG – 8, 9)

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 Stratup 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, McGrawHill, 11th Edition.
6. NISP -Brochure inside pages - startup policy 2019.pdf

ELECTRICAL MACHINES- I LABORATORY

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Prerequisites: Electrical Machines-I

Course Objectives:

- Understand the characteristics and performance of DC generators and motors.
- Learn methods to test and determine efficiency of DC machines and transformers.
- Study open circuit and short circuit tests on transformers.
- Perform experiments to verify voltage and current relationships in transformers.
- Use simulation tools for modeling electrical machines.

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

- Conduct tests on DC machines and interpret results.
- Measure and analyze performance curves of DC motors and generators.
- Determine efficiency and regulation of transformers.
- Verify practical transformer connections and voltage/current relationships.
- Apply simulation tools to model and analyze electrical machines.

The following experiments are required to be conducted compulsory experiments:

1. Magnetization characteristics of DC shunt generator (Determination of critical field resistance and critical speed)
2. Load test on DC shunt generator (Determination of characteristics)
3. Load test on DC series generator (Determination of characteristics)
4. Hopkinson's test on DC shunt machines (Predetermination of efficiency)
5. Swinburne's test (Predetermination of efficiency)
6. Brake test on DC compound motor (Determination of performance curves)
7. OC and SC Test on Single Phase Transformer
8. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star).

In addition to the above eight experiments, at least any two of the experiments from the following list arerequired to be conducted:

1. Brake test on DC shunt motor (Determination of performance curves)
2. Load test on DC compound generator (Determination of characteristics).
3. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-PhaseTransformer
4. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
5. Speed control of DC shunt motor
6. Modeling of DC Machine using simulation tools.
7. Equivalent circuit of Transformer DC Machine using simulation tools.

TEXT BOOKS:

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I.J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

REFERENCES:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, "Electrical Machines", Oxford, 2017.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
4. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

ELECTRICAL MEASUREMENTS AND SENSORS LABORATORY

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Prerequisites: Electrical Measurements and Sensors

Course Objectives:

- Learn to calibrate and test various electrical measuring instruments.
- Understand the operation of different bridges for resistance, capacitance, and inductance measurement.
- Perform tests on transformers, CTs, and PTs for error determination.
- Use sensors and transducers for displacement, strain, and energy measurement.
- Gain hands-on experience with modern measuring techniques and kits.

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

- Calibrate energy meters, watt meters, ammeters, and voltmeters.
- Measure electrical parameters using potentiometers, bridges, and testing kits.
- Determine performance and errors in CTs and PTs.
- Operate and analyze data from various sensors and transducers.
- Apply modern measuring equipment for practical applications in power and instrumentation.

The following experiments are required to be conducted as compulsory experiments:

1. Calibration and testing of single-phase energy Meter.
2. Calibration of dynamometer power factor meter.
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter.
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Dielectric oil testing using H.T. testing Kit.
6. Schering Bridge & Anderson Bridge.
7. Measurement of 3 - Phase reactive power with single-phase wattmeter.
8. Measurement of displacement with the help of LVDT.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:

1. Calibration LPF wattmeter – by Phantom testing.
2. Measurement of 3-phase power with single watt meter and two CTs.
3. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angle of given CT by Null method.
4. PT testing by comparison – V. G. as Null detector – Measurement of % ratio error and phase angle of the given PT
5. Resistance strain gauge – strain measurements and Calibration.
6. Transformer turns ratio measurement using AC bridges.
7. Measurement of % ratio error and phase angle of given CT by comparison.
8. Demonstration on Measurement of Energy by using NET METER.
9. Demonstration of different sensors using trainee kit

TEXT BOOKS:

1. A. K. Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co. Publications,2005.
2. Dr. Rajendra Prasad, "Electrical Measurements & Measuring Instruments", Khanna Publishers 1989.

REFERENCES:

1. G. K. Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition, 2016.
2. R. K. Rajput, "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd.,2007.
3. S. C. Bhargava, "Electrical Measuring Instruments and Measurements", BS Publications, 2012.
4. Buckingham and Price, "Electrical Measurements", Prentice – Hall, 1988.
5. Reissland, M. U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition 2010.
6. E.W. Golding and F. C. Widdis, "Electrical Measurements and measuring Instruments", fifth Edition,Wheeler Publishing, 2011.

DIGITAL ELECTRONICS LABORATORY

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Prerequisites: Digital Electronics

Course Objectives:

- Learn to implement and verify digital logic circuits.
- Understand the design of combinational and sequential logic systems.
- Gain experience in using universal gates for logic realization.
- Develop skills in designing counters, registers, and converters.
- Familiarize with different logic families like DTL, TTL, and ECL.

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

- Implement Boolean expressions using basic and universal gates.
- Design and test combinational circuits like adders, subtractors, converters, and multiplexers.
- Build sequential circuits such as counters, shift registers, and sequence generators.
- Generate and verify clock signals for digital systems.
- Compare different digital logic families and their characteristics.

List of Experiments:

1. Realization of Boolean Expressions using Gates
2. Design and realization logic gates using universal gates
3. Generation of clock using NAND/NOR gates
4. Design a 4 – bit Adder / Subtractor
5. Design and realization a 4 – bit gray to Binary and Binary to Gray Converter
6. Design and realization of a 4-bit pseudo random sequence generator using logic gates.
7. Design and realization of an 8-bit parallel load and serial out shift register using flip-flops.
8. Design and realization Asynchronous and Synchronous counters using flip-flops
9. Design and realization 8x1 using 2x1 mux
10. Design and realization 2-bit comparator
11. Verification of truth tables and excitation tables
12. Realization of logic gates using DTL, TTL, ECL, etc.,

TEXT BOOKS:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

REFERENCES:

1. R.S. Sedha, “A Textbook of Digital Electronics”, S.Chand, 2005
2. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

DESIGN OF ELECTRICAL SYSTEMS USING AUTOCAD

(Skill Development Course)

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Prerequisites:

Course Objectives:

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

ENVIRONMENTAL SCIENCE
(Mandatory Course)

B.Tech. II Year I Sem.

L	T	P	C
1	0	0	0

Prerequisites:

Course Objectives:

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

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

- Understand the structure, function, and significance of ecosystems, including energy flow, biogeochemical cycles, and biodiversity conservation through field experiences.
- Analyze the classification, utilization, and sustainable management of natural resources, along with alternative energy options.
- Evaluate biodiversity at genetic, species, and ecosystem levels, its values, threats, and conservation methods under national and international frameworks.
- Identify types, sources, and impacts of environmental pollution, and apply suitable control technologies while assessing global environmental challenges and protocols.
- 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

NUMERICAL METHODS AND COMPLEX VARIABLES

B.Tech. II Year II Sem.

L	T	P	C
3	1	0	4

Prerequisites: Mathematics courses of first year of study

Course Objectives:

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

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

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

UNIT-I:

Fourier Series & Fourier Transforms

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

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

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

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

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, 36^{th} 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.

ELECTRICAL MACHINES – II

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: Electrical Circuits-I &II & Electrical Machines-I, Electromagnetic Fields

Course Objectives:

- Learn the construction, working principles, and performance of poly-phase induction machines.
- Understand methods of testing, starting, and speed control of induction motors.
- Gain knowledge of synchronous generators, their construction, EMF equation, and characteristics.
- Study voltage regulation methods and parallel operation of alternators.
- Understand the operation and characteristics of synchronous motors and single-phase motors.

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

- Explain the construction and operating principles of induction and synchronous machines.
- Analyze the performance of induction motors using equivalent circuits and test results.
- Calculate EMF, armature reaction, and regulation of synchronous machines.
- Evaluate synchronization, load sharing, and operational parameters of alternators.
- Compare various types of single-phase motors and their applications

.

UNIT-I:

POLY-PHASE INDUCTION MACHINES: Constructional details of cage and wound rotor machines-production of a rotating magnetic field - principle of operation - rotor EMF and rotor frequency - rotor reactance, rotor current and Power factor at standstill and during operation. Rotor power input, rotor copper loss and mechanical power developed and their inter relation. Torque equation-expressions for maximum torque and starting torque – torque-slip characteristics.

UNIT-II:

PERFORMANCE OF INDUCTION MACHINES: Equivalent circuit - phasor diagram - crawling and cogging, No-load Test and Blocked rotor test -Predetermination of performance-Methods of starting and starting current and Torque calculations, Applications.

SPEED CONTROL METHODS: Change of voltage, change of frequency, voltage/frequency, injection of an EMF into rotor circuit (qualitative treatment only)-induction generator-principle of operation.

UNIT-III:

SYNCHRONOUS MACHINES: Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation. Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – phasor diagram – load characteristics.

UNIT-IV:

REGULATION: Synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction theory- Determination of X_d and X_q (Slip test) Phasor diagrams – Regulation of salient pole alternators.

PARALLEL OPERATION OF SYNCHRONOUS MACHINES: Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing -Effect of change of excitation and mechanical power input.

UNIT-V:

SYNCHRONOUS MOTORS: Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed. Hunting and its suppression – Methods of starting.

SINGLE PHASE MACHINES: Single phase induction motor – Constructional Features-Double revolving field theory – split-phase motors – AC series motor- Universal Motor- Shadedpole motor and Applications.

TEXT BOOKS:

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
2. I.J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

REFERENCES:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, “Electrical Machines”, Oxford, 2017.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.
4. A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.

POWER SYSTEMS – II

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: Electrical Circuits-I&II, Power Systems – I, and Electromagnetic Fields.

Course Objectives:

- Understand constructional features and electrical parameters of overhead transmission lines.
- Learn methods for calculating performance, sag, tension, and insulation requirements of lines.
- Study voltage control techniques and compensation methods in power systems.
- Analyze per unit system representation and travelling wave phenomena on transmission lines.
- Learn symmetrical components and perform fault analysis in power systems.

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

- Calculate inductance, capacitance, sag, and tension for overhead lines.
- Evaluate performance of short, medium, and long transmission lines.
- Apply voltage control and power factor improvement methods.
- Use per unit system for power system analysis and study travelling wave behavior.
- Perform symmetrical component analysis and fault calculations.

UNIT-I:

OVER HEAD TRANSMISSION LINES: Line conductors, Composite conductors transposition, bundled conductors, Inductance and capacitance of single phase and three phase lines with symmetrical spacing, and effect of earth on capacitance, skin and proximity effects.

OVERHEAD LINE INSULATORS: Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators, Sag and tension calculations.

UNIT-II:

PERFORMANCE OF LINES: Representation of lines, short transmission lines, medium length lines, nominal T and PI- representations, long transmission lines. The equivalent circuit representation of a long Line, A, B, C, D constants, Ferranti Effect.

Corona: Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Advantages and Disadvantages of corona, interference between power and Communication lines.

UNIT-III:

VOLTAGE CONTROL & POWER FACTOR IMPROVEMENT: Introduction – methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase modifiers, power factor improvement methods.

COMPENSATION IN POWER SYSTEMS: Introduction - Concepts of Load compensation – Load ability characteristics of overhead lines – Uncompensated transmission line – Symmetrical line.

UNIT-IV

PER UNIT REPRESENTATION OF POWER SYSTEMS: The one-line diagram, impedance and reactance diagrams, per unit quantities, changing the base of per unit quantities, advantages of per unit system.

TRAVELLING WAVES ON TRANSMISSION LINES: Production of travelling waves, open circuited line, short-circuited line, line terminated through a resistance, line connected to a cable, Reflection and Refraction coefficients.

UNIT-V:

SYMMETRICAL COMPONENTS AND FAULT CALCULATIONS: Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks, fault calculations, sequence network equations, single line to ground fault, line to line fault, double line to ground fault, three phase fault, faults on power systems, faults with fault impedance, reactors and their location, short circuit capacity of a bus.

TEXT BOOKS:

1. C. L. Wadhwa, “Generation, Distribution and Utilization of Electrical Energy”, 3rd Edition, New Age International, 2009.
2. D.P. Kothari and I.J. Nagrath, “Modern Power System Analysis”, Tata Mc Graw Hill Pub. Co., New Delhi, Fourth edition, 2011.

REFERENCES:

1. A. Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, “A Text book on Power System Engineering”, Dhanpat Rai Publishing Company (P) Ltd, 2008.
2. W. D. Stevenson, “Elements of Power System Analysis”, 4th Edition, McGraw Hill, 1984.
3. John J. Grainger & W.D. Stevenson, “Power System Analysis”, Mc Graw Hill International,1994.
4. Hadi Sadat, “Power System Analysis”, Tata Mc Graw Hill Pub. Co. 2002.

POWER ELECTRONICS

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: Electrical Circuits-I&II, Analog & Digital Electronics

Course Objectives:

- Understand the characteristics and operation of power semiconductor devices.
- Study AC–DC, DC–DC, DC–AC, and AC–AC power conversion techniques.
- Learn control methods for converters, inverters, and choppers.
- Analyze performance for various loads and applications.
- Interpret data sheets and protection methods for power devices.

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

- Explain construction, characteristics, triggering, and protection of power devices.
- Analyze single-phase and three-phase controlled rectifiers.
- Design and evaluate DC–DC converters for given specifications.
- Understand inverter operation and apply PWM techniques.
- Explain AC voltage controllers and cyclo-converters with applications

UNIT-I:

Power Switching Devices: Concept of power electronics, scope and applications, types of power converters; Switches: Diodes, BJT, SCR, MOSFET and IGBT V-I characteristics; Gate triggering and commutation of SCR, Thyristor ratings and protection. **Interpretation of power device data sheets.**

UNIT-II:

AC-DC Converters (Phase Controlled Rectifiers): Principles of 1-phase, 3-phase semi and full controlled converters with R, RL, and RLE load (with and without Freewheeling diodes), Effect of load and source inductances, 1-phase and 3-phase dual converters (block diagram approach only)-Applications.

UNIT-III:

DC TO DC CONVERTERS: Principle of operation of Buck, Boost and Buck-Boost converter (steady state analysis) – Isolated Converters-Fly-Back, Forward type converters. Applications.

UNIT-IV:

DC-AC Converters (Inverters): Principle of operation of 1-phase bridge inverters with R, RL loads, 3-phase bridge inverters - 120- and 180-degrees mode of operation, Voltage control of single-phase inverters –PWM techniques: single pulse, multiple pulse and sinusoidal pulse. Applications.

UNIT-V:

AC-AC Converters: Principle of operation of 1-phase AC voltage controllers and 1-phase cyclo-converters for R, R-L loads, relevant waveforms, Advantages and disadvantages-Applications.

TEXT BOOKS:

1. M. H. Rashid, “Power electronics: circuits, devices, and applications”, Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, “Power Electronics: Converters, Applications and Design”, John Wiley & Sons, 2007.

REFERENCES:

1. R. W. Erickson and D. Maksimovic, “Fundamentals of Power Electronics”, Springer Science & Business Media, 2007.
2. L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.

MICROPROCESSORS AND MICROCONTROLLERS

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: Digital Electronics and Computer Programming

Course Objectives:

- Understand the architecture and operation of the 8086 microprocessors.
- Learn assembly language programming for 8086 and 8051.
- Study the architecture, instruction set, and interfacing techniques of 8051 microcontroller.
- Explore advanced processors like ARM, OMAP, Arduino, and Raspberry Pi.
- Develop interfacing skills for industrial and embedded applications.

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

- Describe the architecture, memory organization, and programming model of 8086.
- Write assembly programs for 8086 and 8051 for various applications.
- Interface microprocessors and microcontrollers with peripheral devices.
- Apply microcontroller concepts in real-time control and industrial applications.
- Understand the fundamentals and applications of ARM, OMAP, Arduino, and Raspberry Pi

UNIT-I:

8086 Architecture-Pin diagram, Register Organization, Memory Segmentation, Programming Model, Modes of operation, Timing diagrams, Memory addresses, Physical Memory Organization, interrupts of 8086.

Instruction Set and Assembly Language Programming Of 8086: Instruction formats, addressing modes, Instruction Set, Assembler Directives, and assembly language programming.

UNIT-II:

I/O Interface: 8255 PPI, Various modes of operations and interface of I/O devices to 8086, A/D, D/A Converter Interfacing.

Interfacing With Advanced Devices: 8086 System bus structure, Memory and I/O Interfacing with 8086, Interfacing through various IC Peripheral Chips, 8257 (DMA Controller), 8259 (Interrupt Priority Control).

Communication Interface: USART Interfacing

UNIT-III:

Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O ports and Memory Organization, addressing modes and Instruction set of 8051, Simple Programs using Stack Pointer, Assembly language programming of 8051

Interrupts Communication: Interrupts - Timer/Counter and Serial Communication, Interrupt Priority in the 8051, Programming of 8051- Timers, Counters and Interrupts.

UNIT-IV:

Interfacing And Industrial Applications: Applications of Micro Controllers, interfacing 8051 to LED's, Keyboard Interfacing, Interfacing Seven Segment Display, ADC and DAC Interfacing, Stepper Motor Interfacing

UNIT-V:

ARM Processor fundamentals, ARM Architecture, Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture. Arduino, RasberryPi Architecture and Applications (schematic and block diagrams).

TEXT BOOKS:

1. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, MHE, 2nd Edition 2006.
2. Microprocessors and Interfacing, D. V. Hall, MGH, 2nd Edition 2006.
3. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012

REFERENCES:

1. Introduction to Embedded Systems, Shibu K.V, MHE, 2009
2. The 8051 Microcontrollers, Architecture and Programming and Applications -K.Uma Rao, Andhe Pallavi, Pearson, 2009.
3. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed.

ELECTRICAL MACHINES - II LABORATORY

B.Tech. II Year II Sem.

L	T	P	C
0	0	2	1

Prerequisites: Electrical Machines-II

Course Objectives:

- Familiarize with testing methods of transformers, induction motors, and synchronous machines.
- Understand performance characteristics and parameters of AC machines.
- Learn to determine voltage regulation and efficiency of alternators.
- Study load characteristics of synchronous motors.
- Acquire practical skills in handling and connecting AC electrical machines.

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

- Perform standard tests on transformers, induction motors, and synchronous machines.
- Determine equivalent circuit parameters and performance curves.
- Conduct experiments to find voltage regulation and efficiency of alternators.
- Analyze characteristics of synchronous motors under different load conditions.
- Apply laboratory skills for practical industrial situations.

The following experiments are required to be conducted as compulsory experiments:

1. Sumpner's test on a pair of single-phase transformers
2. No-load & Blocked rotor tests on three phase Induction motor
3. Regulation of a three -phase alternator by synchronous impedance & m.m.f. methods
4. 'V' and 'Inverted V' curves of a three–phase synchronous motor.
5. Equivalent Circuit of a single-phase induction motor
6. Determination of Xd and Xq of a salient pole synchronous machine
7. Brake test on three phase Induction Motor
8. Regulation of three-phase alternator by Z.P.F. and A.S.A methods

In addition to the above experiments, at least any two of the following experiments are required to beconducted from the following list:

1. Separation of core losses of a single-phase transformer
2. Efficiency of a three-phase alternator
3. Parallel operation of Single-phase Transformers
4. Measurement of sequence impedance of a three-phase alternator.
5. Scott Connection of transformer

TEXT BOOKS:

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I.J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

REFERENCES:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, "Electrical Machines", Oxford, 2017.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
4. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

CONTROL SYSTEMS LABORATORY

B.Tech. II Year II Sem.

L	T	P	C
0	0	2	1

Prerequisite: Control Systems

Course Objectives:

- Provide hands-on experience with control system components and their characteristics.
- Understand time-domain and frequency-domain analysis of control systems.
- Learn to determine transfer functions of motors and generators.
- Familiarize with compensation techniques and stability analysis.
- Apply simulation tools for modeling and analysis of control systems.

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

- Measure and analyze the time response of second-order systems.
- Determine the transfer functions of DC motors and generators.
- Study and implement feedback effects on servo motors.
- Analyze system stability using Bode, Root Locus, and Nyquist plots.
- Design and simulate controllers and compensators using software tools.

The following experiments are required to be conducted compulsory experiments:

1. Time response of Second order system
2. Characteristics of Synchros
3. Effect of feedback on DC servo motor
4. Transfer function of DC motor
5. Transfer function of DC generator
6. Lag and lead compensation – Magnitude and phase plot
7. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using simulation tools.
8. State space model for classical transfer function using simulation tools.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

1. Characteristics of AC servo motor
2. Temperature controller using PID
3. Effect of P, PD, PI, PID Controller on a second order systems
4. (a) Simulation of P, PI, PID Controller.
   (b) Linear system analysis (Time domain analysis, Error analysis) using suitable software
5. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions, and application of speed control of motor.
6. Design of Lead-Lag compensator for the given system and with specification using suitable software

TEXT BOOKS:

1. M. Gopal, “Control Systems: Principles and Design”, McGraw Hill Education, 1997.
2. B. C. Kuo, “Automatic Control System”, Prentice Hall, 1995.

REFERENCES:

1. K. Ogata, “Modern Control Engineering”, Prentice Hall, 1991.
2. I. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International, 2009.

MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

B.Tech. II Year II Sem.

L	T	P	C
0	0	2	1

Prerequisites: Microprocessors and Microcontrollers

Course Objectives:

- Provide practical exposure to programming 8086 and 8051 using various instructions and addressing modes.
- Develop skills in interfacing microprocessors/microcontrollers with peripheral devices.
- Understand communication between processor systems.
- Implement real-time control applications using assembly programming.
- Strengthen debugging and problem-solving skills for embedded systems.

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

- Write and execute assembly language programs for 8086 and 8051.
- Perform serial and parallel communication between systems.
- Interface and control peripheral devices like LCDs, keypads, ADCs, DACs, and motors.
- Implement timer, counter, and interrupt-based applications.
- Design small-scale embedded control applications using microprocessor/microcontroller kits

The following programs/experiments are to be written for assembler and to be executed the same with 8086 and 8051 kits.

List of Experiments:

1. Programs for 16-bit arithmetic operations 8086(using various addressing modes)
2. Programs for sorting an array for 8086.
3. Programs for string manipulation for 8086.
4. Serial and Parallel communication between two microprocessor kits.
5. Programming using arithmetic, logical and bit manipulation instructions of 8051.
6. Program and verify Timer/Counter in 8051.
7. Program and verify interrupt handling in 8051.
8. Interfacing LCD to 8051
9. Interfacing Matrix/Keyboard to 8051
10. Data transfer from peripheral to memory through DMA controller 8237/8257
11. Interfacing to 8086/8051 and programming to control stepper motor.
12. Interfacing to 8086/8051 and programming to control traffic lights.
13. Interfacing to 8086/8051 and programming to control elevator motor.
14. Interfacing ADC and DAC to 8086/8051.

TEXT BOOKS:

1. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, MHE, 2nd Edition 2006.
2. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed.

REFERENCES:

1. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012
2. Microprocessors and Interfacing, D. V. Hall, MGH, 2nd Edition 2006.
3. Introduction to Embedded Systems, Shibu K.V, MHE, 2009
4. The 8051 Microcontrollers, Architecture and Programming and Applications -K.Uma Rao, Andhe Pallavi, Pearson, 2009.

PCB DESIGN / FPGA FUNDAMENTALS
(Skill Development Course)

B.Tech. II Year II Sem.

L	T	P	C
0	0	2	1

Prerequisites:

Course Objectives:

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