GEETHANJALI INSTITUTE OF SCIENCE & TECHNOLOGY: NELLORE (AUTONOMOUS)

NELLORE–524317(A.P) INDIA

B.TECH IN ELECTRICAL AND ELCTRONICS ENGINEERING (ACCREDITATED BY NBA)

COURSE STRUCTURE AND SYLLABIUNDER RG- 23 REGULATIONS

DEPARTMENT VISION

To make the department as a hub of technological excellence, transforming the future Electrical Engineers into innovative, ethical and responsible professionals.

DEPARTMENT MISSION

DM1: Adopting effective result oriented techniques that deliver quality education in a learning environment striving to enhance the intellectual capabilities and skills of the learners.

DM2: Providing adequate infrastructure for technical skill development and encourage research in order to meet Industrial demands.

DM3: Promoting industry interface and exposure, positive values of integrity, ecological awareness, and societal accountability among the Engineering aspirants.

DM4: Empowering undergraduates, guiding them towards bright professional prospects through personality development and life skill-based activities.

PROGRAMME EDUCATIONAL OBJECTIVES:

Graduates of B. Tech., in Electrical and Electronics Engineering program shall able to

PEO1: Acquiring professional expertise in several kinds of industrial, societal, and pragmatic uses

PEO2: Pursuing higher studies, research and development, with other innovative skills and being creative striving in the fields of engineering, science, and technology, proceeding on multiple career paths.

PEO3: Exhibit excellence in Multi-Disciplinary collaborationsby showcasingunique interpersonal competencies and ethical practices.

PEO4: Engage in lifelong learning and adapt to the perpetually evolving trends in profession and societal needs.

Program Specific Outcomes

PSO1: Capability to exhibit expertise and experience in accurately evaluating the origins and impact electrical systems, processes, and technologies, in this present digital era.

PSO2: Conceive, identify, and execute ideas for electrical industry applications by employing MATLAB /SciLAB.

Program Outcomes

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineeringFundamentals and an engineering specialization the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature and analyze complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems anddesign system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineeringactivities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning in formed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering Solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development
PO8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities andNorms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual and as a member orLeader in diverse teams and in multi disciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend andwrite effective reports and design documentation, make effective presentations and give And receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the Engineering and management principles and apply the set one's own work, as a memberAnd leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for and have the preparation and ability to engageIn independent and life- long learning in the broadest context of technological change.

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B.Tech I Year I semester

Department of Electrical and Electronics Engineering

Course Structure (RG23)

B.Tech I Year I semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	BS&H	23A0009T	Communicative English	2	0	0	2
2	BS&H	23A0004T	Chemistry	3	0	0	3
3	BS&H	23A0001T	Linear Algebra and calculus	3	0	0	3
4	ES	23A0101T	Basic Civil and Mechanical Engineering	3	0	0	3
5	PC	23A0501T	Introduction to programming	3	0	0	3
6	ES	23A0302P	Engineering Workshop	0	0	3	1.5
7	BS&H	23A0010P	Communicative English Lab	0	0	2	1
8	BS&H	23A0007P	Chemistry Lab	0	0	2	1
9	PC	23A0502P	Computer Programming Lab	0	0	3	1.5
10	BS&H	23AYG01P	Health and Wellness, Yoga and Sports	0	0	1	0.5
Total credits							**19.5**

Member Secretary **BOS Chairman**

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B.Tech I Year I semester

COMMUNICATIVE ENGLISH
(Common to all Branches of Engineering)

Course Code	L:T: P: S	Credits	Exam marks	Exam Duration	Course Type
23A0009T	2: 0: 0: 0	2	CIE:30 SEE:70	3 Hours	HS

Course Objectives:

- Facilitate effective **listening skills** for better comprehension of academic lectures and English spoken by native speakers
- Help improve **speaking skills** motivating the learners to participate in activities such as role plays, discussions and structured talks/oral presentations
- Focus on appropriate **reading skills** for comprehension of various academic texts and authentic materials
- Impart effective strategies for good **writing skills** in summarizing, writing well organized essays, drafting formal letters and designing well structured reports
- Broaden the knowledge base of **grammatical structures** and **vocabulary** and encourage their appropriate use in speech and writing

Syllabus		Total Hours:32
UNIT - I	**HUMAN VALUES:** Gift of Magi **(Short Story)**	**8 Hrs**

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
Reading: Skimming to get the main idea of a text Scanning to look for specific pieces of information.
Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.
Grammar: Parts of Speech, Basic Sentence Structures-forming questions
Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

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UNIT - II	The Brook by Alfred Tennyson (Poem)	7Hrs

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts.
Speaking: Discussion in pairs/small groups on specific topics followed by short structured talks**.**
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
Writing: Structure of a paragraph - Paragraph writing (specific topics)
Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions.
Vocabulary: Homonyms, Homophones, Homographs.

UNIT - III	BIOGRAPHY: Elon Musk	6 Hrs

Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed
Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
Writing: Summarizing, Note-making, paraphrasing
Grammar: Verbs - tenses; subject-verb agreement; Compound words**,**
Vocabulary: Compound words, Collocations

UNIT - IV	INSPIRATION: The Toys of Peace -Saki	6 Hrs

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data

Writing: Letter Writing: Official Letters, Resumes

Grammar : Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons

UNIT - V	MOTIVATION: The Power of Intrapersonal Communication (An Essay)	5 Hrs

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic contexts

Reading: Reading for Comprehension

Writing: Writing structured essays on specific topics**.**

Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Vocabulary: Technical Jargons

Course Outcomes (CO):

On completion of this course, student will be able to

- The learner will be able to speak and write grammatically accurate sentences through applications of principles of English grammar
- The learner will enhance vocabulary skills to build strong language skills.
- The learner acquires the ability to understand the academic text from multiple dimensions employing ethical and logical reasoning based on accurate comprehension
- The learner gains evaluation potential by employing standard reading & listening strategies to grasp the core essence and spirit of the text
- The learner will gain mastery on speaking & writing skills through the application of relevant guidelines, through consistent practice of functional English expression

Textbooks:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

Reference Books:

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Web Resources:

GRAMMAR:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/

6. https://www.talkenglish.com/grammar/grammar.aspx

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

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B.Tech I Year I semester

CHEMISTRY
(Common to CSE, AI&ML, CS, ECE, EEE, DS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0004T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	BSC

Course Objectives: Student will be able to

- To familiarize chemistry and its applications.
- To train the students on the principles and applications of electrochemistry and polymers.
- To introduce instrumental methods.

Syllabus		Total Hours: 48 Hrs
Unit- I	**Structure and Bonding Models**	**9Hrs**

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ2, Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ2 , particle in one dimensional box, molecular orbital theory – bonding in homo- and hetero-nuclear diatomic molecules – energy level diagrams of O2, CO, and NO. π-molecular orbitals of butadiene and benzene, calculation of bond order.

Unit-II	**Modern Engineering materials**	**10Hrs**

Semiconductors – Introduction, basic concept, application
Superconductors: Introduction, Basic concept and Applications.
Supercapacitors: Introduction, Basic concept, Classification and Applications.
Nanomaterials: Introduction, classification, properties and applications of Fullerenes, carbon nanotubes and Graphine nanoparticles.

Unit-III	**Electrochemistry and Applications**	**10Hrs**

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry-potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).
Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.
Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygenfuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

Unit-IV	**Polymer Chemistry**	**10Hrs**

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.
Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.
Elastomers–Buna-S, Buna-N–preparation, properties and applications.
Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications.
Biodegadable polymers - **poly dioxanone,** Polyglycolic Acid (PGA), Polylactic Acid (PLA).

Unit-V	**Instrumental Methods and applications**	**9Hrs**

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification, **Gas chromatography,** HPLC: Principle, Instrumentation and applications.

Course Outcomes (CO): After completion of the course, students will be able to

- Describe Planck's quantum theory, dual nature of matter, Schrodinger equation, molecular orbital Theory and molecular orbital energy level diagram of differentmolecules
- Explain Crystal field theory, splitting in octahedral and tetrahedral geometry and the magnetic behavior, Oxidation state, coordination and color of complexes.
- Explain the principle of Band diagrams of conductors, superconductor, semiconductorsand insulato and nonmaterial
- Discuss the principles of electrochemistry in potentiometry, conductometry, battery ar electrochemical sensors
- Explain polymerization and the preparation, properties, and applications ofthermoplastics &thermosetting, elastomers, & conducting polymers
- Discuss the different applications of analytical instruments

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e,Oxford University Press, 2010.

Reference Books:

1. G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc Graw H 2020.
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
3. J.M.Lehn, Supra Molecular Chemistry, VCH Publications

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B.Tech I Year I semester

LINEAR ALGEBRA & CALCULUS
(Common to All Branches of Engineering)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0001T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	BS

Course Objectives:

To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

Syllabus — **Total Hours: 48**

Unit - I	Matrices	10 Hrs

Rank of a matrix by echelon form, normal form. Cauchy–Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations - Gauss elimination method, Iteration Methods: Gauss - Jacobi and Gauss Seidel Iteration Methods. Applications: Finding the current in electrical circuits.

Unit - II	Eigenvalues, Eigenvectors and Orthogonal Transformation	9 Hrs

Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

Unit - III	Calculus	9 Hrs

Mean Value Theorems: Rolle's Theorem (Without Proof), Lagrange's mean value theorem (Without Proof) with their geometrical interpretation, Cauchy's mean value theorem (Without Proof), Taylor's and Maclaurin theorems with remainders (Without Proof), Problems and applications on the above theorems.

Unit - IV	Partial differentiation and Applications (Multi variable calculus)	10 Hrs

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

Unit - V	Multiple Integrals (Multi variable Calculus)	10 Hrs

Double integrals, triple integrals, change of order of integration (Cartesian Coordinate only), change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals)

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

CO1: Solving systems of linear equations that is needed by engineers for practical applications.

CO2: Find the eigen values and eigen vectors to facilitate the calculation of matrix characteristics.

CO3: Utilize mean value theorems to real life problems.

CO4: Apply the technique of partial differentiation to find the Jacobian and the extreme values of functions of several variables.

CO5: Apply the techniques of multiple integrals to find the areas and volumes.

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, Pearson publishers, 9th edition
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021
6. Engineering Mathematics III by N.P. Bali, Dr. K.L. Sai Prasad, University Science Press.
7. Engineering Mathematics I by T.K.V. Iyengar, B.Krishna Gandhi,, S. Chand Publications, 2019 Edition.
8. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N.Prasad, S. Chand Publications.
9. Higher Engineering Mathematics, B. V. Ramana, McGraw Hill Education, 2017.

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B.Tech I Year I semester

Basic Civil & Mechanical Engineering
(Common for all branches)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0101T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	ESC

Course Objectives:

- Get familiarized with the scope and importance of Civil Engineering sub-divisions
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water
- Introduction to basic civil engineering materials and construction techniques

Syllabus	PART-A (CIVIL)	Total Hours: 48
Unit - I	**Introduction**	**9 Hrs**

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques

Unit - II	Fluid Mechanics, Surveying & Bearings	9 Hrs

Fluid Mechanics: Properties of fluids and types of fluids.
Surveying: Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings- Contour mapping.

Unit - III	Basics on Constructions	9 Hrs

Transportation Engineering Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.
Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Textbooks:

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

E-Resources :
https://archive.nptel.ac.in/courses/105/106/105106201/

	PART-B (BASIC MECHANICALENGINEERING)	
Unit - I	**Introduction**	**7hrs**

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society-Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors. Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

Unit - II	**Manufacturing Processes & Thermal Engineering**	7hrs

Manufacturing Processes: Principles of Casting, Forming, joining processes, Machining,

Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration

and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines,

Components of Electric and Hybrid Vehicles.

Unit - III	**Power plants,Transmission & Robotics**	7hrs

Power plants – working principle of Steam, Diesel, Hydro, Nuclear power plants. Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications. Introduction to Robotics - Joints & links, configurations, and applications of robotics.

(**Note:** The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

Course Outcomes:

On completion of the course, the student should be able to

1. Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying
2. Realize the importance of Transportation in nation's economy and the engineering measures related to highways in terms of geometrics.
3. Understand the importance of water resources and storage structures so that the social responsibilities of water conservation will be appreciated.
4. Understand the different manufacturing processes
5. The basics of thermal engineering and its applications.
6. Describe the working of different mechanical power transmission systems and power plants; learn basics of robotics.

Textbooks:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications(India) Pvt. Ltd.

2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.

3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, cengage learning India pvt. Ltd.

ReferenceBooks:

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata Mcgraw Hill publications (India) Pvt. Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata Mcgraw Hill publications (India) Pvt. Ltd.

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B.Tech I Year I semester

INTRODUCTION TO PROGRAMMING
(Common to All branches of Engineering)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0501T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

- To introduce students to the fundamentals of computer programming.
- To provide hands-on experience with coding and debugging.
- To foster logical thinking and problem-solving skills using programming.
- To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- To encourage collaborative learning and teamwork in coding projects

Syllabus		**Total Hours: 48**
Unit - I	**Introduction to Programming and Problem Solving**	**10 Hrs**

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms..

Unit - II	**Control Structures**	**8 Hrs**

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do- while) Break and Continue.

Unit - III	**Arrays and Strings**	**10 Hrs**

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings.

Unit - IV	**Pointers & User Defined Data types**	**10 Hrs**

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

Unit - V	**Functions & File Handling**	**10 Hrs**

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, command line arguments, Preprocessor directives, Basics of File Handling.

Note: The syllabus is designed with C Language as the fundamental language of implementation.

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

CO1: Understand basics of computers, the concept of algorithm and algorithmic thinking.
CO2: Analyse a problem and develop an algorithm to solve it.
CO3: Implement various algorithms using the C programming language.
CO4: Understand more advanced features of C language.
CO5: Develop problem-solving skills and the ability to debug and optimize the code.

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Textbooks:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice- Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996.

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition

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B.Tech I Year I semester

ENGINEERING WORKSHOP
(Common to All branches of Engineering)

Course Code	L : T : P	Credits	Exam Marks	Exam Duration	Course Type
23A0302P	**0 : 0 : 3**	**1.5**	**CIE: 30 EE:70**	**3 Hours**	**ESC**

Course Objectives:
To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills.

Course Outcomes:

On completion of this course, the students are able to:-

1. Identify workshop tools and their operational capabilities.
2. Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.
3. Apply fitting operations in various applications.
4. Apply basic electrical engineering knowledge for House Wiring Practice.

SYLLABUS **Total Hours : 32**

1. Demonstration: Safety practices and precautions to be observed in workshop.
2. Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints.
3. Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint
4. Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
5. Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
6. Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises.
7. V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre
8. Electrical Wiring: Familiarity with different types of basic electrical circuits and make the following connections.
9. Parallel and series b) Two-way switch c) Godown lighting
10. d) Tube light e) Three phase motor f) Soldering of wires
11. Foundry Trade: Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
12. Welding Shop: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
13. Plumbing: Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

Textbooks:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

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B.Tech I Year I semester

COMMUNICATIVE ENGLISH LAB
(Common to all Branches of Engineering)

Course Code	L : T : P	Credits	Exam Marks	Exam Duration	Course Type
23A0010P	0 : 0 : 2	1	CIE: 30 EE:70	3 Hours	HS

Course Objectives:

The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning students will get trained in the basic communication skills and also make them ready to face job interviews.

Course Outcomes:

On completion of this course, the students are able to:-

1. Analyze the English speech sounds, stress, intonation for better Listening practice
2. Apply communication skills through various language learning activities
3. Application of writing skills through design and preparation of professional Resume & email writing
4. Create effective resonate and prepare themselves to face interviews in future

List of Experiments **Total Hours : 32**

1. VOWELS & CONSONANTS
2. NEUTRILIZATION/ ACCENT RULES
3. COMMUNICATION SKILLS & JAM
4. ROLE PLAY OR CONVERSATIONAL PRACTICE
5. EMAIL WRIRING
6. RESUME WRITING, COVER LETTER, SOP
7. GRPOUP DISCUSSION-METHODS & PRACTICE
8. DEBATE - METHOD & PRACTICE
9. PPT PRESENTATION / PSTER PRESENTATION
10. INTERVIEW SKILLS

Suggested Software: Walden InfoTech / Young India Films

e Books:

1. Meenakshi Raman, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.
2. Grant Taylor: English Conversation Practice, Tata McGraw-Hill Education India, 2016
3. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
4. T. Balasubramanyam, A Textbook of English Phonetics for Indian Students,(3rd Ed) Trinity Press.

Online Learning Resources/Virtual Labs:

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com

3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

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B.Tech I Year I semester

COMPUTER PROGRAMMING LAB
(Common to All branches of Engineering)

Course Code	L : T : P	Credits	Exam Marks	Exam Duration	Course Type
23A0502P	**0 : 0 : 3**	**1.5**	**CIE: 30 EE:70**	**3 Hours**	**PCC**

Course Objectives:
The course aims to give students hands – on experience and train them on the concepts of the C- programming language.

Course Outcomes:
On completion of this course, the students are able to:-

CO1: Read, understand, and trace the execution of programs written in C language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers.
CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

SYLLABUS **Total Hours : 32**

UNIT I
WEEK 1
Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:
Tutorial 1: Problem-solving using Computers.
Lab1: Familiarization with programming environment
I. Basic Linux environment and its editors like Vi, Vim & Emacs etc.
II. Exposure to Turbo C, gcc
II. Writing simple programs using printf(), scanf()

WEEK 2
Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.
Suggested Experiments /Activities:
Tutorial 2: Problem-solving using Algorithms and Flow charts.
Lab 1: Converting algorithms/flow charts into C Source code.
Developing the algorithms/flowcharts for the following sample programs
i) Sum and average of 3 numbers
ii) Conversion of Fahrenheit to Celsius and vice versa
iii) Simple interest calculation

WEEK 3
Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.
Suggested Experiments/Activities:
Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.

i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

UNIT II

WEEK 4

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:

Lab4: Simple computational problems using the operator' precedence and associativity

i) Evaluate the following expressions.
a. A+B*C+(D*E) + F*G
b. A/B*C-B+A*D/3
c. A+++B---A
d. J= (i++) + (++i)
ii) Find the maximum of three numbers using conditional operator
iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5

Objective: Explore the full scope of different variants of "if construct" namely if-else, null- else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

Lab 5: Problems involving if-then-else structures.

i) Write a C program to find the max and min of four numbers using if-else.
ii) Write a C program to generate electricity bill.
iii) Find the roots of the quadratic equation.
iv) Write a C program to simulate a calculator using switch case.
v) Write a C program to find the given year is a leap year or not

WEEK 6

Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

Lab 6: Iterative problems e.g., the sum of series

i) Find the factorial of given number using any loop.
ii) Find the given number is a prime or not.
iii) Compute sine and cos series
iv) Checking a number palindrome
v) Construct a pyramid of numbers.

UNIT III

WEEK 7:

Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7:1D Array manipulation, linear search

i) Find the min and max of a 1-D integer array.
ii) Perform linear search on1D array.
iii) The reverse of a 1D integer array
iv) Find 2's complement of the given binary number.
v) Eliminate duplicate elements in an array**.**

WEEK 8:

Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings**.**

Lab 8: Matrix problems, String operations, Bubble sort

i) Addition of two matrices
ii) Multiplication two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v) Reverse a string using built-in and without built-in string functions

UNIT IV

WEEK 9:

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C.

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereference.

i) Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list
iv) Read student name and marks from the command line and display the student details along with the total.
v) Write a C program to implement realloc()

WEEK 10:

Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

Suggested Experiments/Activities:

Tutorial 10: Bitfields, Self-Referential Structures, Linked lists

Lab10 : Bitfields, linked lists

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

i) Create and display a singly linked list using self-referential structure.
ii) Demonstrate the differences between structures and unions using a C program.
iii) Write a C program to shift/rotate using bitfields.
iv) Write a C program to copy one structure variable to another structure of the same type.

UNIT V

WEEK 11:

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:

Tutorial 11: Functions, call by value, scope and extent,

Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

i) Write a C function to calculate NCR value.
ii) Write a C function to find the length of a string.
iii) Write a C function to transpose of a matrix.
iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12:

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

i) Write a recursive function to generate Fibonacci series.
ii) Write a recursive function to find the lcm of two numbers.
iii) Write a recursive function to find the factorial of a number.
iv) Write a C Program to implement Ackermann function using recursion.
v) Write a recursive function to find the sum of series.

WEEK 13:

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

Lab 13: Simple functions using Call by reference, Dangling pointers.

i) Write a C program to swap two numbers using call by reference.
ii) Demonstrate Dangling pointer problem using a C program.
iii) Write a C program to copy one string into another using pointer.
iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK14:

Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

i) Write a C program to write and read text into a file.
ii) Write a C program to write and read text into a binary file using fread() and fwrite()
iii) Copy the contents of one file to another file.
iv) Write a C program to merge two files into the third file using command-line arguments.
v) Find no. of lines, words and characters in a file
vi) Write a C program to print last n characters of a given file

Textbooks:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice- Hall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

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B.Tech I Year I semester

CHEMISTRY LAB

(Common to CSE, AI&ML, ECE, EEE, DS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0007P	0:0:2:0	1	CIE:30 SEE:70	3 Hours	BSC

Course Objectives:

- Verify the fundamental concepts with experiments

Syllabus **Total Hours: 48**

List of Experiments

1. Measurement of 10Dq by spectrophotometric method
2. Conductometric titration of strong acid vs. strong base
3. Conductometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Simultaneous estimation of Mn and Cr ions by spectrophotometry in water samples.
10. Wavelength measurement of sample through UV-Visible Spectroscopy
11. Identification of functional groups in organic compounds by IR Spectroscopy.
12. Preparation of nanomaterials by precipitation method
13. Estimation of Ferrous Iron by Dichrometry
14. Determination of Hardness of a groundwater sample
15. pH metric titration of strong acid vs strong base

(Any 10 experiments from the above list)

Course Outcomes:

On completion of this course, the students are able to:

- Determine the cell constant and conductance of solutions and the strength of an acid by conductometry
- Synthesize of advanced polymer materials
- Measure the strength of an acid present in secondary battery and Ferrous ion usingvolumetric analysis
- Determine the potentials and EMFs of solutions by Potentiometry
- Identify some organic and inorganic compounds by instrumental methods
- Synthesize of nanomaterials by simple methods

Text Book(s):

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.
2. Jain & Jain. Engineering Chemistry: Dhanapath rai Publications., 2015.
3. S.S.Dara, Experiments and Calculations in Engineering Chemistry: S-Chand Publications, Revised edition, 2008.

Reference Book(s):

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar

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B.Tech I Year I semester

HEALTH AND WELLNESS, YOGA AND SPORTS

(Common to CSE & EEE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23AYG01P	0:0:1:0	0.5	100	3 Hours	BSC

Course Objectives:

- The main objective of introducing this course is to make the students maintain their mental andphysical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality

Syllabus **Total Hours: 18**

UNIT I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

UNIT II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
Practicing general and specific warm up, aerobics
ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Course Outcomes:

After completion of the course the student will be able to

CO1: Understand the importance of yoga and sports for Physical fitness and sound health.
CO2: Demonstrate an understanding of health-related fitness components.
CO3: Compare and contrast various activities that help enhance their health.
CO4: Assess current personal fitness levels.
CO5: Develop Positive Personality

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Reference Book(s):

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning,2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

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B.Tech I Year II semester

Department of Electrical and Electronics Engineering

Course Structure (RG23)

B.Tech I Year II semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1.	BS&H	23A0003T	Engineering Physics	3	0	0	3
2.	BS&H	23A0002T	Differential Equations and vector calculus	3	0	0	3
3.	PC	23A0203T	Electrical Circuits Analysis – I	3	0	0	3
4.	ES	23A0201T	Basic Electrical and Electronics Engineering	3	0	0	3
5.	ES	23A0301T	Engineering Graphics	1	0	4	3
6.	ES	23A0202P	Electrical and Electronics Engineering Workshop	0	0	3	1.5
7.	ES	23A0503P	IT Workshop	0	0	2	1
8.	BS&H	23A0006P	Engineering Physics Lab	0	0	2	1
9.	PC	23A0204P	Network Analysis and Simulation Lab / Electrical Circuits Lab / Data Structures Lab	0	0	3	1.5
10	BS&H	23ANS01P	NSS/NCC/Scouts and Guides / Community Service	0	0	1	0.5
			Total credits				**20.5**

Member Secretary **BOS Chairman**

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B.Tech I Year II semester

ENGINEERING PHYSICS
(Common to all branches)

Course Code	L : T : P	Credits	Exam Marks	Exam Duration	Course Type
23A0003T	3 : 0 : 0	3	CIE: 30 EE:70	3 Hours	BS

Prerequisite: Student should know about fundamental and basic principles in physics

Course Objectives:
To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

Course Outcomes:
On completion of this course, the students are able to:-
1. Analyze the intensity variation of light due to polarization, interference anddiffraction.
2. Familiarize with the basics of crystals and their structures.
3. Summarize various types of polarization of dielectrics and classify the magneticmaterials.
4. Apply fundamentals of quantum mechanics to band theory of solids.
5. Identify the type of semiconductor using Hall effect.

SYLLABUS **Total Hours:48**

Unit- I WAVE OPTICS 10

Interference: Introduction - Principle of superposition –Interference of light - Interference inthin films (Reflection Geometry) & applications - Colors in thin films- Newton's Rings- Determination of wavelength and refractive index.
Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due tosingle slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).
Polarization: Introduction -Types of polarization - Polarization by reflection, refraction andDouble refraction - Nicol's Prism -Half wave and Quarter wave plates

Unit- II CRYSTALLOGRAPHY AND X-RAY DIFFRACTION 8

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.
X-ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods.

Unit- III DIELECTRIC AND MAGNETIC MATERIALS 10

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientationpolarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dilectric constant – Frequency dependence of polarization – dielectric loss
Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls

(Qualitative) - Hysteresis - soft and hard magnetic materials

Unit- IV	QUANTUM MECHANICS AND FREE ELECTRON THEORY	10

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy.

Unit- V	SEMICONDUCTORS	10

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation - Hall effectand its applications.

Superconductors- Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory – High T_c superconductors– Applications of superconductors

Textbooks:

1. A Text book of Engineering Physics - M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015).
3. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers

Reference Books:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

E-resources:

- https://www.textbooks.com/Catalog/MG5/Applied-Physics.php
- https://edurev.in/courses/9596_Electromagnetic-Theory-Notes--Videos--MCQs--PPTs
- https://libguides.ntu.edu.sg/c.php?g=867756&p=6226561
- https://bookauthority.org/books/best-applied-physics-books
- https://www.electronicsforu.com/resources/16-free-ebooks-on-material-science/2

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B.Tech I Year II semester

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(Common to All Branches of Engineering)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0002T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	BS

Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

Syllabus		Total Hours: 48
Unit - I	**Differential equations of first order and first degree**	**9 Hrs**

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decayElectrical circuits.

Unit - II	**Linear differential equations of higher order (Constant Coefficients)**	**9 Hrs**

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

Unit - III	**Partial Differential Equations**	**10 Hrs**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

Unit - IV	**Vector differentiation**	**10 Hrs**

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions-Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.

Unit - V	**Vector integration**	**10 Hrs**

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems

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

CO1: Solve the first order differential equations related to various engineering fields.
CO2: Solve the linear differential equations of higher order with constant coefficients
CO3: Identify solution methods for partial differential equations that model physical processes.
CO4: Interpret the physical meaning of different operators such as gradient, curl anddivergence.
CO5: Apply Green's, Stokes and Divergence theorem in work done, circulation, flux and triple integrals.

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
5. Higher Engineering Mathematics, B. V. Ramana, , McGraw Hill Education, 2017
6. Engineering Mathematics I by T.K.V. Iyengar, B.Krishna Gandhi,, S. Chand Publications, 2015 Edition.

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B.Tech I Year II semester

ELECTRICAL CIRCUIT ANALYSIS -I
(EEE)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0203T	3:0:0	3	CIE:30 & SEE:70	3 Hours	PCC

Course Objectives:

The objectives of the course are to make the students learn about:

- To develop an understanding of the fundamental laws, elements of electrical circuits and toapply circuit analysis to DC and AC circuits.

Syllabus		Total Hours: 48Hrs
Unit-I	**INTRODUCTION TO ELECTRICAL CIRCUITS**	**9Hrs**

Basic Concepts of passive elements of R, L, C and their V-I relations, Sources (dependent and independent), Kirchoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta-to-star transformation), source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources, node and mesh analysis.

Unit-II	MAGNETIC CIRCUITS	10Hrs

Basic definition of MMF, flux and reluctance, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction – concept of self and mutual inductance, Dot convention – coefficient of coupling and composite magnetic circuit, analysis of series and parallel magnetic circuits.

Unit -III	SINGLE PHASE CIRCUITS	10Hrs

Characteristics of periodic functions, Average value, R.M.S. value, form factor, representation of a sine function, concept of phasor, phasor diagrams, node and mesh analysis. Steady state analysis of R, L and C circuits to sinusoidal excitations-response of pure resistance, inductance, capacitance, series RL circuit, series RC circuit, series RLC circuit, parallel RL circuit, parallel RC circuit.

Unit -IV	RESONANCE AND LOCUS DIAGRAMS	10Hrs

Series Resonance: Characteristics of a series resonant circuit, Q-factor, selectivity and bandwidth, expression for half power frequencies; Parallel resonance: Q-factor, selectivity and bandwidth; Locus diagram: RL, RC, RLC with R, L and C variables.

Unit -V	NETWORK THEOREMS (DC & AC XCITATIONS)	9Hrs

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

1. Remembering the basic electrical elements and different fundamental laws.
2. Understand the network reduction techniques, transformations, concept of self- inductance and mutual inductance, phasor diagrams, resonance and network theorems.
3. Apply the concepts to obtain various mathematical and graphical representations.
4. Analyse nodal and mesh networks, series and parallel circuits, steady state response, different circuit topologies (with R, L and C components).
5. Evaluation of Network theorems, electrical, magnetic and single-phase circuits.

Textbooks:

1. Engineering Circuits Analysis, Jack Kemmerly, William Hayt and Steven Durbin, Tata Mc Graw Hill Education, 2005, sixth edition.
2. Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition

Reference Books:

1. Fundamentals of Electrical Circuits, Charles K. Alexander and Mathew N.O. Sadiku, Mc Graw Hill Education (India), 2013, Fifth Edition
2. Electric Circuits (Schaum's outline Series), Mahmood Nahvi, Joseph Edminister, and
3. K. Rao, Mc Graw Hill Education, 2017, Fifth Edition.
4. Electric Circuits, David A. Bell, Oxford University Press, 2009, Seventh Edition.
5. Introductory Circuit Analysis, Robert L Boylestad, Pearson Publications, 2023, Fourteenth Edition.
6. Circuit Theory: Analysis and Synthesis, A. Chakrabarti, Dhanpat Rai & Co., 2018, Seventh Revised Edition.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ee81/preview
2. https://nptel.ac.in/courses/108104139
3. https://nptel.ac.in/courses/108106172
4. https://nptel.ac.in/courses/117106108

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B.Tech I Year II semester

BASIC ELECTRICAL & ELECTRONICS ENGINEERING
(Common to All branches of Engineering)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0201T	3:0:0	3	CIE:30 & SEE:70	3 Hours	PCC

Course Objectives:

The objectives of the course are to make the students learn about:

- To expose to the field of electrical & electronics engineering, laws and principles of electrical/electronic engineering and to acquire fundamental knowledge in the relevant field.

Syllabus	PART A: BASIC ELECTRICAL ENGINEERING	Total Hours: 48Hrs
Unit-I	**DC & AC Circuits**	**10Hrs**

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

Unit-II	Machines and Measuring Instruments	8Hrs

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

Unit -III	Energy Resources, Electricity Bill & Safety Measures	6Hrs

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

CO1: Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments.

CO2: Understand the problem solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.

CO3: Apply mathematical tools and fundamental concepts to derive various equations related to

machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.

CO4: Analyze different electrical circuits, performance of machines and measuring instruments.

CO5: Evaluate different circuit configurations, Machine performance and Power systems operation.

Textbooks:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

Web Resources:

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

The objectives of the course are to make the students learn about:

- This course provides the student with the fundamental skills to understand the principles of digital electronics, basics of semiconductor devices like diodes & transistors, characteristics and its applications.

Syllabus

Unit-I	**SEMICONDUCTOR DEVICES**	**6Hrs**

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier

Unit-II	**BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION**	**10Hrs**

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

Unit -III	**DIGITAL ELECTRONICS**	**8Hrs**

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adder, Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only).

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

CO1: Apply the concept of science and mathematics to understand the working of diodes,

transistors, and their applications.

CO2: Explain the characteristics of diodes and transistors.

CO3: Familiarize with the number systems, codes, Boolean algebra and logic gates.

C04: Understand the working mechanism of different combinational, sequential circuits and their role in the digital systems

Textbooks:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.

R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009

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B.Tech I Year II semester

ENGINEERING GRAPHICS

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0301T	1:0:4	3	CIE:30 & SEE:70	3 Hours	ESC

Course Objectives:

The objectives of the course are to make the students learn about:

- Understand the basic principles and conventions of engineering drawing, use engineering instruments and draw engineering curves.
- Use orthographic projections and make the students draw the projections of lines and planes inclined to both the planes.
- Draw the projections of the solids in different positions with respect to the reference planes.
- Understand the importance of sectioning and concept of development of surfaces.
- Represent and convert isometric views to orthographic views and vice versa.

Syllabus **Total Hours: 48Hrs**

Unit-I	Introduction:	9Hrs

Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.
Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.
Scales: Plain scales, diagonal scales and vernier scales.

Unit-II	Orthographic Projections	10Hrs

Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.
Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes
Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

Unit -III	Projections of Solids	10Hrs

Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Unit -IV	Sections of Solids & Development of Surfaces	10Hrs

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.
Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Unit -V	Conversion of Views & Computer graphics	9Hrs

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.
Computer graphics: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (Not for end examination).

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.
- Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
- Understand and apply concepts of sectional views to represent details of solids in simple positions.
- Gain a clear understanding of the principles behind development of surfaces and to understand how to unfold basic geometric shapes into flat patterns.
- Develop the ability to draw isometric views and orthographic views and should be able to convert isometric views to orthographic views and vice versa.

Textbooks:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

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B.Tech I Year II semester

ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP
(Common to All branches of Engineering)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0202P	**0:0:3**	**1.5**	**CIE:30 & SEE:70**	**3 Hours**	**PCC**

Course Objectives:

This course will enable students to:

1. To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations

PART A: ELECTRICAL ENGINEERING LAB

List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises.

Reference Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Note: Minimum Six Experiments to be performed

PART B: ELECTRONICS ENGINEERING LAB

Course Objectives:

To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

Course Outcomes(CO):

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

CO1: Identify & testing of various electronic components.
CO2: Understand the usage of electronic measuring instruments.
CO3: Plot and discuss the characteristics of various electron devices.
CO4: Explain the operation of a digital circuit.

Reference Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.

2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

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B.Tech I Year II semester

IT WORKSHOP (Common to All branches of Engineering)					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A0503P	**0:0:2**	**1**	**CIE:30 & SEE:70**	**3 Hours**	**PCC**

Course Objectives:

This course will enable students to:

1. To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
2. To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
3. To teach basic command line interface commands on Linux.
4. To teach the usage of Internet for productivity and self-paced life-long learning
5. To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

List of Experiments:

PC Hardware & Software Installation

1. Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

2. Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

3. Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

4. Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

5. Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

1. **Task1:** Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.
2. **Task 2:** Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

3. **Task 3:** Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

4. **Task 4**: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

5. **Task 5:** Install any anti-virus software on your computer

LaTeX and WORD

1. **Task 1** – Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.
2. **Task 2**: Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.
3. **Task 3:** Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.
4. **Task 4**: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using **Excel** – Accessing, overview of toolbars, saving excel files, Using help and resources.

1. **Task 1**: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text
2. **Task 2:** Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function.

LOOKUP/VLOOKUP

1. **Task 3**: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWER POINT

1. **Task 1**: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.
2. **Task 2:** Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.
3. **Task 3**: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI TOOLS – ChatGPT

1. **Task 1**: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.
   • Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"
2. **Task 2**: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas
   • Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."
3. **Task 3**: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.
   • Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Course Outcomes (CO):

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

CO1: Perform Hardware troubleshooting.

CO2: Understand Hardware components and inter dependencies.

CO3: Safeguard computer systems from viruses/worms.

CO4: Document/ Presentation preparation.

CO5: Perform calculations using spreadsheets

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition

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B.Tech I Year II semester

ENGINEERING PHYSICS LAB
(Common to All Branches of Engineering)

Course Code	L : T : P	Credits	Exam Marks	Exam Duration	Course Type
23A0006P	0 : 0 : 2	1	CIE: 30 EE:70	3 Hours	BS

Prerequisite: Student should know about fundamental and basic principles in physics

Course Objectives:
To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

Course Outcomes:
On completion of this course, the students are able to:-
1. Operate optical instruments like travelling microscope and spectrometer.
2. Estimate dielectric constant of capacitor and magnetic induction of current carrying coil
3. Identify the type of semiconductor and calculate band gap of it.
4. Evaluate different modulus of materials.
5. Measure the frequency of tuning fork and verify the laws in Sonometer.

SYLLABUS **Total Hours : 32**

List of Experiments

1. Determination of radius of curvature of a given plano convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of wavelength of Laser light using diffraction grating.
5. Estimation of Planck's constant using photoelectric effect.
6. Magnetic field along the axis of a current carrying circular coil by Stewart Gee'sMethod.
7. Determination of dielectric constant using charging and discharging method.
8. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
9. Determination of magnetic susceptibility by Kundt's tube method.
10. Determination of the resistivity of semiconductors by four probe methods.
11. Determination of energy gap of a semiconductor using p-n junction diode.
12. Determination of Hall voltage and Hall coefficient of a given semiconductor usingHall effect.
13. Determination of temperature coefficients of a thermistor.
14. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
15. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
16. Determination of Frequency of electrically maintained tuning fork by Melde'sexperiment.
17. Sonometer : Verification of laws of stretched string.
18. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.

Note: Any **TEN** of the listed experiments are to be conducted. Out of which any **TWO** experiments may be conducted in virtual mode.

References:

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

URL:*www.vlab.co.in*

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B.Tech I Year II semester

ELECTRICAL CIRCUITS LAB
(EEE & allied branches)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0204P	0:0:3	1.5	CIE:30 & SEE:70	3 Hours	PCC

Course Objectives:

1. To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics. It also gives practical exposure to the usage of different circuits with different conditions

List of Experiments:

1. Verification of Kirchhoff's circuit laws.
2. Verification of node and mesh analysis.
3. Verification of network reduction techniques.
4. Determination of cold and hot resistance of an electric lamp
5. Determination of Parameters of a choke coil.
6. Determination of self, mutual inductances, and coefficient of coupling
7. Series and parallel resonance
8. Locus diagrams of R-L (L Variable) and R-C (C Variable) series circuits
9. Verification of Superposition theorem
10. Verification of Thevenin's and Norton's Theorems
11. Verification of Maximum power transfer theorem
12. Verification of Compensation theorem
13. Verification of Reciprocity and Millman's Theorems

Course Outcomes (CO):

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

CO1: Understand the concepts of network theorems, node and mesh networks, series and parallel resonance and Locus diagrams.

CO2: Apply various theorems to compare practical results obtained with theoretical calculations.

CO3: Determine self, mutual inductances and coefficient of coupling values, parameters of choke coil.

CO4: Analyse different circuit characteristics with the help of fundamental laws and various configurations.

CO5: Create locus diagrams of RL, RC series circuits and examine series and parallel resonance.

Reference Book(s):

1. Engineering Circuits Analysis, Jack Kemmerly, William Hayt and Steven Durbin, Tata Mc Graw Hill Education, 2005, sixth edition.
2. Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition.

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B.Tech I Year II semester

NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE
(Common to CSE & EEE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23ANS01P	0:0:1:0	0.5	100	3 Hours	BSC

Course Objectives:

- The objective of introducing this course is to impart discipline, character, fraternity, teamwork,social consciousness among the students and engaging them in selfless service

Syllabus **Total Hours: 18**

UNIT I Orientation
General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:
i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II Nature & Care Activities:
i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues.

UNIT III Community Service Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities- experts-etc.

ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc.
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
v) Any other programmes in collaboration with local charities, NGOs etc.

Course Outcomes:

After completion of the course the student will be able to

CO1: Understand the importance of discipline, character and service motto.
CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO3: Explore human relationships by analyzing social problems.
CO4: Determine to extend their help for the fellow beings and downtrodden people.
CO5: Develop leadership skills and civic responsibilities.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Reference Book(s):

1. Nirmalya Kumar Sinha & Surajit Majumder, A Text Book of National Service Scheme
   Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. Red Book - National Cadet Corps – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering", McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. Social Problems in India, Rawat Publications, New Delhi.

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B.Tech II Year I semester

Department of Electrical and Electronics Engineering

Course Structure (RG23)

B.Tech II Year I semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	BS	23A0012T	Numerical Methods And Complex Variables	3	0	0	3
2	HSMC	23A0021T	Universal Human Values	2	1	0	3
3	Engineering Science	23A0207T	Electromagnetic Field Theory	3	0	0	3
4	Professional Core	23A0208T	Electrical Circuit Analysis-II	3	0	0	3
5	Professional Core	23A0209T	DC Machines & Transformers	3	0	0	3
6	Professional Core	23A0210P	Electrical Circuit Analysis-II and Simulation Lab	0	0	3	1.5
7	Professional Core	23A0211P	DC Machines & Transformers Lab	0	0	3	1.5
8	Skill Enhancement Course	23A0517P	Data Structures	0	1	2	2
9	Audit Course	23A0109T	Environmental Science	2	0	0	-
			Total credits	**16**	**2**	**8**	**20**

Member Secretary **BOS Chairman**

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B.Tech II Year I semester

NUMERICAL METHODS AND COMPLEX VARIABLES					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0012T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**BS**

Course Outcomes:

Student will be able to

CO1: Apply numerical methods to solve algebraic and transcendental equations, form the Interpolating polynomials and fitting of curve. L2, L3

CO2: Solve the differential equations numerically L3, L5

CO3: Understand limit, continuity and differentiation of complex variables Cauchy Riemann equations ,analytic functions & properties.L3

CO4: Understand Cauchy theorem ,Cauchy integral formula and apply these to evaluate complex integrals.L2, L3

CO5: Find residues and evaluate complex integrals by using residue theorem.L3, L5

UNIT I	**Solution of Algebraic & Transcendental Equations and Interpolation**	**10hrs**

Introduction-Bisection Method, Regula-falsi method and Newton Raphson method.
Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae.Curve fitting: Fitting of straight line, second-degree and Exponential curve by method of least squares.

UNIT II	**Solution of Initial value problems to Ordinary differential equations**	**10hrs**

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's and modified Euler's methods-Runge-Kutta methods (second and fourthorder).

UNIT III	**Complex Variable – Differentiation**	9hrs

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy- Riemann equations, analytic functions harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method.

UNIT IV	**Complex Variable – Integration**	9hrs

Line integral-Contour integration, Cauchy's integral theorem (Simple Case), Cauchy Integral formula, Power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series.

UNIT V	**Residues**	10hrs

Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine

Textbooks:

1. B.S.Grewal, Higher Engineering Mathematics, KhannaPublishers,2017, 44th Edition
2. S S Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited.

ReferenceBooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, JohnWiley & Sons, 2018, 10th Edition.
2. B.V.Ramana, Higher Engineering Mathematics, by Mc Graw Hill publishers
3. R.K.Jainand S.R.K.Iyengar, Advanced Engineering Mathematics, Alpha

ScienceInternationalLtd.,2021 5th Edition(9th reprint).

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview
2. https://onlinecourses.nptel.ac.in/noc20_ma50/preview
3. http://nptel.ac.in/courses/111105090

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B.Tech II Year I semester

UNIVERSAL HUMAN VALUES					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0021T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**HSMC**

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
- Identify one's self, and one's surroundings (family, society nature) (L1, L2)
- Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
- Relate human values with human relationship and human society. (L4)
- Justify the need for universal human values and harmonious existence (L5)
- Develop as socially and ecologically responsible engineers (L3, L6)

UNIT I	**INTRODUCTION TO VALUE EDUCATION**	10hrs

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Practice Session PS1 Sharing about Oneself self-exploration as the Process for Value Education Continuous Happiness and Prosperity – the Basic Human Aspirations Exploring Human Consciousness Happiness and Prosperity – Current Scenario Method to Fulfill the Basic Human Aspirations Exploring Natural Acceptance Practice Sessions for UNIT I – Introduction to Value Education PS1 Sharing about Oneself PS2 Exploring Human Consciousness PS3 Exploring Natural Acceptance.

UNIT II	**HARMONY IN THE HUMAN BEING**	10hrs

Understanding Human being as the Co-existence of the self and the body.Distinguishing between the Needs of the self and the body Exploring the difference of Needs of self and body. The body as an Instrument of the self Understanding Harmony in the self Exploring Sources of Imagination in the self
Harmony of the self with the body Programme to ensure self-regulation and Health Exploring Harmony of self with the body Practice Sessions for UNIT II – Harmony in the Human Being PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self PS6 Exploring Harmony of self with the body

UNIT III	**HARMONY IN THE FAMILY AND SOCIETY**	10hrs

Harmony in the Family – the Basic Unit of Human Interaction Trust– the Foundational Value in Relationship Exploring the Feeling of Trust Respect – as the Right Evaluation Exploring the Feeling of Respect Other Feelings, Justice in Human-to-Human Relationship Understanding Harmony in the Society

Vision for the Universal Human Order Exploring Systems to fulfil Human Goal Practice Sessions for UNIT III – Harmony in the Family and Society PS7 Exploring the Feeling of Trust PS8 Exploring the Feeling of Respect PS9 Exploring Systems to fulfil Human Goal

UNIT IV	**HARMONY IN THE NATURE/EXISTENCE**	9hrs

Understanding Harmony in the Nature Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature Exploring the Four Orders of Nature Realizing Existence as Co-existence at All Levels The Holistic Perception of Harmony in Existence Exploring Co-existence in Existence. Practice Sessions for UNIT IV – Harmony in the Nature (Existence) PS10 Exploring the Four Orders of Nature PS11 Exploring Co-existence in Existence

UNIT V	**IMPLICATIONS OF THE HOLISTIC UNDERSTANDING – A LOOK AT PROFESSIONAL ETHICS**	9hrs

Natural Acceptance of Human Values Definitiveness of (Ethical) Human Conduct Exploring Ethical Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order Competence in Professional Ethics

Exploring Humanistic Models in Education Holistic Technologies, Production Systems and Management Models-Typical Case Studies Strategies for Transition towards Value-based Life and Profession Exploring Steps of Transition towards Universal Human Order Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics PS12 Exploring Ethical Human Conduct PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

Textbook

1. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria,Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Online Resources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%20

1- Introduction%20to%20Value%20Education.pdf

2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202- Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203- Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205- Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3- S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023- 25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

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B.Tech II Year I semester

ELECTROMAGNETIC FIELD THEORY					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0207T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**ESC**

Course Outcomes:

CO1: Remember the concepts of vector algebra, vector calculus, various fundamental laws, self and mutual inductance **L1**

CO2: Understand the concepts of electrostatics, conductors, dielectrics, capacitance, magneto statics, magnetic fields, time varying fields, self and mutual inductances **L2**

CO3: Apply vector calculus, Coulomb's law, Gauss's law, Ohm's law in point form, Biot- Savart's law, Ampere's circuital law, Maxwell's third equation, self and mutual inductances, Faraday's laws, Maxwell's fourth equation, Poynting theorem to solve various numerical problems **L3**

CO4: Analyze vector calculus, electrostatic fields, behavior of conductor in electric filed, Biot-Savart's law and its applications **L4**

CO5: Analyze magnetic force, moving charges in a magnetic field, self-inductance of different cables, mutual inductance between different wires and time varying fields **L4**

UNIT I — 10hrs

Vector Analysis:

Vector Algebra: Scalars and Vectors, Unit vector, Vector addition and subtraction, Position and distance vectors, Vector multiplication, Components of a vector.

Coordinate Systems: Rectangular, Cylindrical and Spherical coordinate systems.

Vector Calculus: Differential length, Area and Volume.Del operator, Gradient of a scalar, Divergence of a vector and Divergence theorem (definition only). Curl of a vector and Stoke's theorem (definition only), Laplacian of a scalar

Electrostatics:

Coulomb's law and Electric field intensity (EFI) – EFI due to Continuous charge distributions (line and surface charge), Electric flux density, Gauss's law (Maxwell's first equation, $\nabla . \vec{D} = \rho$), Applications of Gauss's law, Electric Potential, Work done in moving a point charge in an electrostatic field (second Maxwell's equation for static electric fields, $\nabla \times \vec{E} = 0$), Potential gradient, Laplace's and Poison's equations.

UNIT II — 10hrs

Conductors – Dielectrics and Capacitance:

Behaviour of conductor in Electric field, Electric dipole and dipole moment – Potential and EFI due to an electric dipole, Torque on an Electric dipole placed in an electric field, Current density-conduction and convection current densities, Ohm's law in point form, Behaviour of conductors in an electric field, Polarization, dielectric constant and strength, Continuity equation and relaxation time, Boundary conditions between conductor to dielectric, dielectric to dielectric and conductor to free space, Capacitance of parallel plate, coaxial and spherical capacitors, Energy stored and density in a static electric field, Coupled and decoupled capacitors.

UNIT III — 10hrs

Magneto statics, Ampere's Law and Force in magnetic fields:

Biot-Savart's law and its applications viz. Straight current carrying filament, circular, square, rectangle and solenoid current carrying wire – Magnetic flux density and Maxwell's second Equation ($\nabla . \vec{B} = 0$), Ampere's circuital law and its applications viz. MFI due to an infinite sheet, long filament, solenoid, toroidal current carrying conductor, point form of Ampere's circuital law, Maxwell's third equation ($\nabla \times \vec{H} = \vec{J}$).

Magnetic force, moving charges in a magnetic field – Lorentz force equation, force on a current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors, Magnetic dipole, Magnetic torque, and moment.

UNIT IV		**9hrs**

Self and mutual inductance:

Self and mutual inductance – determination of self-inductance of a solenoid, toroid, coaxial cable and mutual inductance between a straight long wire and a square loop wire in the same plane – Energy stored and energy density in a magnetic field.

UNIT V		**9hrs**

Time Varying Fields:

Faraday's laws of electromagnetic induction, Maxwell's fourth equation($\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$), integral and point forms of Maxwell's equations, statically and dynamically induced EMF, Displacement current, Modification of Maxwell's equations for time varying fields, Poynting theorem and Poynting vector.

Textbooks:

1. "Elements of Electromagnetics" by Matthew N O Sadiku, Oxford Publications, 7th edition, 2018.
2. "Engineering Electromagnetics" by William H. Hayt& John. A. Buck Mc. Graw-Hill, 7th Editon.2006.

Reference Books:

1. "Introduction to Electro Dynamics" by D J Griffiths, Prentice-Hall of India Pvt. Ltd, 2nd edition.
2. "Electromagnetic Field Theory" by Yaduvir Singh, Pearson India, 1st edition, 2011.
3. "Fundamentals of Engineering Electromagnetics" by Sunil Bhooshan, Oxford University Press, 2012.
4. Schaum's Outline of Electromagneticsby Joseph A. Edminister, MahamoodNavi, 4th Edition,2014.

Web Resources:

1. https://archive.nptel.ac.in/courses/108/106/108106073/
2. https://nptel.ac.in/courses/117103065

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B.Tech II Year I semester

ELECTRICAL CIRCUIT ANALYSIS-II					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0208T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Outcomes:

CO1: Remember the concepts of Laplace transforms, formulation of various circuit topologies (R, L and C components) and basic filters **L1**
CO2: Understand three phase balanced and unbalanced circuits, different circuit configurations and it's mathematical modeling, network parameters and various filters**L2**
CO3: Apply Laplace transforms to solve various electrical network topologies and filter design concepts**L3**
CO4: Analyze three phase circuits, transient response of various network topologies,electric circuits with periodic excitations and filter characteristics**L4**
CO5: Design suitable electrical circuits and various filters for different applications**L5**

UNIT I	**9hrs**

Analysis of three phase balanced circuits:
Phase sequence, star and delta connection of sources and loads, relation between line andphase quantities, analysis of balanced three phase circuits, measurement of active and reactive power.

Analysis of three phase unbalanced circuits:
Loop method, Star-Delta transformation technique, two-wattmeter method for measurement of three phase power.

UNIT II	**9hrs**

Laplace transforms – Definition and Laplace transforms of standard functions– Shifting theorem – Transforms of derivatives and integrals,Inverse Laplace transforms and applications.
Transient Analysis: Transient response of R-L, R-C and R-L-C circuits (Series and parallel combinations) for D.C. and sinusoidal excitations – Initial conditions - Solution using differential equation approach and Laplace transform approach.

UNIT III	**10hrs**

Network Parameters: Impedance parameters, Admittance parameters, Hybrid parameters, Transmission (ABCD) parameters, conversion of Parameters from one form to other, Conditions for Reciprocity and Symmetry, Interconnection of Two Port networks in Series, Parallel and Cascaded configurations- problems.

UNIT IV	**10hrs**

Analysis of Electric Circuits with Periodic Excitation: Fourier series and evaluation of Fourier coefficients, Trigonometric and complex Fourier series for periodic waveforms, Application to Electrical Systems – Effective value and average value of non-sinusoidal periodic waveforms, power factor, effect of harmonics

UNIT V	**10hrs**

Filters: Classification of filters-Low pass, High pass, Band pass and Band Elimination filters, Constant-k filters -Low pass and High Pass, Design of Filters.

Textbooks:

1. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, 8th Edition

McGraw-Hill, 2013
2. Fundamentals of Electric Circuits, Charles K. Alexander, Mathew N. O. Sadiku, 3rd Edition, Tata McGraw-Hill, 2019

Reference Books:

1. Network Analysis, M. E. Van Valkenburg, 3rd Edition, PHI, 2019.
2. Network Theory, N. C. Jagan and C. Lakshminarayana, 1st Edition, B. S. Publications, 2012.
3. Circuits and Networks Analysis and Synthesis, A. Sudhakar, Shyam Mohan S. Palli, 5th Edition, Tata McGraw-Hill, 2017.
4. Engineering Network Analysis and Filter Design (Including Synthesis of One Port Networks)- Durgesh C. KulshreshthaGopal G. Bhise, Prem R. Chadha ,Umesh Publications 2012.
5. Circuit Theory: Analysis and Synthesis, A. Chakrabarti, DhanpatRai& Co., 2018, 7th Revised Edition.

Web Resources:

1. https://archive.nptel.ac.in/courses/117/106/117106108/
2. https://archive.nptel.ac.in/courses/108/105/108105159/

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B.Tech II Year I semester

DC MACHINES & TRANSFORMERS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0209T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Outcomes:

CO1 Understand the process of voltage build-up in DC generators and characteristics. **L2**
CO2 Understand the process of torque production, starting and speed control of DC motors and illustrate their characteristics.**L2**
CO3 Obtain the equivalent circuit of single-phase transformer, auto transformer and determine its efficiency & regulation. **L3**
CO4 Apply various testing methods for transformers and speed control of DC motors **L3**
CO5 Analyze various configurations of three-phase transformers. **L4**

UNIT I		**10hrs**

DC Generators:

Construction and principle of operation of DC machines – EMF equation for generator – Excitation techniques– characteristics of DC generators –applications of DC Generators, Back-emf and torque equations of DC motor – Armature reaction and commutation, Applications.

UNIT II		**10hrs**

Starting, Speed Control and Testing of DC Machines:

Characteristics of DC motors – losses and efficiency – applications of DC motors. Necessity of a starter – starting by 3-point and 4-point starters – speed control by armature voltage and field current control – testing of DC machines – brake test, Swinburne's test –Hopkinson's test–Field Test.

UNIT III		**9hrs**

Single-phase Transformers:

Introduction to single-phase Transformers (Construction and principle of operation)–emf equation – operation on no-load and on load –lagging, leading and unity power factors loads –phasor diagrams– equivalent circuit –regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – all day efficiency, Applications.

UNIT IV		**10hrs**

Testing of Transformers:

Open Circuit and Short Circuit tests – Sumpner's test – separation of losses— Parallel operation with equal and unequal voltage ratios– auto transformer – equivalent circuit – comparison with two winding transformers.

UNIT V		**9hrs**

Three-Phase Transformers:

Polyphase connections- Y/Y, Y/Δ, Δ/Y, Δ/Δ, open Δ and Vector groups – third harmonics in phase voltages– Parallel operation–three winding transformers- transients in switching –off load and on load tap changers–Scott connection.

Textbooks:

1. Electrical Machinery by Dr. P S Bimbhra, 7th edition, Khanna Publishers, New Delhi,1995.Performance and analysis of AC machines by M.G. Say, CBS, 2002

Reference Books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 5th edition
2. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2011.
3. Generalized Theory of Electrical Machines by Dr. P S Bimbhra, 7th Edition, Khanna Publishers, 2021.
4. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria& Sons,2007.
5. Electric Machinery by Fitzgerald, A.E.,Kingsley, Jr.,C.,&Umans, S. D, 7th edition, McGraw-Hill Education, 2014.

Web Resources:

1. nptel.ac.in/courses/108/105/108105112
2. nptel.ac.in/courses/108/105/108105155

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B.Tech II Year I semester

ELECTRICAL CIRCUIT ANALYSIS-II AND SIMULATION LAB					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0210P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Outcomes:

CO1 Understand the power calculations in three phase circuits.
CO2 Analyze the time response of given network.
CO3 Determination of two port network parameters.
CO4 Simulate and analyze electrical circuits using software tools
CO5 Apply various theorems to solve different electrical networks using simulation tools

List of Experiments:

Any 10 of the following experiments are to be conducted:

1. Measurement of Active Power and Reactive Power for balanced loads.
2. Measurement of Active Power and Reactive Power for unbalanced loads.
3. Determination of Z and Y parameters.
4. Determination of ABCD and hybrid parameters
5. Verification of Kirchhoff's current law and voltage law using simulation tools.
6. Verification of mesh and nodal analysis using simulation tools.
7. Verification of super position and maximum power transfer theorems using simulation tools.
8. Verification of Reciprocity and Compensation theorems using simulation tools.
9. Verification of Thevenin's and Norton's theorems using simulation tools.
10. Verification of series and parallel resonance using simulation tools.
11. Simulation and analysis of transient response of RL, RC and RLC circuits.
12. Verification of self-inductance and mutual inductance by using simulation tools.

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B.Tech II Year I semester

DC MACHINES & TRANSFORMERS LAB					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0211P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Outcomes:

CO1 Demonstrate starting and speed control methods of DC Machines.
CO2 Apply theoretical concepts to determine the performance characteristics of DC Machines.
CO3 Analyze the parallel operation of single phase transformers
CO4 Determine the performance parameters of single-phase transformer.
CO5 Analyze the performance analysis of transformers using various tests

List of Experiments:

Any 10 of the following experiments are to be conducted:

1. Speed control of DC shunt motor by Field Current and Armature Voltage Control.
2. Brake test on DC shunt motor- Determination of performance curves.
3. Swinburne's test - Predetermination of efficiencies as DC Generator and Motor.
4. Hopkinson's teston DC shunt Machines.
5. Load test on DC compound generator-Determination of characteristics.
6. Load test on DC shunt generator-Determination of characteristics.
7. Fields test on DC series machines-Determination of efficiency.
8. Brake test on DC compound motor-Determination of performance curves.
9. OC & SC tests on single phase transformer.
10. Sumpner's test on single phase transformer.
11. Scott connection of transformers.
12. Parallel operation of Single-phase Transformers.
13. Separation of core losses of a single-phase transformer.

Reference:

1. https://ems-iitr.vlabs.ac.in/List%20of%20experiments.html

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B.Tech II Year I semester

DATA STRUCTURES
(Skill Enhancement Course)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0517P	0: 1:2:0	2	CIE: 30 SEE:70	3 Hours	SEC

Course Outcomes:

CO1 Understand the role of data structures in organizing and accessing data **L2**
CO2 Design, implement and apply linked lists for dynamic data storage **L3**
CO3 Develop applications using stacks and queues **L5**
CO4 Design and implement algorithms for operations on binary trees and binary search trees **L5**
CO5 Design novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees **L5**

UNIT I — 8hrs

Introduction to Data Structures: Definition and importance of Data structures, Abstract data types (ADTs) and its specifications,**Arrays**: Introduction, 1-D, 2-D Arrays, accessing elements of array, Row Major and Column Major storage of Arrays, **Searching Techniques**: Linear & Binary Search, **Sorting Techniques**: Bubble sort, Selection sort, Quick sort.

Sample experiments:

1. Program to find min & max element in an array.
2. Program to implement matrix multiplication.
3. Find an element in given list of sorted elements in an array using Binary search.
4. Implement Selection and Quick sort techniques.

UNIT II — 6hrs

Linked Lists: Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

Sample experiments:

1. Write a program to implement the following operations.

a. Insert b. Deletion c. Traversal

2. Write a program to store name, roll no, and marks of students in a class using circular double linked list.
3. Write a program to perform addition of given two polynomial expressions using linked list.

UNIT III — 6hrs

Stacks: Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.

Sample experiments:

1. Implement stack operations using

a. Arrays b. Linked list

2. Convert given infix expression into post fix expression using stacks.
3. Evaluate given post fix expression using stack.
4. Write a program to reverse given linked list using stack.

UNIT IV — 6hrs

Queues: Introduction to queues: properties and operations, Circular queues, implementing queues using arrays and linked lists,Applications of queues scheduling, etc.

Deques: Introduction to deques (double-ended queues), Operations on deques and their applications.

Sample experiments:

1. Implement Queue operations using
a. Arrays b. Linked list
2. Implement Circular Queue using
a. Arrays b. Linked list
3. Implement Dequeue using linked list.

UNIT V		**6hrs**

Trees: Introduction to Trees, Binary trees and traversals, Binary Search Tree – Insertion, Deletion & Traversal

Sample experiments:

1. Implement binary tree traversals using linked list.
2. Write program to create binary search tree for given list of integers. Perform in-order traversal of the tree. Implement insertion and deletion operations.

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, SartajSahni, Susan Anderson-Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick

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B.Tech II Year I semester

ENVIRONMENTAL SCIENCE					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0109T	**2: 0:0:0**	**0**	**CIE: 30 SEE:70**	**3 Hours**	**ACC**

Course Objectives:

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

UNIT I

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem.
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III

Environmental Pollution: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management:floods, earthquake, cyclone and landslides.

UNIT IV		

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V		

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Textbooks:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, "Environmental Studies", Pearson education
3. S.Azeem Unnisa, "Environmental Studies" Academic Publishing Company
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt. Ltd.

References:

1. Deeksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications.
2. M.Anji Reddy, "Text book of Environmental Sciences and Technology", BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, "Environmental Sciences and Engineering", Prentice hall of India Private limited
5. G.R.Chatwal, "A Text Book of Environmental Studies" Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

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B.Tech II Year II semester

Department of Electrical and Electronics Engineering

Course Structure (RG23)

B.Tech II Year II semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1.	Management Elective- I	23A0022T 23A0024T 23A0023T	Managerial Economics and Financial Analysis Organizational Behavior Business Environment	2	0	0	2
2.	Engineering Science/Basic Science	23A0412T	Analog Circuits	3	0	0	3
3.	Professional Core	23A0212T	Power Systems-I	3	0	0	3
4.	Professional Core	23A0213T	Induction and Synchronous Machines	3	0	0	3
5.	Professional Core	23A0214T	Control Systems	3	0	0	3
6.	Professional Core	23A0215P	Induction and Synchronous Machines Lab	0	0	3	1.5
7.	Professional Core	23A0216P	Control Systems Lab	0	0	3	1.5
8.	Skill Enhancement course	23A0510P	Python Programming	0	1	2	2
9.	Engineering Science	23A0413T	Design Thinking & Innovation	1	0	2	2
			Total credits	**15**	**1**	**10**	**21**

Mandatory Community Service Project of 08 weeks duration during summer vacation

Member Secretary **BOS Chairman**

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B.Tech II Year II semester

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0022T	**2: 0:0:0**	**2**	**CIE: 30 SEE:70**	**3 Hours**	**MEC**

Course Objectives:

- To inculcate the basic knowledge of microeconomics and financial accounting
- To make the students learn how demand is estimated for different products, input- output relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

Course Outcomes:

- Define the concepts related to Managerial Economics, financial accounting and management(L2)
- Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2)
- Apply the Concept of Production cost and revenues for effective Business decision (L3)
- Analyze how to invest their capital and maximize returns (L4)
- Evaluate the capital budgeting techniques. (L5)
- Develop the accounting statements and evaluate the financial performance of business entity (L5)

UNIT - I	**Managerial Economics**	8hrs

Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

UNIT - II	**Production and Cost Analysis**	6hrs

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least- cost combination– Short run and long run Production Function- Isoquants and Is costs, Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

UNIT - III	**Business Organizations and Markets**	6hrs

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition– Oligopoly-Price-Output Determination - Pricing Methods and Strategies

UNIT - IV	**Capital Budgeting**	6hrs

Introduction – Nature, meaning, significance. Types of Working Capital, Components,

Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

UNIT - V	**Financial Accounting and Analysis**	6hrs

Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

Reference Books:

1. Ahuja Hl Managerial economics Schand.
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

Online Learning Resources:

https://www.slideshare.net/123ps/managerial-economics-ppt
https://www.slideshare.net/rossanz/production-and-cost-45827016
https://www.slideshare.net/darkyla/business-organizations-19917607
https://www.slideshare.net/balarajbl/market-and-classification-of-market https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396 https://www.slideshare.net/ashu1983/financial-accounting

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B.Tech II Year II semester

ORGANISATIONAL BEHAVIOUR					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0024T	**2: 0:0:0**	**2**	**CIE: 30 SEE:70**	**3 Hours**	**MEC**

Course Objectives:

- To enable student's comprehension of organizational behavior
- To offer knowledge to students on self-motivation, leadership and management
- To facilitate them to become powerful leaders
- To Impart knowledge about group dynamics
- To make them understand the importance of change and development

Course Outcomes:

- Define the Organizational Behaviour, its nature and scope. (L2)
- Understand the nature and concept of Organizational behaviour (L2)
- Apply theories of motivation to analyse the performance problems (L3)
- Analyse the different theories of leadership (L4)
- Evaluate group dynamics (L5)
- Develop as powerful leader (L5)

UNIT - I	**Introduction to Organizational Behavior**	6hrs

Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective -Understanding Individual Behaviour –Attitude -Perception - Learning – Personality.

UNIT - II	**Motivation and Leading**	6hrs

Theories of Motivation- Maslow's Hierarchy of Needs - Hertzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Cleland's theory of needs–Mc Gregor's theory X and theory Y– Adam's equity theory.

UNIT - III	**Organizational Culture**	6hrs

Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management -Evaluating Leader.

UNIT - IV	**Group Dynamics**	8hrs

Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of group behaviour - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization– Conflict resolution

UNIT - V	**Organizational Change and Development**	6hrs

Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

Textbooks:

1. Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12 Th edition.
2. P Subba Ran, Organisational Behaviour, Himalya Publishing House.

Reference Books:

1. McShane, Organizational Behaviour, TMH
2. Nelson, Organisational Behaviour, Thomson.
3. Robbins, P. Stephen, Timothy A. Judge, Organisational Behaviour, Pearson.
4. Aswathappa, Organisational Behaviour, Himalaya.

O**nline Learning Resources:**

https://www.slideshare.net/Knight1040/organizational-culture
9608857s://www.slideshare.net/AbhayRajpoot3/motivation-165556714 https://www.slideshare.net/harshrastogi1/group-dynamics-159412405
https://www.slideshare.net/vanyasingla1/organizational-change-development-26565951

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B.Tech II Year II semester

BUSINESS ENVIRONMENT					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0023T	**2: 0:0:0**	**2**	**CIE: 30 SEE:70**	**3 Hours**	**MEC**

Course Objectives:

- To make the student to understand about the business environment
- To enable them in knowing the importance of fiscal and monitory policy
- To facilitate them in understanding the export policy of the country
- To Impart knowledge about the functioning and role of WTO
- To Encourage the student in knowing the structure of stock markets

Course Outcomes:

- Define Business Environment and its Importance. (L2)
- Understand various types of business environment. (L2)
- Apply the knowledge of Money markets in future investment (L3)
- Analyse India's Trade Policy (L4)
- Evaluate fiscal and monitory policy (L5)
- Develop a personal synthesis and approach for identifying business opportunities (L5)

UNIT - I	**Overview of Business Environment**	6hrs

Introduction – meaning Nature, Scope, significance, functions and advantages. Types- Internal &External, Micro and Macro. Competitive structure of industries -Environmental analysis-advantages & limitations of environmental analysis.

UNIT - II	**Fiscal Policy & Monetary Policy**	8hrs

Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Evaluation of recent fiscal policy of GOI. Highlights of Budget- Monetary Policy - Demand and Supply of Money –RBI -Objectives of monetary and credit policy - Recent trends-Role of Finance Commission.

UNIT - III	**India's Trade Policy**	6hrs

Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank -Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

UNIT - IV	**World Trade Organization**	6hrs

Introduction – Nature, significance, functions and advantages. Organization and Structure - Role and functions of WTO in promoting world trade - GATT -Agreements in the Uruguay Round – TRIPS, TRIMS - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.

UNIT - V	**Money Markets and Capital Markets**	6hrs

Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI – Stock Exchanges
- Investor protection and role of SEBI, Introduction to international finance.

Textbooks:

1. Francis Cherunilam, International Business: Text and Cases, Prentice Hall of India.
2. K. Aswathappa, Essentials of Business Environment: Texts and Cases & Exercises 13th Revised Edition.HPH

Reference Books:

1. K. V. Sivayya, V. B. M Das, Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black, International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari. S. N, International Business, Wiley India.
4. E. Bhattacharya, International Business, Excel Publications, New Delhi.

Online Learning Resources:

https://www.slideshare.net/ShompaDhali/business-environment-53111245
https://www.slideshare.net/rbalsells/fiscal-policy-ppt
https://www.slideshare.net/aguness/monetary-policy-presentationppt
https://www.slideshare.net/DaudRizwan/monetary-policy-of-india-69561982
https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt
https://www.slideshare.net/viking2690/wto-ppt-60260883
https://www.slideshare.net/prateeknepal3/ppt-mo

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B.Tech II Year II semester

ANALOG CIRCUITS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0412T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**ESC**

Course Outcomes:

CO1: Understand the concepts of diode clipping and clamping circuits, different amplifier configurations, operation of oscillator circuits, operational amplifiers, timers, ADC and DAC **L2**

CO2: Apply the above concepts for different circuit design **L3**

CO3: Analyze various circuit characteristics by using Amplifiers, Transistors, Comparators, Wave form generators, ADC and DAC **L4**

CO4: Analyze various circuit characteristics by using timers, Phase locked loops and operational amplifiers **L4**

CO5: Evaluate different system configurations by using various amplifier, transistor and waveform generators **L5**

UNIT I — 10hrs

Diode clipping and clamping circuits: Diode clippers, clipping at two independent levels, Transfer characteristics of clippers, clamping circuit operation.

DC biasing of BJTs: Load lines, Operating Point, Bias Stability, Collector-to-Base Bias, Self-Bias, Stabilization against Variations in V_{BE} and β for the Self-Bias Circuit, Bias Compensation, Thermal Runaway, Thermal Stability.

UNIT II — 10hrs

Small Signals Modeling of BJT: Analysis of a Transistor Amplifier Circuit using h- parameters, Simplified CE Hybrid Model, Analysis of CE, CC, CB Configuration using Approximate Model, Frequency Response of CE and CC amplifiers.

Feedback Amplifiers: Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output and Input Resistances, Voltage-Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback.

UNIT III — 9hrs

Oscillator Circuits: Barkhausen Criterion of oscillation, Oscillator operation, R-C phase shift oscillator, Wien bridge Oscillator, Crystal Oscillator.

Operational Amplifiers: Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Block Diagram Representation of Typical Op-Amp, OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op-amp & its features.

UNIT IV — 9hrs

OP-AMPS Applications: Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator.

Comparators and Waveform Generators: Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators.

UNIT V — 10hrs

Timers and Phase Locked Loop: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger, PLL block schematic, principles and

description of individual blocks, 565 PLL, Applications of VCO (566).

Digital To Analog And Analog To Digital Converters: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

Textbooks:

1. Electronic Devices and Circuits- J. Millman, C.Halkias, Tata Mc-Graw Hill, 2nd Edition, 2010.
2. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition, 2003.

Reference Books:

1. Electronic Devices and Circuit Theory – Robert L.Boylestad and Lowis Nashelsky, Pearson Edition, 2021.
2. Electronic Devices and Circuits–G.K. Mithal, Khanna Publisher, 23rd Edition, 2017.
3. Electronic Devices and Circuits – David Bell, Oxford, 5thEdition, 2008.
4. Electronic Principles–Malvino, Albert Paul, and David J. Bates, McGraw-Hill/Higher Education, 2007.
5. Operational Amplifiers and Linear Integrated Circuits– Gayakwad R.A, Prentice Hall India, 2002.
6. Operational Amplifiers and Linear Integrated Circuits –Sanjay Sharma, Kataria & Sons, 2nd Edition, 2010.
7. Design of Analog CMOS Integrated Circuits - Behzad Razavi

Web Resources:

1. https://nptel.ac.in/courses/122106025.
2. https://nptel.ac.in/courses/108102112.

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B.Tech II Year II semester

POWER SYSTEMS-I					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0212T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Outcomes:

CO1: Understand the different types of power plants, operation of power plants **L2**

CO2: Understand the concepts of distribution systems, underground cables, economic aspects and tariff **L2**

CO3: Understand various substations that are located in distribution systems **L2**

CO4: Apply the above concepts to illustrate different power generation layouts **L3**

CO5: Analyze various economic aspects related to power generation and distribution **L4**

UNIT I	**Power Stations**	**10hrs**

Hydroelectric Power Stations:

Selection of site, general layout of a hydroelectric power plant with brief description of major components and principle of operation

Thermal Power Stations:

Selection of site, general layout of a thermal power plant. Brief description of components: boilers, super heaters, economizers and electrostatic precipitators, steam turbines: impulse and reaction turbines, condensers, feed water circuit, cooling towers and chimney.

UNIT II	**Nuclear Power Stations**	**10hrs**

Nuclear Power Stations:

Location of nuclear power plant, working principle, nuclear fission, nuclear fuels, nuclear chain reaction, nuclear reactor components: moderators, control rods, reflectors and coolants, types of nuclear reactorsand brief description of PWR, BWR and FBR. Radiation: radiation hazards and shielding, nuclear waste disposal.

UNIT III	**Substations**	**10hrs**

Substations:

Air Insulated Substations – indoor & outdoor substations, substations layouts of 33/11 kV 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, double bus bar with one and two circuit breakers, main and transfer bus bar system with relevant diagrams.

Gas Insulated Substations (GIS) – advantages of gas insulated substations, constructional aspects of GIS, comparison of air insulated substations and gas insulated substations.

UNIT IV	Distribution Systems & Underground Cables	9hrs

Distribution Systems:

Classification of Distribution systems, A.C Distribution, Overhead versus Underground system,Connection schemes of Distribution system, Requirements of Distribution system, Design considerations in Distribution system.

Underground Cables:

Types of cables, construction, types of insulating materials, calculation of insulation resistance, stress in insulation and power factor of cable.Capacitance of single and 3-Core belted Cables. Grading of cables: capacitance grading and intersheath grading.

UNIT V	Economic Aspects & Tariff	9hrs

Economic Aspects – load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity factor and plant use factor, base and peak load plants.

Tariff Methods– Costs of generation and their division into fixed, semi-fixed and running costs, desirable characteristics of a tariff method, tariff methods: simple rate, flat rate, block- rate, two-part, three–part, and power factor tariff methods, Time of Day (ToD) tariff and Time of Use (ToU) tariff.

Textbooks:

1. S. N. Singh, Electric Power Generation, Transmission and Distribution, PHI Learning Pvt Ltd, New Delhi, 2nd Edition, 2010
2. J. B. Gupta, Transmission and Distribution of Electrical Power, S. K. Kataria and sons,10th Edition, 2012

Reference Books:

1. I.J.Nagarath& D.P. Kothari, Power System Engineering, McGraw-Hill Education, 3rd Edition, 2019.
2. C.L.Wadhwa,Generation, Distribution and Utilization of Electrical Energy, New Age International Publishers, 6th Edition, 2018.
3. V. K. Mehta and Rohit Mehta, Principles of Power System, S. Chand, 4th Edition, 2005.
4. Turan Gonen, Electric Power Distribution System Engineering, McGraw-Hill, 1985.
5. Handbook of switchgear, BHEL, McGraw-Hill Education, 2007.

Web Resources:

1. https://nptel.ac.in/courses/108102047

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B.Tech II Year II semester

INDUCTION AND SYNCHRONOUS MACHINES					
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23A0213T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Outcomes:

CO1: Understand the construction, principle and operation of single phase and three phase induction motors **L2**

CO2: Understand the construction, principle and operation of synchronous generator and synchronous motor **L2**

CO3: Understand various applications of various alternating machines **L2**

CO4: Apply the above concepts to solve various mathematical and complex problems **L3**

CO5: Analyze the characteristics of induction motor, synchronous motor and synchronous generators **L4**

UNIT I	**3-phase induction motors**	**9hrs**

3-phase induction motors:

Construction of Squirrel cage and Slipring induction motors– production of rotating magnetic field – principle of operation – rotor emf and rotor frequency – rotor current and power factor at standstill and during running conditions– rotor power input, rotor copper loss and mechanical power developed and their inter-relationship –equivalent circuit – phasor diagram, Applications.

UNIT II	**Performance of 3-Phase induction motors**	**10hrs**

Performance of 3-Phase induction motors:

Torque equation – expressions for maximum torque and starting torque – torque-slip characteristics – double cage and deep bar rotors –No load, Brake test and Blocked rotor tests – circle diagram for predetermination of performance- methods of starting –starting current and torque calculations - speed control of induction motor with V/f control method, rotor resistance control and rotor emf injection technique –crawling and cogging – induction generator operation.

UNIT III	**Single Phase Motors**	**9hrs**

Single Phase Motors:

Single phase induction motors – constructional features – double revolving field theory, Cross field theory – equivalent circuit- starting methods: capacitor start capacitor run, capacitor start induction run, split phase & shaded pole, AC series motor, Applications.

UNIT IV	**Synchronous Generator**	**10hrs**

Synchronous Generator:

Constructional features of non-salient and salient pole type alternators- armature windings – distributed and concentrated windings – distribution& pitch factors – E.M.F equation – armature reaction – voltage regulation by synchronous impedance method – MMF method and Potier triangle method –two reaction analysis of salient pole machines -methods of synchronization- Slip test – Parallel operation of alternators.

UNIT V	**Synchronous Motor**	**10hrs**

Synchronous Motor:

Synchronous motor principle and theory of operation – Effect of excitation on current and power factor– synchronous condenser –expression for power developed –hunting and its suppression – methods of starting, Applications.

Textbooks:

1. Electrical Machinery, Dr. P.S. Bhimbra, Khanna Publishing, 2021,First Edition.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

Reference Books:

1. Electrical machines, D.P. Kothari and I.J. Nagrath, McGraw Hill Education, 2017, Fifth Edition.
2. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria& Sons,2007.
3. Electric Machinery, A.E.Fitzgerald, Charles kingsley, Stephen D.Umans, McGraw-Hill, 2020, Seventh edition.

Web Resources:

1. https://nptel.ac.in/courses/108/105/108105131
2. https://nptel.ac.in/courses/108106072

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B.Tech II Year II semester

CONTROL SYSTEMS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0214T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Outcomes:

CO1: Understand the concepts of various mathematical representations of control systems, Time response of first order and second order systems, stability, frequency response and fundamentals of modern control systems **L2**

CO2: Apply Block diagram reduction, Signal flow graph, Routh criterion, Root locus, Bode, Polar, Nyquist concepts for solving various numerical problems **L3**

CO3: Analyze time response characteristics, frequency response characteristics, stability analysis of various control systems **L4**

CO4: Design various compensators and controllers for different control systems by using design procedures **L5**

CO5: Create suitable control systems for various real time applications **L5**

UNIT I	**CONTROL SYSTEMS CONCEPTS**	**10hrs**

Open loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback characteristics, Effects of positive and negative feedback, Mathematical models – Differential equations of translational and rotational mechanical systems and electrical systems, Analogous Systems, Block diagram reduction methods – Signal flow graphs - Reduction using Mason's gain formula. Principle of operation of DC and AC Servo motor, Transfer function of DC servo motor - AC servo motor, Synchros.

UNIT II	**TIME RESPONSE ANALYSIS**	9hrs

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants, P, PI, PID Controllers.

UNIT III	**STABILITY ANALYSIS IN TIME DOMAIN**	9hrs

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT IV	**FREQUENCY RESPONSE ANALYSIS**	10hrs

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin-Stability Analysis.
Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.

UNIT V	**STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS**	10hrs

Concepts of state, state variables and state model, state models - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and it's Properties. System response through State Space models. The concepts of controllability and observability, Duality between

controllability and observability.

Textbooks:

1. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. Control Systems Engineering by I. J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 5th edition, 2007.

Reference Books:

1. Control Systems Principles & Design by M.Gopal, 4th Edition, Mc Graw Hill Education, 2012.
2. Automatic Control Systems by B. C. Kuo and Farid Golnaraghi, John wiley and sons, 8th edition, 2003.
3. Feedback and Control Systems, Joseph J Distefano III, Allen R Stubberud & Ivan J Williams, 2nd Edition, Schaum's outlines, Mc Graw Hill Education, 2013.
4. Control System Design by Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.
5. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell and Abbas Emami-Naeini, 6th Edition, Pearson, 2010.

Web Resources:

1. https://nptel.ac.in/courses/108102043
2. https://nptel.ac.in/courses/108106098.

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INDUCTION AND SYNCHRONOUS MACHINES LAB					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0215P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Outcomes:

CO1: Analyze various performance characteristics of 3-phase and 1-phase induction Motors
CO2: Evaluate the performance of 3-phase Induction Motor by obtaining the circle diagram and equivalent circuit of 3-phase Induction Motor and single phase induction motor
CO3: Adapt the power factor improvement methods for single phase Induction Motor
CO4: Pre-determine the regulation of 3-phase alternator
CO5: Determine the synchronous machine reactance of 3-phase alternator

List of Experiments:

Any 10 experiments of the following are required to be conducted

1. Brake test on three phase Induction Motor.
2. Circle diagram of three phase induction motor.
3. Speed control of three phase induction motor by V/f method.
4. Equivalent circuit of single-phase induction motor.
5. Power factor improvement of single-phase induction motor by using capacitors.
6. Load test on single phase induction motor.
7. Regulation of a three -phase alternator by synchronous impedance &MMF methods.
8. Regulation of three-phase alternator by Potier triangle method.
9. V and Inverted V curves of a three-phase synchronous motor.
10. Determination of X_d, X_q& Regulation of a salient pole synchronous generator.
11. Determination of efficiency of three phase alternator by loading with three phase induction motor.
12. Parallel operation of three-phase alternator under no-load and load conditions.
13. Determination of efficiency of a single-phase AC series Motor by conducting Brake test.

Reference:

1. https://em-coep.vlabs.ac.in/List%20of%20experiments.html

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CONTROL SYSTEMS LAB					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0216P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Outcomes:

CO1: Understand how to use feedback control system to determine transfer function of DC servo motor and any other given circuit with R, L and C components **L2**
CO2: Model the systems and able to design the controllers and compensators. **L3**
CO3: Get the knowledge about the effect of poles and zeros location on transient and steady state behavior of second order systems and implement through software tools **L4**
CO4: Determine the performance and time domain specifications of first and second order systems. **L4**
CO5: Understand the stability analysis **L2**

List of Experiments:

Any 10 of the Following Experiments are to be conducted.

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servo motor
5. Transfer function of DC Machine
6. Effect of P, PD, PI, PID Controller on a second order system
7. Lag and lead compensation – Magnitude and phase plot
8. Temperature controller using PID
9. Characteristics of magnetic amplifiers
10. Characteristics of AC servo motor
11. Linear system analysis (Time domain analysis, Error analysis) using MATLAB.
12. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB
13. State space model for classical transfer function using MATLAB – Verification.

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B.Tech II Year II semester

PYTHON PROGRAMMING					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0510P	**0: 1:2:0**	**2**	**CIE: 30 SEE:70**	**3 Hours**	**SEC**

Course Objectives:

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

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

- Showcase adept command of Python syntax, deftly utilizing variables, data types, control structures, functions, modules, and exception handling to engineer robust and efficient code solutions. (L4)
- Apply Python programming concepts to solve a variety of computational problems (L3)
- Understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs (L3)
- Proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas (L2)
- Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries (L3)

UNTI-I:		**8hrs**

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.

i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators

5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT-II:		6hrs

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the

function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.
Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.
Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
   i. Addition ii. Insertion iii. slicing
6. Write a program to perform any 5 built-in functions by taking any list.

UNIT-III:		6hrs

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

1. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2. Write a program to count the number of vowels in a string (No control flow allowed).
3. Write a program to check if a given key exists in a dictionary or not.
4. Write a program to add a new key-value pair to an existing dictionary.
5. Write a program to sum all the items in a given dictionary.

UNIT-IV:		6hrs

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.
Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

1. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
2. Python program to print each line of a file in reverse order.
3. Python program to compute the number of characters, words and lines in a file.
4. Write a program to create, display, append, insert and reverse the order of the items in the array.
5. Write a program to add, transpose and multiply two matrices
6. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V:		6hrs

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using array () function.
3. Python program to demonstrate use of ndim, shape, size, dtype.
4. Python program to demonstrate basic slicing, integer and Boolean indexing.
5. Python program to find min, max, sum, cumulative sum of array
6. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a) Apply head () function to the pandas data frame
    b) Perform various data selection operations on Data Frame
7. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Reference Books:

1. Gowri shankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

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B.Tech II Year II semester

DESIGN THINKING & INNOVATION					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0413T	**1: 0:2:0**	**2**	**CIE: 30 SEE:70**	**3 Hours**	**ESC**

Course Objectives:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes:

- Define the concepts related to design thinking. (L1, L2)
- Explain the fundamentals of Design Thinking and innovation (L1, L2)
- Apply the design thinking techniques for solving problems in various sectors. (L3)
- Analyse to work in a multidisciplinary environment (L4)
- Evaluate the value of creativity (L5)
- Formulate specific problem statements of real time issues (L3, L6)

UNIT I	**Introduction to Design Thinking**	6hrs

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT II	**Design Thinking Process**	6hrs

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT III	**Innovation**	8hrs

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT IV	**Product Design**	6hrs

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

UNIT V	Design Thinking in Business Processes	6hrs

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes.

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown,Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell,Universal Principles of Design- Kritinaholden, Jill Butter.
4. Chesbrough.H, The Era of Open Innovation – 2013

Online Learning Resources:

https://nptel.ac.in/courses/110/106/110106124/
https://nptel.ac.in/courses/109/104/109104109/
https://swayam.gov.in/nd1_noc19_mg60/preview

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B.Tech II Year II semester

COMMUNITY SERVICE PROJECT
……Experiential learning through community engagement

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0224		2			

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development.
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit.
- The community will benefit with the focused contribution of the college students for the village/ local development.
- The college finds an opportunity to develop social sensibility and responsibility among students and emerge as a socially responsible institution

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems

Implementation of Community Service Project

- Every student should put in 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, housewives, etc
- A logbook must be maintained by each of the students, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty in charge.
- An evaluation to be done based on the active participation of the student and grade could be

awarded by the mentor/faculty member.

- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project reports should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training.

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
  - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
  - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology
    - Energy
    - Internet
    - Free Electricity
    - Drinking Water

EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills.

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding

- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity.

Relationship with the Institution

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research.

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment.
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals.
- New energy, enthusiasm and perspectives applied to community work.
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions, and modifications. Colleges are expected to focus on specific local issues for this kind of project. The students are expected to carry out these projects with involvement, commitment, responsibility, and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of project. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting should be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods

15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling lvel- observation.

Complementing the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs

Programs for School Children

1. Reading Skill Program (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially relevant themes. Programs for Women Empowerment
1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship General Camps
1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programs on Environment
10. Health and Hygiene

11. Hand wash programmes
12. Commemoration and Celebration of important days Programs for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development Common Programs

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programs in consonance with the Govt. Departments like –

i. Agriculture
ii. Health
iii. Marketing and Cooperation
iv. Animal Husbandry
v. Horticulture
vi. Fisheries
vii. Sericulture
viii. Revenue and Survey
ix. Natural Disaster Management
x. Irrigation
xi. Law & Order
xii. Excise and Prohibition
xiii. Mines and Geology Energy

Role of Students:

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also, with the Governmental Departments. If the program is rolled out, the District Administration could be roped in for the successful deployment of the program.
- An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity Duration: 8 weeks

1. Preliminary Survey (One Week)

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secreteriats could be aligned for the survey.

2. Community Awareness Campaigns (One Week)

- Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmesto be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. Community Immersion Programme (Three Weeks)

- **Along with the Community Awareness Programmes**, the student batch can also work with any one of the below-listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.

4. Community Exit Report (One Week)

- During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks' works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University. Throughout the Community Service Project, a daily logbook need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

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B.Tech III Year I semester

Department of Electrical and Electronics Engineering

Course Structure (RG23)

B.Tech III Year I semester							
S.No.	**Category**	**Course code**	**Title**	**L**	**T**	**P**	**Credits**
1	Professional Core	23A0218T	Power Electronics	3	0	0	3
2	Professional Core	23A0445T	Digital Circuits	3	0	0	3
3	Professional Core	23A0219T	Power Systems-II	3	0	0	3
4	Professional Core	23A0522T	Introduction To Quantum Technologies And Applications	3	0	0	3
5	Professional Elective- I	23A0446T 23A0220T 23A0221T	**Professional Elective- I** 1. Signals and Systems 2. Electrical safety and Risk Management 3. Utilization of Electrical Energy	3	0	0	3
6	Open Elective-I		**Open Elective-I**	3	0	0	3
7	Professional Core	23A0223P	Power Electronics Lab	0	0	3	1.5
8	Professional Core	23A0447P	Analog and Digital Circuits Lab	0	0	3	1.5
9	Skill Enhancement course	23A0026P	**Skill Enhancement course** Soft Skills	0	1	2	2
10	Engineering Science	23A0420	Tinkering Lab	0	0	2	1
11	Evaluation of Community	23A0224	Evaluation of Community Service Internship	-	-	-	2
			Total	**18**	**1**	**10**	**26**

Open Elective – I

S.No.	Course Code	Course Name	Offered by the Dept.
1	23A0148T	Green Buildings	CIVIL
2	23A0149T	Construction Technology and Management	
3	23A0319T	Sustainable Energy Technologies	ME
4	23A0442T	Electronic Circuits	ECE
5	23A0545T	Java Programming	CSE & Allied/IT
6	23A0546T	Fundamentals of Artificial Intelligence	
7	23A0547T	Quantum Technologies and Applications	
8	23A0027T	Mathematics for Machine Learning and AI	Mathematics
9	23A0034T	Materials Characterization Techniques	Physics
10	23A0040T	Chemistry of Energy Systems	Chemistry
11	23A0044T	English for Competitive Examinations	Humanities
12	23A0051T	Entrepreneurship and New Venture Creation	

Note:
1. A student is permitted to register for Honours or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.
2. A student shall not be permitted to take courses as Open Electives/Minor/Honours with content substantially equivalent to the courses pursued in the student's primary major.
3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline.

Member Secretary **BOS Chairman**

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B.Tech III Year I semester

POWER ELECTRONICS
(Professional Core)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0218T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PCC

Course Outcomes:

CO1: Understand the I-V Characteristics and Gate Drive Requirements of Power Devices Including Diodes, Thyristors, MOSFETs, and IGBTs. -L2

CO2: Design Single-Phase and Three-Phase Rectifiers with Different Load Conditions and Evaluate Power Factor and Source Inductance Effects. -L5

CO3: Apply Duty Ratio Control and Analyze Steady-State Waveforms of Buck, Boost, and Buck- Boost Converters. L3

CO4: Analyze the Operation of Inverters, AC Voltage Controllers, and Cyclo Converters with Various Load Conditions and Commutation Techniques. L4

CO5: Explore advanced power electronic devices like GaN and SiC, understanding their applications in modern power systems. L3

UNIT I	Power Switching Devices	9hrs

Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO. Introduction to Galium Nitride and Silicon Carbide Devices.

UNIT II	Rectifiers	10hrs

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance; Analysis of rectifiers with filter capacitance, Dual Converter -Numerical problems.

UNIT III	DC-DC Converters	9hrs

Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.

UNIT IV	Inverters	10hrs

Single phase Voltage Source inverters – operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters – Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode – 120 degree mode of operation - Numerical problems.

UNIT V	AC Voltage Controllers & Cyclo Converters	10hrs

AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti-parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – RMS load voltage, current and power factor - wave forms – Numerical problems. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output voltage equation.

Text Books:

1. M. H. Rashid, ―Power Electronics: Circuits, Devices and Applications‖, 2nd edition, Prentice Hall of India, 1998.
2. P.S. Bimbhra, ―Power Electronics‖, 4th Edition, Khanna Publishers, 2010.
3. M. D. Singh & K. B. Kanchandhani, ―Power Electronics‖, Tata Mc Graw Hill Publishing Company, 1998.

Reference Books:

1. Ned Mohan, ―Power Electronics‖, Wiley, 2011.
2. Robert W. Erickson and Dragan Maksimovic, ―Fundamentals of Power Electronics‖ 2nd Edition, Kluwer Academic Publishers, 2004.
3. Vedam Subramanyam, ―Power Electronics‖, New Age International (P) Limited, 1996.
4. V. R. Murthy, ―Power Electronics‖, 1st Edition, Oxford University Press, 2005.
5. P. C. Sen, ―Power Electronics‖, Tata Mc Graw-Hill Education, 1987.
6. J. M. D. Murphy ―Power Electronic Control of Alternating Current Motors‖.

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B.Tech III Year I semester

DIGITAL CIRCUITS
(Professional Core)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0445T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

1. To Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. To analyze combinational circuits like adders, subtractors, and code converters.
3. To explore combinational logic circuits and their applications in digital design.
4. To understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. To gain knowledge about programmable logic devices and digital IC‘s.

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

1. Learn Boolean algebra, logic simplification techniques, and combinational circuit design. L1
2. Analyze combinational circuits like adders, subtractors, and code converters. L2
3. Explore combinational logic circuits and their applications in digital design. L3
4. Understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.L1
5. Gain knowledge about programmable logic devices and digital IC‘s. L3

UNIT I	**Logic Simplification and Combinational Logic Design**:	**10hrs**

Review of Boolean Algebra and De Morgan‘s Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR- AND and NAND/NOR realizations.

UNIT II	**Introduction to Combinational Design 1**:	9hrs

Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.

UNIT III	**Combinational Logic Design 2:**	9hrs

Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

UNIT IV	**Sequential Logic Design**:	9hrs

Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers.

UNIT V	**Programmable Logic Devices:**	11hrs

ROM, Programmable Logic Devices (PLA and PAL).

Digital IC’s: Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de-multiplexer (74x155), comparator (74x85).

Text Books:

1. Digital Design, M.Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999.

2. Switching theory and Finite Automata Theory, Zvi Kohavi and Nirah K.Jha, 2nd Edition, Tata McGraw Hill, 2005.

Reference Books:

1. Fundamentals of Logic Design, Charles H Roth,Jr., 5th Edition, Brooks/cole Cengage Learning, 2004.

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B.Tech III Year I semester

POWER SYSTEMS-II
(Professional Core)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0219T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

- To study about line parameters and constants
- To study the performance of transmission lines
- To know about overhead line insulators, corona, sag and tension in transmission lines
- To study about symmetrical components and different types of faults in power system.
- To understand the concept of voltage control, compensation methods

Course Outcomes:

CO1 Analyse the transmission lines and obtain the transmission line parameters and constants.
CO2 Analyse transmission line performance
CO3 Design transmission lines to meet the day to day power requirements.
CO4 Understand the concepts of cables and transients in transmission lines
CO5 Apply load compensation techniques to control reactive power.

UNIT I	Transmission Line Parameters:	10hrs

Types of Conductors - Calculation of Resistance for Solid Conductors, Bundle Conductors, Skin effect, Proximity effect, Concept of GMR & GMD- Transposition of Power lines- Calculation of inductance for single phase and three phase, Single and Double circuit lines, Symmetrical and asymmetrical conductor configurations with and without transposition. Calculation of Capacitance for 2 wire and 3 wire systems, effect of ground on Capacitance, Capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems

UNIT II	Performance Of Transmission Lines:	9hrs

Classification of Transmission Lines-Short, medium and long line and their models representation - Nominal-T, Nominal-π and A, B, C, D Constants for symmetrical networks, Numerical Problems and solutions for estimating regulation and efficiency of all types of lines. Ferranti effect and Charging Current

UNIT III	Overhead Line Insulators:	10hrs

Types of Insulators, String efficiency and Methods for improvement, – Voltage Distribution, Calculation of String efficiency, Capacitance Grading and Static Shielding., Numerical Problems.
Sag and Tension: Sag and Tension Calculations with equal and unequal heights of towers, Effect of wind and ice on weight of conductor, Stringing chart, Sag template and its applications Numerical Problems.
Corona: Corona- factors affecting corona, critical voltages and Power loss due to Corona. Radio Interference

UNIT IV	Underground Cables:	10hrs

Comparison between Underground and Overhead systems Construction of cables, Classification, Properties of insulating materials, Insulation resistance of single core cable, Capacitance of single core cable, Grading of cable
Power System Transients:
Types of system transients – Travelling or propagation of surges – Attenuation, Distortion, Reflection and Refraction co-efficients – Termination of lines with different types of conditions – Bewley‘s Lattice diagrams

UNIT V	**Voltage Control and Power Factor Improvement**:	**9hrs**

Methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase modifiers, power factor improvement methods.

Compensation in Power Systems: Concepts of Load compensation Load ability characteristics of overhead lines – Uncompensated transmission line – Symmetrical line – Radial line with asynchronous load – Compensation of lines.

Text Books:

1. C.L. Wadhwa, ―Electrical Power Systems‖, New Age International Pub. Co, Third Edition, 2001.
2. D.P. Kothari and I.J. Nagrath, ―Modern Power System Analysis‖, Tata Mc Graw Hill Pub. Co.,New Delhi, Fourth edition, 2011.
3. B.R.Gupta,―Power System Analysis and Design‖, S.ChandPublishing.1998.

Reference Books:

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. John J. Grainger & W.D. Stevenson, ―Power System Analysis‖, Mc Graw Hill International,1994.
3. Hadi Sadat, ―Power System Analysis‖, Tata Mc Graw Hill Pub. Co. 2002.
4. W.D. Stevenson, ―Elements of Power system Analysis‖, McGraw Hill International Student Edition.

Online Learning Resource:

1. https://onlinecourses.nptel.ac.in/noc22_ee17/preview

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B.Tech III Year I semester

INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS
(Qualitative Treatment)

Course Code	L:T:P:S	Credits	Exam Marks	Exam ration	Course Type
23A0522T	**3: 0:0:0**	**3**	**CIE: 30 E:70**	**3 Hours**	**PCC**

Course Objectives (COBJ):

- Introduce fundamental quantum concepts like superposition and entanglement.
- Understand theoretical structure of qubits and quantum information.
- Explore conceptual challenges in building quantum computers.
- Explain principles of quantum communication and computing.
- Examine real-world applications and the future of quantum technologies.

Course Outcomes (CO):

- Explain core quantum principles in a non-mathematical manner.
- Compare classical and quantum information systems.
- Identify theoretical issues in building quantum computers.
- Discuss quantum communication and computing concepts.
- Recognize applications, industry trends, and career paths in quantum technology.

Unit I	**Introduction to Quantum Theory and Technologies**	10hrs

The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics – theoretical comparison, Quantum states and measurement: nature of observation, Overview of quantum systems: electrons, photons, atoms, The concept of quantization: discrete energy levels, Why quantum? Strategic, scientific, and technological significance, A snapshot of quantum technologies: Computing, Communication, and Sensing, National and global quantum missions: India‘s Quantum Mission, EU, USA, China

Unit II	**Theoretical Structure of Quantum Information Systems**	10hrs

What is a qubit? Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non-engineering view),Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract, The role of entanglement and non-locality in systems, Quantum information vs classical information: principles and differences, Philosophical implications: randomness, determinism, and observer role

Unit III	**Building a Quantum Computer – Theoretical Challenges and Requirements**	10hrs

What is required to build a quantum computer (conceptual overview)?,Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers:
Why maintaining entanglement is difficult, Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison),Superconducting circuits, Trapped ions, Photonics, Vision vs reality: what‘s working and what remains elusive, The role of quantum software in managing theoretical complexities

Unit IV	**Quantum Communication and Computing – Theoretical Perspective**	9hrs

Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution

(QKD),Role of Entanglement in Communication, The Idea of the Quantum Internet – Secure Global Networking, Introduction to Quantum Computing, Quantum Parallelism (Many States at Once),Classical vs Quantum Gates, Challenges: DE coherence and Error Correction, Real-World Importance and Future Potential

Unit V	**Applications, Use Cases, and the Quantum Future**	9hrs

Real-world application domains: Healthcare (drug discovery),Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, PsiQuantum, Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization, Emerging careers in quantum: roles, skillsets, and preparation pathways, Educational and research landscape – India's opportunity in the global quantum race

Textbooks**:**

1. Michael A. Nielsen, Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.
3. Chris Bernhardt, *Quantum Computing for Everyone*, MIT Press, 2019.

Reference Books**:**

1. David McMahon, *Quantum Computing Explained*, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, *An Introduction to Quantum Computing*, Oxford University Press, 2007.
3. Scott Aaronson, *Quantum Computing Since Democritus*, Cambridge University Press, 2013.
4. **Alastair I.M. Rae**, *Quantum Physics: A Beginner's Guide*, Oneworld Publications, Revised Edition, 2005.
5. **Eleanor G. Rieffel, Wolfgang H. Polak**, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.
6. **Leonard Susskind, Art Friedman**, *Quantum Mechanics: The Theoretical Minimum*, Basic Books, 2014.
7. **Bruce Rosenblum, Fred Kuttner**, *Quantum Enigma: Physics Encounters Consciousness*, Oxford University Press, 2nd Edition, 2011.
8. **GiulianoBenenti, GiulioCasati, GiulianoStrini**, *Principles of Quantum Computation and Information, Volume I: Basic Concepts*, World Scientific Publishing, 2004.
9. **K.B. Whaley et al.**, *Quantum Technologies and Industrial Applications: European Roadmap and Strategy Document*, Quantum Flagship, European Commission, 2020.
10. **Department of Science & Technology (DST), Government of India**, *National Mission on Quantum Technologies & Applications – Official Reports and Whitepapers*, MeitY/DST Publications, 2020 onward.

Online Learning Resources**:**

- IBM Quantum Experience and Qiskit Tutorials
- Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
- edX – The Quantum Internet and Quantum Computers
- YouTube – Quantum Computing for the Determined by Michael Nielsen
- Qiskit Textbook – IBM Quantum

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B.Tech III Year I semester

SIGNALS AND SYSTEMS
(Professional Elective -I)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0446T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

- To understand the basic properties of signal & systems and LTI systems.
- To learn Fourier series representation of periodic signals.
- To study representation of signals in continuous and discrete time Fourier transform
- To analyze the sampling theorem and characterize signals & systems in time & frequency domain.
- To apply Laplace transform and Z transform to study about the stability of systems.

Course Outcomes:

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

- Explain the basic properties of signal & systems and LTI systems. L2
- Apply Fourier series to represent periodic signals. L3
- Represent signals in continuous and discrete time Fourier transform. L2
- Analyze the sampling theorem and characterize signals & systems in time & frequency domain. L3
- Analyse the stability of systems by applying Laplace transform and Z transform . L3

UNIT I	**Signals and Systems**	**10hrs**

Continuous and Discrete Time Signals, Transformations of the Independent Variable, Elementary Signals-Unit Impulse, Unit Step Functions, Ramp Signal, Rectangular function, Signum Function, Sinc & Sa Function, Exponential and Sinusoidal Signals, Classification of Signals & Systems, Continuous and Discrete Time Systems, Basic System Properties, Linear Time Invariant (LTI) Systems, Discrete-Time LTI Systems, Convolution Sum, Continuous Time LTI Systems, Convolution Integral, Properties of LTI Systems, Causal LTI Systems described by Differential and Difference Equations, Singularity Functions.

UNIT II	**Fourier series representation of periodic signals**	**10hrs**

Response of LTI Systems to Complex Exponentials. Fourier Series Representation of Continuous Time Periodic Signals, Trigonometric, Polar, Exponential fourier Series & related problems, Convergence of the Fourier Series, Properties of Continuous Time Fourier Series, Fourier Series Representation of Discrete Time Periodic Signals, Properties of Discrete Time Fourier Series, Fourier Series and LTI Systems,

UNIT III	**The Continuous-Time Fourier Transform**	**9hrs**

Representation of aperiodic Signals, Continuous Time Fourier Transform, Fourier Transform for

Periodic Signals, Properties of the Continuous Time Fourier Transform, Systems characterized by Linear constant coefficient differential equations, Discrete Time Fourier Transform - Representation of Aperiodic Signals, Discrete Time Fourier Transform, Frequency Response, Systems Characterized by Linear Constant-Coefficient Difference Equations.

UNIT IV	**Time & Frequency Characterization of Signals and Systems**	**9hrs**

The Magnitude Phase Representation of the Fourier Transform, Magnitude Phase Representation of the Frequency Response of LTI Systems, Time-Domain Properties of Ideal Frequency Selective Filters, Time Domain and Frequency Domain Aspects of Non-ideal Filters, Examples of Continuous time filters and Discrete time filters described by differential equations, First-Order and Second-Order Continuous and Discrete-Time Systems, Examples of Time and Frequency Domain Analysis of Systems,

Sampling: Representation of a Continuous Time Signal by Its Samples, Sampling Theorem, Reconstruction of a Signal from Its Samples Using Interpolation, Effect of under sampling: Aliasing, Discrete Time Processing of Continuous-Time Signals.

UNIT V	**Laplace and z-Transforms**	**10hrs**

The Laplace Transform, Region of Convergence for Laplace Transforms, Inverse Laplace Transform, Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot, Properties of the Laplace Transform, Some Laplace Transform Pairs, Analysis and Characterization of LTI Systems Using the Laplace Transform, System Function Algebra and Block Diagram Representations, Unilateral Laplace Transform, Z-Transform - Region of Convergence for the z-Transform, Inverse z-Transform, Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot, Properties of the z-Transform, Some Common z-Transform Pairs, Analysis and Characterization of LTI Systems Using z-Transforms, System Function Algebra and Block Diagram Representations, Unilateral z-Transforms.

TEXT BOOKS:

1. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky, & S. Hamid, 2nd Edition, Pearson Higher Education, 1997.
2. Principles of Linear Systems and Signals, B.P. Lathi, 2nd Edition, Oxford University Press, 2011.

REFERENCE BOOKS:

1. Signals & Systems, Simon Haykin and B. Van Veen, 2nd Edition, John Wiley, 2003.
2. Signals and systems, Narayana Iyer and K Satya Prasad, 1st Edition, CENGAGE Learning, 2011.
3. Signals, Systems and Transforms, C. L. Philips, J. M. Parr and Eve A. Riskin, 4th Edition, Pearson education, 2008.

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B.Tech III Year I semester

ELECTRICAL SAFETY AND RISK MANAGEMENT
(Professional Elective-I)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0220T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PEC**

COURSE OUTCOMES:

At the end of the course the student shall be able to

CO1: Explain the objectives and precautions of Electrical Safety, effects of Shocks and their Prevention. L2

CO2: Summarize the Safety aspects during Installation of Plant and Equipment. L3

CO3: Describe the electrical safety in residential, commercial and agricultural installations. L3

CO4: Describe the various Electrical Safety in Hazardous Areas, Equipment Earthing and System Neutral Earthing. L3

CO5: State the electrical systems safety management and IE rules.

UNIT-I	**Introduction to Electrical Safety, Shocks and Their Prevention:**	**10hrs**

Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over‘s, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops.

UNIT-II	**Safety During Installation of Plant and Equipment:**	**10hrs**

Introduction, preliminary preparations, preconditions for start of installation work, during, risks during installation of electrical plant and equipment, safety aspects during installation, field quality and safety during erection, personal protective equipment for erection personnel, installation of a large oil immersed power transformer, installation of outdoor switchyard equipment, safety during installation of electrical rotating machines, drying out and insulation resistance measurement of rotating machines.

UNIT-III	**Electrical Safety In Residential, Commercial and Agricultural Installations:**	**9hrs**

Wiring and fitting – Domestic appliances – water tap giving shock – shock from wet wall – fan firing shock – multi-storied building – Temporary installations – Agricultural pump installation – Do‘s and Don‘ts for safety in the use of domestic electrical appliances.

UNIT-IV	**Electrical Safety in Hazardous Areas:**	**10hrs**

Hazardous zones – class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipments for hazardous locations – Classification of equipment enclosure for various hazardous gases and vapours – classification of equipment/enclosure for hazardous locations.

Equipment Earthing and System Neutral Earthing: Introduction, Distinction between system grounding and Equipment Grounding, Equipment Earthing, Functional Requirement of earthing system, description of a earthing system, , neutral grounding(System Grounding), Types of Grounding, Methods of Earthing Generators Neutrals.

UNIT-V		**9hrs**

Safety Management of Electrical Systems:

Principles of Safety Management, Management Safety Policy, Safety organization, safety auditing, Motivation to managers, supervisors, employees.

Review of IE Rules and Acts and Their Significance: Objective and scope – ground clearances and section clearances – standards on electrical safety - safe limits of current, voltage –Rules regarding first aid and fire fighting facility.

The Electricity Act, 2003, (Part1, 2, 3,4 & 5)

TEXT BOOKS:

1. S. Rao, Prof. H.L. Saluja, ―Electrical safety, fire safety Engineering and safety management‖, Khanna Publishers. New Delhi, 1988.(units-I to V)
2. www.apeasternpower.com/downloads/elecact2003.pdf (Part of unit-V)

REFERENCE:

1. Pradeep Chaturvedi, *"Energy management policy, planning and utilization",* Concept Publishing company, New Delhi, 1997.

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B.Tech III Year I semester

UTILIZATION OF ELECTRICAL ENERGY
(Professional Elective-I)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0221T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

COURSE DESCRIPTION:

The course deals with different types and characteristics of electric drives; types of electric heating and welding; Fundamentals and various methods of Illumination; electric traction; electrolysis, Extraction, and refining of metals.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Apply the appropriate electric drives for various industrial applications. -L4

CO2. Understand the different types of heating and welding techniques. -L2

CO3. Design an illumination system for the proper lighting system. -L5

CO4. Understand the basic principle and different braking techniques of electric traction. -L2

CO5. Understand the basic principle and applications of the electrolytic process.-L1

UNIT-I	**Electric Drives:**	9hrs

Type of electric drives – rating and choice of motor - starting and running characteristics – particular applications of electric drives - types of industrial loads - Continuous - intermittent and variable loads.

UNIT-II	**Electric Heating & Welding:**	9hrs

Introduction: Advantages and methods of electric heating - resistance heating - induction heating and dielectric heating.

Electric welding: Classification- resistance and arc welding - electric welding equipment - comparison between AC and DC Welding.

UNIT-III	**Illumination:**	10hrs

Introduction - terms used in illumination - laws of illumination - sources of light. Discharge lamps – mercury vapor and sodium vapor lamps–comparison between tungsten filament lamps and fluorescent tubes–compact fluorescent lamp–LED-Basic principles of light control-Types and design of good lighting system and practice - flood lighting.

UNIT-IV	**Electric Traction:**	10hrs

Traction systems: System of electric traction and track electrification - Review of existing electric traction systems in India - Special features of traction motor - Speed-time curves for different services - methods of electric braking - plugging - rheostatic braking - regenerative braking. Introduction to Magnetic Levitation vehicles.

UNIT-V	**Electrolytic Process:**	10hrs

Introduction - Basic principles - Faradays laws of electrolysis - Energy efficiency – Electrodeposition - Factors governing deposition Processes - Deposition of Alloys – Extraction and refining of metals. Fuel Cells.

Text Books:

1. C.L Wadhwa, Generation Distribution and Utilization of Electrical Energy, New age International Publishers,
2. J. B. Gupta, Utilization of Electrical Power and Electric Traction, S. K. Kataria and sons, 2002
3. G. C. Garg (2005), Utilization of Electrical Power & Electric traction, 8th edition, Khanna publishers, New Delhi.
4. N. V. Suryanarayana, Utilization of Electrical Power including Electric drives and Electric traction, New Age International (P) Limited, Publishers, 1996.

REFERENCE BOOKS:

1. Partab (2007), Art & Science of Utilization of electrical Energy, 2nd edition, Dhanpat Rai & Sons, New Delhi.
2. Alan. V. Oppenheim, Ronald. W. Schafer, John R Buck, Discrete Time Signal Processing, PrenticeHall,2ndedition,2006.E.OpenshawTaylor,UtilizationofElectricEnergy,Orient Longman,1971.

Online Learning Resources:

1. **https://nptel.ac.in/courses/108105060**
2. **https://nptel.ac.in/courses/112105221**
3. https://vssut.ac.in/lecture_notes/lecture1426861925.pdf
4. https://vpmpee.wordpress.com/uee-3340903/

OPEN ELECTIVES

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B.Tech III Year I semester

GREEN BUILDINGS (OPEN ELECTIVE - I)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0148T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives :
The objectives of this course are to make the student:

1. **To understand** the fundamental concepts of green buildings, their necessity, and sustainable features.
2. **To analyze** green building concepts, rating systems, and their benefits in India.
3. **To apply** green building design principles, energy efficiency measures, and renewable energy sources.
4. **To evaluate** air conditioning systems, HVAC designs, and energy modeling for sustainable buildings.
5. **To assess** material conservation strategies, waste management, and indoor environmental quality in green buildings.

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

1. **Understand** the importance of green buildings, their necessity, and sustainable features.
2. **Analyze** various green building practices, rating systems, and their impact on environmental sustainability.
3. **Apply** principles of green building design to enhance energy efficiency and incorporate renewable energy sources.
4. **Evaluate** HVAC systems, energy-efficient air conditioning techniques, and their role in sustainable building design.
5. **Assess** material conservation techniques, waste reduction strategies, and indoor air quality management in green buildings.

UNIT-I		**9hrs**

Introduction to Green Building– Necessity of Green Buildings, Benefits of Green Buildings, Green Building Materials and Equipment in India, Key Requisites for Constructing A Green Building, Important Sustainable Features for Green Buildings.

UNIT-II		**10hrs**

Green Building Concepts and Practices– Indian Green Building Council, Green Building Movement in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities and Benefits: Opportunities of Green Buildings, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy- Saving Approaches in Buildings, LEED India Rating System, and Energy Efficiency.

UNIT-III		**9hrs**

Green Building Design– Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximizing System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable
Energy Sources, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT-IV		**10hrs**

Air Conditioning– Introduction, CII Godrej Green Business Centre, Design Philosophy, Design Interventions, Energy Modeling, HVAC System Design, Chiller Selection, Pump Selection, Selection of Cooling towers,
Selection of Air Handling Units, Pre-Cooling of Fresh Air, Interior Lighting Systems, Key Features of The Building, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT-V		**10hrs**
Material Conservation– Handling of Non-Process Waste, Waste Reduction During Construction, Materials With Recycled Content, Local Materials, Material Reuse, Certified Wood, Rapidly Renewable Building Materials and Furniture. Indoor Environment Quality and Occupational Health– Air Conditioning, Indoor Air Quality, Sick Building Syndrome, tobacco Smoke.		

TEXT BOOKS:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by tom woolley and Sam kimings, 2009.

REFRENCE BOOKS:

1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009
3. Energy Conservation Building Code –ECBC-2020, published by BEE

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/102/105102195/

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B.Tech III Year I semester

CONSTRUCTION TECHNOLOGY AND MANAGEMENT
(OPEN ELECTIVE – I)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0149T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:
The objectives of this course are to make the student :

1. To understand project management fundamentals, organizational structures, and leadership principles in construction.
2. To analyze manpower planning, equipment management, and cost estimation in civil engineering projects.
3. To apply planning, scheduling, and project management techniques such as CPM and PERT.
4. To evaluate various contract types, contract formation, and legal aspectsin construction management.
5. To assess safety management practices, accident prevention strategies, and quality management systems in construction.

Course Outcomes (COs):

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

1. Understand (Cos)project management fundamentals, organizational structures, and leadership principles in construction.
2. Analyze manpower planning, equipment management, and cost estimationin civil engineering projects.
3. Apply planning, scheduling, and project management techniques such as CPM and PERT.
4. Evaluate various contract types, contract formation, and legal aspectsin construction management.
5. Assess safety management practices, accident prevention strategies, and quality management systems in construction.

UNIT-I		10hrs

Introduction: Project forms, Management Objectives and Functions; Organizational Chart of A Construction Company; Manager's Duties and Responsibilities; Public Relations; Leadership and Team - Work; Ethics,Morale, Delegation and Accountability.

UNIT-II		10hrs

Man and Machine: Man-Power Planning, Training, Recruitment, Motivation, Welfare Measures and Safety Laws; Machinery for Civil Engineering., Earth Movers and Hauling Costs, Factors Affecting Purchase, Rent, and Lease of Equipment, and Cost Benefit Estimation.

UNIT-III		9hrs

Planning, Scheduling and Project Management: Planning Stages, Construction Schedules and Project Specification, Monitoring and Evaluation; Bar-Chart, CPM, PERT, Network-formulation and Time Computation.

UNIT-IV		10hrs

Contracts: Types of Contracts, formation of Contract – Contract Conditions – Contract for Labour, Material, Design, Construction – Drafting of Contract Documents Based On IBRD/ MORTH Standard Bidding Documents – Construction Contracts – Contract Problems – Arbitration and Legal Requirements Computer Applications in Construction Management: Software for Project Planning, Scheduling and Control.

UNIT-V		9hrs
Safety Management – Implementation and Application of QMS in Safety Programs, ISO 9000 Series, Accident Theories, Cost of Accidents, Problem Areas in Construction Safety, Fall Protection, Incentives, Zero Accident Concepts, Planning for Safety, Occupational Health and Ergonomics.		

TEXT BOOKS:

1. Construction Project Management, SK. Sears, GA. Sears, RH. Clough, John Wiley and Sons, 6th Edition, 2016.
2. Construction Project Scheduling and Control by Saleh Mubarak, 4th Edition, 2019
3. Pandey, I.M (2021) Financial Management 12th edition. Pearson India Education Services Pvt. Ltd.

REFRENCE BOOKS:

1. Brien, J.O. andPlotnick, F.L., CPMin Construction Management, Mcgraw Hill, 2010.
2. Punmia, B.C., andKhandelwal, K.K., Project Planning and control with PERT and CPM, Laxmi Publications, 2002.
3. Construction Methods and Management: Pearson New International Edition 8 th Edition Stephens Nunnally.
4. Rhoden, M and Cato B, Construction Management and Organisational Behaviour, Wiley-Blackwell, 2016.

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/104/105104161/
https://archive.nptel.ac.in/courses/105/103/105103093/

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B.Tech III Year I semester

SUSTAINBLE ENERGY TECHNOLOGIES
(Open Elective-I)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0319T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course objectives:

The objectives of the course are to

1 demonstrate the importance the impact of solar radiation, solar PVmodules
2 understand the principles of storage in PV systems
3 discuss solar energy storage systems and their applications.
4 get knowledge in wind energy and bio-mass
5 gain insights in geothermal energy, ocean energy and fuel cells.

COURSE OUTCOMES

On successful completion of this course the student will be able to

CO1 Illustrate the importance of solar radiation and solar PV modules.L1, L2
CO2 Discuss the storage methods in PV systems L2,L3
CO3 Explain the solar energy storage for different applications L2,L3
CO4 Understand the principles of wind energy, and bio-mass energy. L2, L3
CO5 Attain knowledge in geothermal energy, ocean energy and fuel cells. L1, L2,L3, L4

UNIT-I **10hrs**

SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems.

SOLAR PV MODULES AND PV SYSTEMS:

PV Module Circuit Design, Module Structure, Packing Density, Interconnections, Mismatch and Temperature Effects, Electrical and Mechanical Insulation, Lifetime of PV Modules, Degradation and Failure, PV Module Parameters, Efficiency of PV Module, Solar PV Systems-Design of Off Grid Solar Power Plant. Installation and Maintenance.

UNIT-II **9hrs**

STORAGE IN PV SYSTEMS:

Battery Operation, Types of Batteries, Battery Parameters, Application and Selection of Batteries for Solar PV System, Battery Maintenance and Measurements, Battery Installation for PV System.

UNIT-III		**9hrs**

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating

collectors, orientation.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

UNIT-IV		**10hrs**

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

UNIT-V		**10hrs**

GEOTHERMAL ENERGY: Origin, Applications, Types of Geothermal Resources, Relative Merits.

OCEAN ENERGY: Ocean Thermal Energy; Open Cycle & Closed Cycle OTEC Plants, Environmental Impacts, Challenges.

FUEL CELLS: Introduction, Applications, Classification, Different Types of Fuel Cells Such as Phosphoric Acid Fuel Cell, Alkaline Fuel Cell, PEM Fuel Cell, MC Fuel Cell.

Text Books:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH
2. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006

References:

1. Principles of Solar Engineering - D.Yogi Goswami, Frank Krieth& John F Kreider / Taylor & Francis
2. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd
3. Renewable Energy Technologies -Ramesh & Kumar /Narosa
4. Non-conventional Energy Source- G.D Roy/Standard Publishers

Online Learning Resources:

https://nptel.ac.in/courses/112106318

https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=-mwIa2X-SuSiNy13 https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=Apfjx6oDfz1Rb_N3

https://youtu.be/zx04Kl8y4dE?si=VmOvp_OgqisILTAF

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B.Tech III Year I semester

ELECTRONIC CIRCUITS
(Open Elective –I)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0442T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

1. To understand semiconductor diodes, their characteristics and applications.
2. To explore the operation, configurations, and biasing of BJTs.
3. To study the operation, analysis, and coupling techniques of BJT amplifiers.
4. To learn the operation, applications and uses of feedback amplifiers and oscillators.
5. To analyze the characteristics, configurations, and applications of operational amplifiers.

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

1. Understand semiconductor diodes, their characteristics and applications.
2. Explore the operation, configurations, and biasing of BJTs.
3. Gain knowledge about the operation, analysis, and coupling techniques of BJT amplifiers.
4. Learn the operation, applications and uses of feedback amplifiers and oscillators.
5. Analyze the characteristics, configurations, and applications of operational amplifiers.

UNIT-I **10hrs**

Semiconductor Diode and Applications: Introduction, PN junction diode – structure, operation and VI characteristics, Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Positive and Negative Clipping and Clamping circuits (Qualitative treatment only).
Special Diodes: Zener and Avalanche Breakdowns, VI Characteristics of Zener diode, Zener diode as voltage regulator, Construction, operation and VI characteristics of Tunnel Diode, LED, Varactor Diode, Photo Diode .

UNIT-II **10hrs**

Bipolar Junction Transistor (BJT): Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch and Amplifier, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diodes.

UNIT-III **9hrs**

Single stage amplifiers: Classification of Amplifiers - Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model.
Multistage amplifiers: Different Coupling Schemes used in Amplifiers - RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier; Multistage RC coupled BJT amplifier (Qualitative treatment only)

UNIT-IV **9hrs**

Feedback amplifiers: Concepts of feedback, Classification of feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations (Qualitative treatment only).
Oscillators: Classification of oscillators, Condition for oscillations, RC Phase shift Oscillators, Generalized analysis of LC Oscillators-Hartley and Colpitts Oscillators, Wien Bridge Oscillator.

UNIT-V **10hrs**

Op-amp: Classification of IC'S, basic information of Op-amp, ideal and practical Op-amp, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.
Applications of op-amp : Summing, scaling and averaging amplifiers, Integrator, Differentiator, phase shift oscillator and comparator.

TEXT BOOKS:

1. Electronics Devices and Circuits, J.Millman and Christos. C. Halkias, 3rd edition, Tata McGraw Hill, 2006.
2. Electronics Devices and Circuits Theory, David A. Bell, 5th Edition, Oxford University press. 2008.

REFERENCE BOOKS:

1. Electronics Devices and Circuits Theory, R.L.Boylestad, LousisNashelsky and K.Lal Kishore, 12th edition, 2006, Pearson, 2006.
2. Electronic Devices and Circuits, N.Salivahanan, and N.Suresh Kumar, 3rd Edition, TMH, 2012
3. Microelectronic Circuits, S.Sedra and K.C.Smith, 5th Edition, Oxford University Press.

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B.Tech III Year I semester

JAVA PROGRAMMING
(Open Elective-I)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0545T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives: The main objective of the course is to Identify Java language components and how they work together in applications

- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java apisfor program development

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

CO1: Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.

CO2: Design and implement classes to model real-world entities, with a focus on attributes, behaviors, and relationships between objects

CO3: Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch.

CO4: Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.

CO5: Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX.

UNIT-I **10hrs**

Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style. Data Types, **Variables, and Operators :**Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, **Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT-II **10hrs**

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT-III **9hrs**

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super ClassObject Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding,

Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT-IV		**10hrs**

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs,

Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Autounboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

UNIT-V		**9hrs**

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings,Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter thread Communication - Suspending, Resuming, and Stopping of Threads. Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Textbooks:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Reference Books:

1. The complete Reference Java, 11thedition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Daniel Liang, Pearson

Online Learning Resources:

1. *https://nptel.ac.in/courses/106/105/106105191/*
2. *https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01288046454761881634 7 _shared/overv*iew

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B.Tech III Year I semester

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE
(Open Elective-I)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0546T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

- To learn the distinction between optimal reasoning Vs. human like reasoning.
- To understand the concepts of state space representation, exhaustive search, heuristic
- search together with the time and space complexities.
- To learn different knowledge representation techniques.
- To understand the applications of AI, namely game playing, theorem proving, and machine learning.

Course Outcomes:

- Learn the distinction between optimal reasoning Vs human like reasoning and formulate an efficient problem space for a problem expressed in natural language. Also select a search algorithm for a problem and estimate its time and space complexities.
- Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
- Learn different knowledge representation techniques.
- Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
- Comprehend the applications of Probabilistic Reasoning and Bayesian Networks.
- Analyze Supervised Learning Vs. Learning Decision Trees

UNIT-I **9hrs**

Introduction to AI - Intelligent Agents, Problem-Solving Agents,
Searching for Solutions - Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

UNIT-II **9hrs**

Games - Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, **Logic-** Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.

UNIT-III **10hrs**

First-Order Logic - Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.
Knowledge Representation: Ontological Engineering, Categories and Objects, Events.

UNIT-IV **10hrs**

Planning - Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning.

UNIT-V **10hrs**

ProbabilisticReasoning:

Acting under Uncertainty, Basic Probability Notation Bayes‘ Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First- Order Probability.

TEXT BOOK:

1. Artificial Intelligence: A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

REFERENCE BOOKS:

1. Artificial Intelligence, 3rd Edn., E. Rich and K. Knight (TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education.

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B.Tech III Year I semester

QUANTUM TECHNOLOGIES AND APPLICATIONS
Open Elective – I

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0547T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

- To introduce the fundamentals of quantum mechanics relevant to quantum technologies.
- To explain key quantum phenomena and their role in enabling novel technologies.
- To explore applications in quantum computing, communication, and sensing.
- To encourage understanding of emerging quantum-based technologies and innovations.

UNIT-I **10hrs**

Fundamentals of Quantum Mechanics (7 Hours)

- Classical vs Quantum Paradigm
- Postulates of Quantum Mechanics
- Wavefunction and Schrödinger Equation (Time-independent)
- Quantum states, Superposition, Qubits
- Measurement, Operators, and Observables
- Entanglement and Non-locality

UNIT-II **9hrs**

Quantum Computing

- Qubits and Bloch Sphere
- Quantum Logic Gates: Pauli, Hadamard, CNOT, and Universal Gates
- Quantum Circuits
- Basic Algorithms: Deutsch-Jozsa. Gover‘s, Shor‘s (conceptual)
- Error Correction and Decoherence

UNIT-III **10hrs**

Quantum Communication and Cryptography (7 Hours)

- Teleportation & No-Cloning
- BB84 Protocol
- Quantum Networks & Repeaters
- Classical vs Quantum Cryptography
- Challenges in Implementation

UNIT-IV **10hrs**

Quantum Sensors and Metrology

- Quantum Sensing: Principles and Technologies
- Quantum-enhanced Measurements
- Atomic Clocks, Gravimeters
- Magnetometers, NV Centers
- Industrial Applications

UNIT-V **9hrs**

Quantum Materials and Emerging Technologies

- Quantum Materials: Superconductors, Topological Insulators
- Quantum Devices: Qubits, Josephson Junctions
- National Quantum Missions (India, EU, USA, China)
- Quantum Careers and Industry Initiatives

Textbooks and References

Primary Textbooks:

- "Quantum Computation and Quantum Information" by Michael A. Nielsen and Isaac L. Chuang (Cambridge University Press)

- "Quantum Mechanics: The Theoretical Minimum" by Leonard Susskind and Art Friedman (Basic Books)

Supplementary Reading:

- "Quantum Computing for Everyone" by Chris Bernhardt (MIT Press)
- "Quantum Physics: A Beginner‘s Guide" by Alastair I.M. Rae
- "An Introduction to Quantum Computing" by Phillip Kaye, Raymond Laflamme, and Michele Mosca
- IBM Quantum Experience and Qiskit Documentation (https://qiskit.org/)

Course Outcomes

- Understand key quantum mechanical concepts and phenomena.
- Comprehend the structure and function of quantum algorithms and circuits.
- Explore applications in quantum communication and cryptography.
- Appreciate the role of quantum technologies in modern engineering systems.

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B.Tech III Year I semester

MATHEMATICS FOR MACHINE LEARNING AND AI
(Open Elective 1)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0027T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

- To provide a strong mathematical foundation for understanding and developing AI/ML algorithms.
- To enhance the ability to apply linear algebra, probability, and calculus in AI/ML models.
- To equip students with optimization techniques and graph-based methods used in AI applications.
- To develop critical problem-solving skills for analysing mathematical formulations in AI/ML.

Course Outcomes:

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

CO1	Apply linear algebra concepts to ML techniques like PCA and regression. (Apply)	L3
CO2	Analyze probabilistic models and statistical methods for AI applications. (Analyze)	L4
CO3	Implement optimization techniques for machine learning algorithms. (Apply)	L3
CO4	Utilize vector calculus and transformations in AI-based models. (Apply)	L3
CO5	Develop graph-based AI models using mathematical representations. (Evaluate)	L5

UNIT-I		**10hrs**

Linear Algebra for Machine Learning(08)

Review of Vector spaces, basis, linear independence, Vector and matrix norms, Matrix factorization techniques, Eigenvalues, eigenvectors, diagonalization, Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).

UNIT-II		**9hrs**

Probability and Statistics for AI(08)

Probability distributions: Gaussian, Binomial, Poisson. Bayes‘ Theorem, Maximum Likelihood Estimation (MLE), and Maximum a Posteriori (MAP).Entropy and Kullback-Leibler (KL) Divergence in AI, Cross entropy loss, Markov chains.

UNIT-III		**9hrs**

Optimization Techniques for ML(08)

Multivariable calculus: Gradients, Hessians, Jacobians. Constrained optimization: Lagrange multipliers and KKT conditions.Gradient Descent and its variants (Momentum, Adam) Newton‘s method, BFGS method.

UNIT-IV		**10hrs**

Vector Calculus & Transformations(08)

Vector calculus: Gradient, divergence, curl. Fourier Transform & Laplace Transform in ML applications.

UNIT-V		**10hrs**

Graph Theory for AI(08)

Graph representations: Adjacency matrices, Laplacian matrices. Bayesian Networks & Probabilistic Graphical Models. Introduction to Graph Neural Networks (GNNs).

Textbooks:

1. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press, 2020.
2. Pattern Recognition and Machine Learningby Christopher Bishop, Springer.

Reference Books:

1. Gilbert Strang, Linear Algebra and Its Applications, Cengage Learning, 2016.
2. Jonathan Gross, Jay Yellen, Graph Theory and Its Applications, CRC Press, 2018.

Web References:

- MIT– Mathematics for Machine Learning https://ocw.mit.edu
- Stanford CS229 – Machine Learning Course https://cs229.stanford.edu/
- DeepAI – Mathematical Foundations for AI https://deepai.org

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B.Tech III Year I semester

MATERIALS CHARACTERIZATION TECHNIQUES

(Common to all branches) (Open Elective-Interdisciplinary)

(Open Elective-I)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0034T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

COURSE OBJECTIVES

1 To provide exposure to different characterization techniques.
2 To explain the basic principles and analysis of different spectroscopic techniques.
3 To elucidate the working of Scanning electron microscope - Principle, limitations and applications.
4 To illustrate the working of the Transmission electron microscope (TEM) - SAED patterns and its applications.
5 To educate the uses of advanced electric and magnetic instruments for characterization.

UNIT-I	Structure analysis by Powder X-Ray Diffraction	10hrs

Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

UNIT-II	Microscopy technique -1 –Scanning Electron Microscopy (SEM)	10hrs

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

UNIT-III	Microscopy Technique -2 - Transmission Electron Microscopy (TEM)	9hrs

Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy

UNIT-IV	Spectroscopy techniques	10hrs

Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

UNIT-V	Electrical & Magnetic Characterization techniques	9hrs

Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.

Textbooks:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2013.
2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008

Reference Books:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville BanwellandElaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity& Stuart R Stocks, Prentice Hall

, 2001 – Science.
3. Practical Guide to Materials Characterization: Techniques and Applications - Khalid Sultan – Wiley – 2021.
4. **Materials Characterization Techniques -**Sam Zhang, Lin Li, Ashok Kumar -CRC Press - 2008

NPTEL courses link :

1. **https://nptel.ac.in/courses/115/103/115103030/**
2. **https://nptel.ac.in/content/syllabus_pdf/113106034.pdf**
3. **https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/**

Course Outcomes

CO1	Analyze the crystal structure and crystallite size by various methods L1,L2, L3, L4
CO2	Analyze the morphology of the sample by using a Scanning Electron Microscope L1,L2, L4
CO3	Analyze the morphology and crystal structure of the sample by using Transmission Electron Microscope L1,L2, L3
CO4	Explain the principle and experimental arrangement of various spectroscopic techniques L1,L2
CO5	Identify the construction and working principle of various Electrical & Magnetic Characterization technique L1,L2

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B.Tech III Year I semester

CHEMISTRY OF ENERGY SYSTEMS
(Open Elective-I)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0040T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

COURSE OBJECTIVES

1. To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
2. To understand the basic concepts of processing and limitations of Fuel cells & their applications.
3. To impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications
4. Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
5. To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method.

COURSE OUTCOMES

1. Solve the problems based on electrode potential, Describe the Galvanic Cell Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer
2. Describe the working Principle of Fuel cell, Explain the efficiency of the fuel cell
3. Discuss about the Basic design of fuel cells, Classify the fuel cell
4. Differentiate between Photo and Photo electrochemical Conversions, Illustrate the photochemical cells, Identify the applications of photochemical reactions, Interpret advantages of photoelectron catalytic conversion.
5. Apply the photo voltaic technology, Demonstrate about solar energy and prospects Illustrate the Solar cells, Discuss about concentrated solar power
6. Differentiate Chemical and Physical methods of hydrogen storage, Discuss the metal organic frame work, Illustrate the carbon and metal oxide porous structures Describe the liquification methods.

UNIT-I	Electrochemical Systems	10hrs

Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries- Introduction ,Lead-acid ,Nickel- cadmium, Lithium ion batteries and their applications.

UNIT-II	Fuel Cells	9hrs

Fuel cell- Introduction, Basic design of fuel cell, working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency and applications.

UNIT-III	Photo and Photo electrochemical Conversions	9hrs

Photochemical cells Introduction and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions and their applications.

UNIT-IV	Solar Energy	10hrs

Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications.

UNIT-V	Hydrogen Storage	10hrs

Hydrogen storage and delivery: State-of-the art, Established technologies, Chemical and Physical methods of hydrogen storage, Compressed gas storage, Liquid hydrogen storage, Other storage methods, Hydrogen storage in metal hydrides, metal organic frameworks (MOF), Metal oxide porous structures, hydrogel , and Organic hydrogen carriers.

Text books

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins

Reference Books:

1. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical services And corporation)
2. Hand book of solar energy and applications by ArvindTiwari and Shyam.
3. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
4. Hydrogen storage by Levine Klebonoff

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B.Tech III Year I semester

ENGLISH FOR COMPETITIVE EXAMINATIONS

(Open Elective-I)

(Common to All Branches of Engineering)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0044T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

1. To enable the students to learn about the structure of competitive English
2. To understand the grammatical aspects and identify the errors
3. To enhance verbal ability and identify the errors
4. To improve word power to answer competitive challenges
5. To make them ready to crack competitive exams

Course Outcomes (CO):

By the end of the program students will be able to

- Identify the basics of English grammar and its importance
- Explain the use of grammatical structures in sentences
- Demonstrate the ability to use various concepts in grammar and vocabulary and their applications in everyday use and in competitive exams
- Analyze an unknown passage and reach conclusions about it.
- Choose the appropriate form of verbs in framing sentences
- Develop speed reading and comprehending ability thereby perform better in competitive exams

UNIT - I	**GRAMMAR-1**	9hrs

Nouns-classification-errors-Pronouns-types-errors-Adjectives-types-errors-Articles-definite-indefinite-Degrees of Comparison-Adverbs-types- errors-Conjunctions-usage-repositions-usage-Tag Questions, types-identifying errors- Practice

UNIT - II	**GRAMMAR-2**	9hrs

Verbs-tenses- structure-usages- negatives- positives- time adverbs-Sequence of tenses--If Clause- Voice-active voice and passive voice- reported Speech-Agreement- subject and verb-Modals-Spotting Errors-Practices

UNIT - III	**VERBAL ABILITY**	10hrs

Sentence completion-Verbal analogies-Word groups-Instructions-Critical reasoning-Verbal deduction-Select appropriate pair-Reading Comprehension-Paragraph-Jumbles-Selecting the proper statement by reading a given paragraph.

UNIT - IV	**READING COMPREHENSION AND VOCUBULARY**	10hrs

Competitive Vocabulary :Word Building – Memory techniques-Synonyms, Antonyms, Affixes-Prefix &Suffix-One word substitutes-Compound words-Phrasal Verbs-Idioms and Phrases-Homophones-Linking Words-Modifiers-Intensifiers - Mastering Competitive Vocabulary- Cracking the unknowing passage-speed reading techniques- Skimming & Scanning-types of answering–Elimination methods

UNIT - V	**WRITING FOR COMPETITIVE**	10hrs

	EXAMINATIONS	

Punctuation- Spelling rules- Word order-Sub Skills of Writing- Paragraph meaning-salient features-types - Note-making, Note-taking, summarizing-precise writing- Paraphrasing-Expansion of proverbs-Essay writing-types

Textbooks:

1. **Wren & Martin, *English for Competitive Examinations*, S.Chand & Co, 2021**
2. *Objective English for Competitive Examination*, Tata McGraw Hill, New Delhi, 2014.

Reference Books:

1. Hari Mohan Prasad, *Objective English for Competitive Examination*, Tata McGraw Hill, New Delhi, 2014.
2. Philip Sunil Solomon, *English for Success in Competitive Exams*, Oxford 2016
3. Shalini Verma , *Word Power Made Handy*, S Chand Publications
4. Neira, Anjana Dev & Co. *Creative Writing: A Beginner's Manual.* Pearson Education India, 2008.
5. Abhishek Jain,Vocabulary Learning Techniques Vol.I&II,RR Global Publishers 2013.
6. Michel Swan, *Practical English Usage*,Oxford,2006.

Online Resources

1. **https://www.grammar.cl/english/parts-of-speech.htm**
2. **https://academicguides.waldenu.edu/writingcenter/grammar/partsofspeech**
3. **https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/active-passive-voice**
4. **https://languagetool.org/insights/post/verb-tenses/**
5. **https://www.britishcouncil.in/blog/best-free-english-learning-resources-british-council**
6. **https://www.careerride.com/post/social-essays-for-competitive-exams-586.aspx**

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B.Tech III Year I semester

ENTREPRENEURSHIP AND NEW VENTURE CREATION					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0051T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

COURSE OBJECTIVES: The objectives of this course are

1. To foster an entrepreneurial mind-set for venture creation and intrapreneurial leadership.
2. To encourage creativity and innovation
3. To enable them to learn pitching and presentation skills
4. To make the students understand MVP development and validation techniques to determine Product-Market fit and Initiate Solution design, Prototype for Proof of Concept.
5. To enhance the ability of analyzing Customer and Market segmentation, estimate Market size, develop and validate Customer Persona

UNIT-I	**Entrepreneurship Fundamentals and context**	**10hrs**

Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skill sets, attributes and networks while on campus.

Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16industries to choose from), Venture Activity

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand theconcept of Entrepreneur and Entrepreneurship in India
- Analyze recent trends in Entrepreneurship role in economic development
- Develop a creative mind set and personality in starting a business.

UNIT-II	**Problem & Customer Identification**	**10hrs**

Understanding and analysing the macro-Problem and Industry perspective - technological, socioeconomic and urbanization trends and their implication on new opportunities - Identifying passion - identifying and defining problem using Design thinking principles - Analysing problem and validating with the potential customer - Understanding customer segmentation, creating and validating customer personas.

Core Teaching Tool: Several types of activities including Class, game, Gen AI, _Get out of the Building‘ and Venture Activity.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand the problem and Customer identification.
- Analyze problem and validating with potential customer

Evaluate customer segmentation and customer personas

UNIT-III	**Solution design, Prototyping & Opportunity Assessment and Sizing**	**10hrs**

Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition - Understanding prototyping and Minimum Viable product (MVP) - Developing a feasibility prototype with differentiating value, features and benefits - Assess relative market position via competition analysis - Sizing the market and assess scope and potential scale of the opportunity.
Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

LEARNING OUTCOMES
At the end if the Unit, the learners will be able to
- Analyze jobs-to-be-done
- Evaluate customer needs to create a strong value proposition

UNIT-IV	**Business & Financial Model, Go-to-Market Plan**	**9hrs**

Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure – Lean approach.
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 financial template, understanding basics of Unit economics and analysing financial performance.
Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy.
Choosing a form of business organization specific to your venture, identifying sources of funds: Debt& Equity, Map the Start-up Life-cycle to Funding Options.
Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

UNIT-V	**Scale Outlook and Venture Pitch readiness**	**9hrs**

Understand and identify potential and aspiration for scale vis-a-vis your venture idea. Persuasive Storytelling and its key components. Build an Investor ready pitch deck.
Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

LEARNING OUTCOMES
At the end of the Unit, the learners will be able to
- Understand aspiration for scale
- Analyze venture idea and its key components

Evaluate and build investors ready pitch

TEXT BOOKS

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha Entrepreneurship, McGrawHill, 11th Edition.(2020)
2. Ries, E. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business,(2011).
3. Osterwalder, A., & Pigneur, Y. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons. (2010).

REFERENCES

1. Simon Sinek,Start with Why, Penguin Books limited. (2011)
2. Brown Tim,Change by Design Revised & Updated: How Design Thinking
3. Transforms Organizations and Inspires Innovation, Harper Business.(2019)
4. Namita Thapar (2022) The Dolphin and the Shark: Stories on Entrepreneurship, Penguin Books Limited
5. Saras D. Sarasvathy, (2008) Effectuation: Elements of Entrepreneurial Expertise, Elgar Publishing Ltd.

COURSE OUTCOMES: At the end of the course, students will be able to

CO1: Develop an entrepreneurial mindset and appreciate the concept of entrepreneurship

CO2: Comprehend the process of problem-opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution

CO3: Analyze and refine business models to ensure sustainability and profitability

CO4: Build Prototype for Proof of Concept and validate MVP of their practice venture idea

CO5: Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture

CO6: Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders

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B.Tech III Year I semester

POWER ELECTRONICS LAB
(Professional Core)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0223P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

COURSE OBJECTIVES:

1. This course is intended to acquire practical knowledge about the operation of various power converters.
2. To understand the basics of triggering circuits required for various power converters.

COURSE OUTCOMES:

CO1: Analyze the Characteristics of Power Semiconductor Devices (SCR, MOSFET, IGBT) and their Role in Power Converters. L4
CO2: Design and Implement Gate Firing Circuits for SCR-based Power Converters. L4
CO3: Evaluate the Performance of Single-phase and Three-phase Power Converters with R and RL Loads. L5
CO4: Apply Different Commutation Techniques to Analyze Inverter for Efficient Power Control. L3
CO5: Apply Different Commutation Techniques to Analyze Chopper Circuits for Efficient Power Control. L3

CHOOSE ANY TEN FROM THE FOLLOWING LIST:

1. Study of Characteristics of SCR, MOSFET & IGBT.
2. Gate firing circuits for SCR‘s: (a) R triggering (b) R-C triggering.
3. Single Phase AC Voltage Controller with R and RL Loads.
4. Single Phase fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E).
6. DC Jones chopper with R and RL Loads.
7. Single Phase Parallel inverter with R and RL loads.
8. Single Phase Cycloconverter with R and RL loads.
9. Single Phase Half controlled converter with R and RL load.
10. Single Phase Fully controlled converter with R and RL load.
11. Three Phase half-controlled bridge converter with R, RL-load.
12. Three Phase fully controlled bridge converter with R, RL-load.
13. Single Phase series inverter with R and RL loads.
14. Single Phase Bridge converter with R and RL loads.
15. Single Phase dual converter with RL loads.

References:

1. O.P. Arora, ―Power Electronics Laboratory: Theory, Practice and Organization (Narosa series in Power and Energy Systems)‖, Alpha Science International Ltd., 2007.
2. M. H. Rashid, ―Simulation of Electric and Electronic circuits using PSPICE‖, M/s PHI Publications.
3. PSPICE A/D user‘s manual – Microsim, USA.
4. PSPICE reference guide – Microsim, USA. 5. MATLAB and its Tool Books user‘s manual and – Math works, USA.

Online Learning Resources/Virtual Labs:

http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php

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B.Tech III Year I semester

ANALOG AND DIGITAL CIRCUITS LAB					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0447P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

1. To study the characteristics and applications of semiconductor diodes and transistors.
2. To design and analyze rectifiers, amplifiers, and oscillator circuits.
3. To implement basic Op-Amp applications. and implement combinational and sequential logic circuits.
4. To utilize universal gates for logic circuit realization and clock generation.
5. To design and implement essential digital components like adders, multiplexers, flip-flops, encoders, and decoders.

Course Outcomes:

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

1. Interpret the characteristics of diodes and transistors for circuit design. **L3**
2. Construct and evaluate rectifiers, amplifiers, and oscillator circuits**. L3**
3. Implement basic Op-Amp applications, combinational and sequential circuits using logic gates**. L4**
4. Design digital systems using universal gates, multiplexers, and comparators. **L4**
5. Develop and realize fundamental digital components such as adders, converters, flip-flops, encoders, and decoders. **L4**

ANALOG CIRCUITS

List of Experiments: (Any 06 Experiments are to be conducted)

1. CB Characteristics
2. CE Characteristics
3. CE Amplifier
4. CC Amplifier
5. Clippers
6. Clampers
7. Hartley & Colpitt‘s Oscillators.
8. RC Phase shift oscillator
9. Astable multivibrator
10. Monostable multivibrator
11. A to D Convertor
12. D to A Convertor
13. Op-Amp Applications-Adder, subtractor, comparator

DIGITAL CIRCUITS

List of Experiments: (Any 6 Experiments are to be conducted)

1. Realization of Boolean Expressions using Gates
2. Design and realization of logic gates using universal gates
3. Generation of clock using NAND / NOR gates
4. Design a 4 – bit Adder / Subtractor
5. Design and realization of a 4 – bit Gray to Binary and Binary to Gray Converter
6. Design and realization of 8x1 MUX using 2x1 MUX
7. Design and realization of 4 bit comparator
8. Design and realization of Flip-Flops.
9. Design and realization of Encoders
10. Design and realization of Decoders
11. Design and realization of Comparator.

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B.Tech III Year I semester

SOFT SKILLS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0026P	**0: 1:2:0**	**2**	**CIE: 30 SEE:70**	**3 Hours**	**SEC**

Pre-requisite Course Objectives:

1. To encourage all round development of the students by focusing on soft skills
2. To make the students aware of critical thinking and problem-solving skills
3. To enhance healthy relationship and understanding within and outside an organization
4. To function effectively with heterogeneous teams

Course Outcomes (CO):

COs	**Statements**
CO1	List out various elements of soft skills L1, L2,
CO2	Describe methods for building professional image L1, L2
CO3	Apply critical thinking skills in problem solving L3
CO4	Analyse the needs of an individual and team for well-being L4
CO5	Assess the situation and take necessary decisions L5
CO6	Create a productive work place atmosphere using social and work-life skills ensuring personal and emotional well-being L6

UNIT-I	Soft Skills & Communication Skills	8hrs

Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills - Significance, process, types - Barriers of communication - Improving techniques

Activities:

Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.

Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

UNIT-II	**Critical Thinking**	6hrs

Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking - Positive thinking – Reflection

Activities:

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale –

evaluating the views of others - Case Study, Story Analysis

UNIT-III	**Problem Solving & Decision Making**	6hrs

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles

Activities:
Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision.

Case Study & Group Discussion

UNIT-IV	**Emotional Intelligence & Stress Management**	6hrs

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

Activities:
Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations.

Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT-V	**Corporate Etiquette**	6hrs

Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette -Corporate grooming tips - Overcoming challenges

Activities
Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games

NOTE-:

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear.

Prescribed Books:

1. Mitra Barun K, *Personality Development and Soft Skills*, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, *Personality Development and Soft Skills: Preparing for Tomorrow,* I K International Publishing House, 2018

Reference Books

1. Sharma, Prashant, *Soft Skills: Personality Development for Life Success,* BPB Publications 2018.
2. Alex K,*Soft Skills*S.Chand& Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan& Sangeetha Sharma,*Soft Skills: An Integrated Approach to Maximise Personality*Published by Wiley, 2013

4. Pillai, Sabina & Fernandez Agna, *Soft Skills and Employability Skills*, Cambridge University Press, 2018
5. Dr. Rajiv Kumar Jain, Dr. Usha Jain,*Life Skills*(Paperback English)Publisher : Vayu Education of India, 2014

Online Learning Resources:

1. **https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y- bOO1_q**
2. **https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7 KlJ**
3. **https://youtu.be/-Y-R9hDl7lU**
4. **https://youtu.be/gkLsn4ddmTs**
5. **https://youtu.be/2bf9K2rRWwo**
6. **https://youtu.be/FchfE3c2jzc**
7. **https://www.businesstrainingworks.com/training-resource/five-free- business-etiquette-training-games/**
8. **https://onlinecourses.nptel.ac.in/noc24_hs15/preview**
9. **https://onlinecourses.nptel.ac.in/noc21_hs76/preview**

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B.Tech III Year I semester

TINKERING LAB					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0420	**0: 0:2:0**	**1**	**CIE: 30 SEE:70**	**3 Hours**	**ESC**

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

Course objectives: The objectives of the course are to

1 Encourage Innovation and Creativity
2 Provide Hands-on Learning and Impart Skill Development
3 Foster Collaboration and Teamwork
4 Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship
5 Impart Problem-Solving mind-set

These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

List of experiments:

1) Make your own parallel and series circuits using breadboard for any application of your choice.
2) Design and 3D print a Walking Robot
3) Design and 3D Print a Rocket.
4) Temperature & Humidity Monitoring System (DHT11 + LCD)
5) Water Level Detection and Alert System
6) Automatic Plant Watering System
7) Bluetooth-Based Door Lock System
8) Smart Dustbin Using Ultrasonic Sensor
9) Fire Detection and Alarm System
10) RFID-Based Attendance System
11) Voice-Controlled Devices via Google Assistant
12) Heart Rate Monitoring Using Pulse Sensor
13) Soil Moisture-Based Irrigation
14) Smart Helmet for Accident Detection
15) Milk Adulteration Detection System
16) Water Purification via Activated Carbon
17) Solar Dehydrator for Food Drying
18) Temperature-Controlled Chemical Reactor
19) Ethanol Mini-Plant Using Biomass
20) Smart Fluid Flow Control (Solenoid + pH Sensor)
21) Portable Water Quality Tester
22) AI Crop Disease Detection
23) AI-based Smart Irrigation
24) ECG Signal Acquisition and Plotting
25) AI-Powered Traffic Flow Prediction
26) Smart Grid Simulation with Load Monitoring
27) Smart Campus Indoor Navigator

28) Weather Station Prototype
29) Firefighting Robot with Sensor Guidance
30) Facial Recognition Dustbin
31) Barcode-Based Lab Inventory System
32) Growth Chamber for Plants
33) Biomedical Waste Alert System
34) Soil Classification with AI
35) Smart Railway Gate
36) Smart Bin Locator via GPS and Load Sensors
37) Algae-Based Water Purifier
38) Contactless Attendance via Face Recognition

- **Note:** The students can also design and implement their own ideas, apart from the list of experiments mentioned above.
- **Note:** A minimum of 8 to 10 experiments must be completed by the students.

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B.Tech III Year I semester

Evaluation of Community Service Internship					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0224	**0: 0:0:0**	**2**			

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B.Tech III Year II semester

Department of Electrical and Electronics Engineering

Course Structure (RG23)

B.Tech III Year II semester

Sl. No.	Category	CourseCode	Course Title	Hours per week			Credits
				L	T	P	C
1.	Professional Core	23A0225T	Electrical Measurements and Instrumentation	3	0	0	3
2.	Professional Core	23A0416T	Microprocessors and Microcontrollers	3	0	0	3
3.	Professional Core	23A0226T	Power System Analysis	3	0	0	3
4.	Professional Elective-II	23A0227T 23A0228T 23A0229T	1. AI&ML for Electrical Engineering 2. Programmable Logic Controllers 3. Switchgear and Protection	3	0	0	3
5.	Professional Elective-III	23A0448T 23A0230T 23A0231T	1. Communication systems 2. Electric Drives 3. Renewable and Distributed Energy Technologies	3	0	0	3
6.	Open Elective - II			3	0	0	3
7.	Professional Core	23A0233P	Electrical Measurements and Instrumentation Lab	0	0	3	1.5
8.	Professional Core	23A0415P	Microprocessors and Microcontrollers Lab	0	0	3	1.5
9.	Skill Enhancement course	23A0234P	Applications of Soft Computing Tools in Electrical Engineering	0	1	2	2
10.	Audit Course	23A0053T	Technical paper Writing & IPR	2	0	0	-
						Total credits	**23**

Mandatory Industry Internship of 08 weeks duration during summer vacation

Open Elective – II

S.No.	Course Code	Course Name	Offered by the Dept.
1	23A0150T	Disaster Management	Civil
2	23A0151T	Sustainability In Engineering Practices	
3	23A0334Tb	Automation and Robotics	ME
4	23A0443T	Digital Electronics	ECE
5	23A0548T	Fundamentals of Operating Systems	CSE& Allied/IT
6	23A0529T	Machine Learning	
7	23A0030T	Optimization Techniques for Engineers	Mathematics
8	23A0029T	Mathematical Foundation Of Quantum Technologies	
9	23A0035T	Physics Of Electronic Materials And Devices	Physics
10	23A0041T	Chemistry Of Polymers And Applications	Chemistry
11	23A0045T	Academic Writing and Public Speaking	Humanities

Member Secretary **BOS Chairman**

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B.Tech III Year II semester

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION
(Professional Core)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0225T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

1. To study about the working principle of electrical measuring instruments
2. To study the performance of instrumental transformers, power factor, frequency and energy meters To study the functioning of DC and AC bridges
3. To study the basics of digital volt meters and transducers
4. To understand the concept of sensors and data acquisition systems

Course Outcomes:

CO1 Understand principle and working of electrical measuring instruments
CO2 Understand the principle of operation of instrument transformers, energy meters and analog instruments
CO3 Understand the principle and working of various DC and AC bridges for the measurement of Resistance, Inductance and Capacitance.
CO4 Understand the principle and working of different digital voltmeters and transducers.
CO5 Understand the working of various sensors and data acquisition systems.

UNIT-I	Measuring instruments & Digital Meters:	10hrs

Fundamentals: True Value, Errors (Gross, Systematic, Random); Static Characteristic of Instruments (Accuracy, Precision, Sensitivity, Resolution & threshold); Error Analysis- Simple problems; Statistical treatment of data-Simple problems.

Indicating Instruments: Three forces in Electromechanical indicating instrument (Deflecting, controlling & damping forces); Moving iron type (attraction and repulsion), PMMC, Electrodynamometer Type instruments: Torque equation (Expression only, no derivation), shape of scale – simple problems on torque equations; Measurement of voltage and current - Extension of Range of ammeter and voltmeter – problems on extension of range of ammeter and voltmeter.

UNIT-II	Measurement Of Power, Power Factor And Energy	10hrs

Instrument transformers: Types, CT and PT – Ratio and phase angle errors; (Expression only, no derivation)
Measurement of power: Principle and Operation of Single-phase dynamometer wattmeter, expression (Expression only no derivation) for deflecting and control torques, errors and compensations.
Measurement of power factor: Principle and operation of Single-phase Electrodynamometer Power factor meter.
Measurement of Frequency: Principle and Operation of single phase frequency meter- vibrating reed type,
- ferro dynamic type meter.
Measurement of Energy: Principle and Operation of Single phase induction type energy meter, driving and braking torques (expression only no derivation), errors and compensations, testing by phantom loading.

UNIT-III	D.C&A.C Bridges	10hrs

Measurement of Resistance: Methods of measuring low, medium and high resistances –Sensitivity of Whetstone‘s bridge– Kelvin‘s double bridge for Measuring low resistance, Megger for measurement of

high resistance.

Measurement of Inductance: - Maxwell's bridge, Anderson's bridge.

Measurement of Capacitance: De Sauty bridge. Wien's bridge–Scheringbridge–Numerical problems.

UNIT-IV	Digital Volt Meters And Transducers	**9hrs**

Digital Voltmeters: Ramp type, Dual Slope integrating type, successive approximation, Potentiometric type DVMs.

Classification of transducers: Active/passive, analog/digital- Strain Gauge-gauge factor (Elementary treatment only)-applications of strain gauge, Q-Meter.

UNIT-V	Transducers, Sensors and Data Acquistion	**9hrs**

Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle Operation of Resistor, Inductor and Capacitive Transducers; LVDT and its Applications, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Piezo Electric Transducers, Photo electric Transducers, Hall effect, Photo Diodes. Optocoupler.

Silicon based micro sensors: Pressure sensor, Gyro sensor, Accelerometer, Flow sensor, Proximity sensor, Temperature sensor, Humidity sensor. (Elementary treatment only)

Introduction to PLC and SCADA Systems: Data acquisition systems (DAS) and interfacing techniques.

Text Books:

1. Electrical & Electronic Measurement & Instruments by A.K. Sawhney Dhanpat Rai & Co. Publications, 2007.
2. Electrical Measurements and measuring Instruments–by E.W.Golding and F.C. Widdis, 5th Edition, Reem Publications, 2011.
3. Buckingham and Price, ―Electrical Measurements‖, Prentice – Hall

Reference Books:

1. Electronic Instrumentation by H.S.Kalsi,Tata Mcgrawhill, 3rd Edition, 2011.
2. Electrical Measurements: Fundamentals, Concepts, Applications–by Reissl and, M.U, New Age International (P) Limited, 2010.
3. Electrical & Electronic Measurement & Instrumentation by R.K.Rajput, 2nd Edition, S. Chand & Co., 2nd Edition, 2013.
4. Sensor Technology: Hand Book by JonS. Wilson, ELSEVIER publications,2005

Online Learning Resource:

1. https://onlinecourses.nptel.ac.in/noc22_ee112/preview

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B.Tech III Year II semester

MICROPROCESSORS AND MICROCONTROLLERS
(Professional Core)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0416T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

1. To comprehend the architecture, operation, and configurations of the 8086 microprocessors.
2. To get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
3. To study the interfacing of 8086 with memory, peripherals, and controllers for various applications.
4. To learn the architecture, instruction set, and programming of the 8051 microcontrollers.
5. To understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

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

1. Gain knowledge on the architecture, operation, and configurations of the 8086 microprocessors. **L1**
2. Get familiar with 8086 programming concepts, instruction set, and assembly language development tools. **L2**
3. Know the interfacing of 8086 with memory, peripherals, and controllers for various applications. **L2**
4. Learn the architecture, instruction set, and programming of the 8051 microcontrollers. **L2**
5. Understand microcontroller interfacing techniques, peripheral programming,

UNIT-I	**8086 Architecture**	**9hrs**
Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.		
UNIT-II	8086 Programming	10hrs
Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.		
UNIT-III	8086 Interfacing	10hrs
Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.		
UNIT-IV		9hrs
Microcontroller - Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.		
UNIT-V		10hrs
Interfacing Microcontroller - Programming 8051 Timers - Serial Port Programming - Interrupts		

Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

Textbooks:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rdEdition,1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

References:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.

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B.Tech III Year II semester

POWER SYSTEM ANALYSIS
(Professional Core)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0226T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

1. The use of per unit values and graph theory concepts, solving a problem using computer.
2. Formation of Ybus and Zbus of a Power System network, power flow studies by various methods.
3. Different types of faults and power system analysis for symmetrical and also unsymmetrical faults.
4. Analysis of power system for steady state and transient stability and also methods to improve stability

Course Outcomes:

CO1: Remember and understand the concepts of per unit values, Y Bus and Z bus formation, load flow studies, symmetrical and unsymmetrical fault calculations. L1

CO2: Apply the concepts of good algorithm for the given power system network and obtain the converged load flow solution and experiment some of these methods using modern tools and examine the results. L4

CO3: Analyse the symmetrical faults and unsymmetrical faults and done the fault calculations, analyse the stability of the system and improve the stability.. L3

CO4: Demonstrate the use of these techniques through good communication skills L5

CO5: Develop accurate algorithms for different networks and determine load flow studies and zero, positive and negative sequence impedances to find fault calculations L5

UNIT-I	**PER-UNIT System and Ybus Formation**	**10hrs**

Per-Unit representation of Power system elements - Per-Unit equivalent reactance network of a three phase Power System - Graph Theory: Definitions, Bus Incidence Matrix, YBus formation by Direct and Singular Transformation Methods, Numerical Problems.

UNIT-II	**Formation of Zbus**	10hrs

Formation of ZBus: Partial network, Algorithm for the Modification of ZBus Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses - Modification of ZBusfor the changes in network

UNIT-III	**Power Flow Analysis**	9hrs

Static load flow equations – Load flow solutions using Gauss Seidel Method: Algorithm and Flowchart. Acceleration Factor, Load flow Solution for Simple Power Systems (Max. 3-Buses): Newton Raphson Method in Polar Co-Ordinates Form: Load Flow Solution- Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods

UNIT-IV	**Short Circuit Studies**	10hrs

Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors. Symmetrical Component Theory: Positive, Negative and Zero sequence components, Positive, Negative and Zero sequence Networks. Symmetrical Fault Analysis: LLLG faults with and without fault impedance, Unsymmetrical Fault Analysis: LG, LL and LLG faults with and without fault impedance, Numerical

Problems.		
UNIT-V	**Stability Analysis**	9hrs

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical methods for solution of swing equation - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

Textbooks:

1. Computer Methods in Power System Analysis by G.W.Stagg and A.H.El-Abiad, Mc Graw-Hill, 2006.
2. Modern Power system Analysis by I.J.Nagrath&D.P.Kothari, Tata McGraw-Hill Publishing Company, 4th Edition, 2011.

Reference Books:

1. Power System Analysis by Grainger and Stevenson, McGraw Hill, 1994.
2. Power System Analysis by Hadi Saadat, McGraw Hill, 1998.
3. Power System Analysis and Design by B.R.Gupta, S. Chand & Company, 2005.

Online Learning Resource:

https://onlinecourses.nptel.ac.in/noc22_ee120/preview

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B.Tech III Year II semester

AI & ML FOR ELECTRICAL ENGINEERS
(Professional Elective-II)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0227T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PEC**

Course Outcomes:

CO1: Understanding the Basics and Architecture of Artificial Intelligence -L1
CO2: Analyzing and Applying Artificial Neural Networks (ANN) Concepts -nL3
CO3: Implementing ANN Applications in Real-World Problems -L5
CO4: Understanding and Applying Fuzzy Logic Concepts -L2
CO5: Designing and Implementing Fuzzy Logic Applications -L5

UNIT-I	**Introduction to Artificial Intelligence**	**10hrs**

Introduction and motivation - Approaches to AI - Architectures of AI - Symbolic Reasoning System - Rule based Systems - Knowledge Representation - Expert Systems.

UNIT-II	**Overview of Machine Learning**	9hrs

The Motivation & Applications of Machine Learning: Learning Associations, Classification, Regression; Supervised Learning; Unsupervised Learning; Reinforcement Learning; Gradient Descent: Batch Gradient Descent, Stochastic Gradient Descent; Data pre processing; Under fitting and Overfitting issues

UNIT-III	**Artificial Neural Networks**	10hrs

Basics of ANN - Comparison between Artificial and Biological Neural Networks - Basic Building Blocks of ANN - Artificial Neural Network Terminologies - McCulloch Pitts Neuron Model - Learning Rules - ADALINE and MADALINE Models - Perceptron Networks (Continuous and Discrete) – Perceptron Convergence Theorem - Back Propagation Neural Networks - Associative Memories – BAM and Hopfield networks.

UNIT-IV	**Fuzzy Logic**	9hrs

Classical Sets - Fuzzy Sets - Fuzzy Properties, Operations and relations - Fuzzy Logic System - Fuzzification - Defuzzification - Membership Functions - Fuzzy Rule base - Fuzzy Logic Controller Design.

UNIT-V	**Applications of AI Techniques**	10hrs

Load forecasting, Load flow studies, Economic load dispatch, Speed control of DC Motor, Speed Control of Induction Motors.

Text Books:

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Neural Networks using MATLAB", McGraw Hill Edition, 2006.

References:

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer International Edition, 2013.
2. Yung C. Shin and Chengying Xu, "Intelligent System - Modeling, Optimization & Control, CRC Press, 2009.
3. Kevin P. Murphy, ―Machine Learning: A Probabilistic Perspective‖, MIT Press, 2012

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B.Tech III Year II semester

PROGRAMMABLE LOGIC CONTROLLERS
(Professional Elective-II)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0228T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PEC**

Course Objectives:

The student will be able to:

1. Understand the basic functions and types of PLCs, Easy Veep software, its applications
2. Understand Classification of PLCs and applications
3. Design PLC Programming for various applications
4. Analyze PLC Troubleshooting aspects

Course Outcomes:

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

CO1: Understand different types of PLCs, Its classification and the usage of Easy Veep software- L2

CO2: Analyze the hardware details of Allen Bradley PLC -L3

CO3: Design PLC Programming for various applications – L5

CO4: Apply PLC programming concepts in different fields of Science and Technology -L4

CO5: Develop Instruction using ADD and SUB functions, UP and Down counters – L5

UNIT-I	Introduction to PLCs	**10hrs**

Basic functions of PLCs, Mechanical relays versus PLC, Different types of PLC‘s – Allen-Bradley – Micrologix: ML1000, ML1100, SLC500, Compact Logix, Mitsubishi FX series, HMI‘s, Processor and I/O cards

UNIT-II	PLC Computational Tool	9hrs

Introduction to Easy Veep software, Link between mechanical, electrical and programming documentation, Logic diagrams, Flip-Flop Logic, M8000, M8001 internal bits interpretation, Binary code, data table, manipulation and search engine in Mitsubishi environment Communication between PC and PLC, Communication between PC and HMI, PLC and HMI Serial Local network, Introduction to SLC500

UNIT-III	PLC Development	10hrs

PLC software and applications, Boolean algebra – understanding binary code, ADD and SUB functions, UP and Down Counters, Introduction to k1Y0, MOV function, CPR and ZCP functions, SHWT and SHRD instructions, Introduction to Absolutely Drum Instruction.Allen Bradley PLC: Introduction to Rockwell Software, Hardware focus, Hardware considerations (Field wiring, Master Control Relay, VFD),

Basic programming and applications, Cascade control – subroutine, Different programs.

UNIT-IV	PLC Programming	9hrs

Programming instructions: Instructions and binary interpretation, Bit Instruction, Timers and

counters, Comparison instructions, Programming Instructions - Math instructions, Move and Logical Instructions, Discussions of programming, communications for PLC-Robotic arm, Exercise of setup and monitoring.		
UNIT-V	Applications	10hrs
Analog and Digital parameters by using SLC5/03-VFD-Panel Mate series 1700, Practical Troubleshooting, troubleshooting technique, Control system stability and tuning basics. Applications: Process to rewind, test, and integrate with extrusion process for wiring and fibre optic industries, Food industry – yeast, flour distribution and control. Process Medical equipment Industry – Gas analyzer, Leak tester (using CO2), plastic wrapping machines etc.		

Textbooks:

1. Automating manufacturing systems with PLCs by Hugh Jack, 2010.
2. PLC Hand Book (Automationdirect Siemens)

Reference Books:

1. Programmable Logic Controllers by R. Bliesener, F Ebel, Festo. Didactic publishers, 2002.
2. Programmable Logic Controllers by W. Bolton, 4th Edition, Newnes, 2006.
3. Introduction to PLCs by Jay F. Hooper, 2nd Edition, Carolina Academic Press, 2006.

Online Learning Resources:

https://nptel.ac.in/courses/108105088

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B.Tech III Year II semester

SWITCHGEAR AND PROTECTION
(Professional Elective-II)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0229T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Outcomes (CO):
After completing the course, the student should be able to do the following:

CO1: Understand the operation of different circuit breakers and their specifications. **-L2**

CO2: Analyze the concepts of different relays which are used in real time power system operation. **-L3**

CO3: Apply various protective schemes for Transformers, Rotating machines**. L4**

CO4: Explain different protective schemes used for Bus bars and Feeders. **L3**

CO5: Understand the methods of protection against over voltages and importance of neutral grounding. **L2**

UNIT-I	**Circuit Breakers**	**10hrs**

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages - Restriking Phenomenon, Average, Max. RRRV, Current Chopping and Resistance Switching - CB ratings and Specifications, Selection of CB: Types and Numerical Problems. – Auto reclosures. Description and Operation of- Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

UNIT-II	**Electromagnetic, Static and Numerical**	10hrs

Basic Requirements of Relays – Primary and Backup protection - Construction details of – Attracted armature, balanced beam, inductor type and differential relays – Universal Torque equation – Characteristics of over current, Direction and distance relays. Static Relays – Advantages and Disadvantages – Definite time, Inverse and IDMT static relays – Comparators – Amplitude and Phase

UNIT-III	**Protection of Generators and Transformers**	9hrs

Protection of generators: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on percentage winding unprotected. Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CTs Ratio, Buchholtz relay Protection.

UNIT-IV	**Protection of Feeders, Transmission Lines and Busbars**	10hrs

Protection of Feeders (Radial & Ring main) using over current Relays. Protection of Transmission lines – 3 Zone protection using Distance Relays. Carrier current protection. Protection of Bus bars - Differential protection, Differential Pilot wire protection.

UNIT-V	Protection Against Over Voltages	9hrs
Generation of Over Voltages in Power Systems. -Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL. Neutral Grounding, Grounded and Ungrounded Neutral Systems. - Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance – Arcing Grounds and Grounding Practices.		
Textbooks: 1. Switchgear and Protection – by Sunil S Rao, Khanna Publishers. 2. Power System Protection and Switchgear by Badari Ram, D.N Viswakarma, TMH Publications.		
Reference Books: 1. Protective Relaying Principles and Applications – J Lewis Blackburn, CRC Press. 2. Numerical Protective Relays, Final Report 2004 – 1009704 EPRI, USA. 3. Protective Relaying Theory and Applications - Walter A Elmore, Marcel Dekker. 4. Transmission network Protection by Y.G. Paithankar, Taylor and Francis, 2009. 5. Power System Protection- P. M. Anderson, Wiley Publishers. **Online Learning Resource:** https://onlinecourses.nptel.ac.in/noc22_ee101/preview		

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B.Tech III Year II semester

COMMUNICATION SYSTEMS

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0448T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

1. To understand the fundamentals of communication systems and amplitude modulation techniques.
2. To learn about the angle modulation techniques and bandwidth considerations in communication systems.
3. To gain knowledge on pulse analog modulation and multiple access techniques used in digital communication systems.
4. To examine pulse modulation and digital modulation techniques used in modern communication systems.
5. To study wireless communication systems, cellular networks, and GSM technology.

Course Outcomes:

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

1. Understand the fundamentals of communication systems and amplitude modulation techniques. **L1**
2. Learn about the angle modulation techniques and bandwidth considerations in communication systems
3. Gain knowledge on pulse analog modulation and multiple access techniques used in digital communication systems. **L3**
4. Get familiar with pulse modulation and digital modulation techniques used in modern communication systems.**L3**
5. Know about wireless communication systems, cellular networks, and GSM technology.**L2**

UNIT-I	Analog communication-I	**10hrs**

Elements of communication systems, need for Modulation, Modulation Methods, Baseband and carrier communication Amplitude Modulation (AM), Generation of AM signals, Rectifier detector, Envelope detector, sideband and carrier power of AM, Double side band suppressed carrier (DSB- SC) modulation & its demodulation, Switching modulators, Ring modulator, Balanced modulator, Single sideband (SSB) transmission, VSB Modulation.

UNIT-II	Analog communication-II : Angle Modulation & Demodulation	9hrs

Concept of instantaneous frequency Generalized concept of angle modulation, Bandwidth of angle modulated waves- Narrow band frequency modulation (NBFM); and Wide band FM (WBFM), Phase modulation, Pre-emphasis & De-emphasis, Illustrative Problems.

UNIT-III		10hrs

Digital communications-I (Qualitative Approach only): Pulse analog modulation techniques, Generation and detection of Pulse amplitude modulation, Pulse width modulation, Pulse position modulation

Multiple Access Techniques: Introduction to multiple access techniques, FDMA, TDMA, CDMA, SDMA: Advantages and applications

UNIT-IV	Digital communications-II (Qualitative	9hrs
Pulse Code Modulation, DPCM, Delta modulation, Adaptive delta modulation, Overview of ASK, PSK, QPSK, BPSK and M-PSK techniques.		
UNIT-V	**Wireless communications (Qualitative**	10hrs
Introduction to wireless communication systems, Examples of wireless communication systems, comparison of 2G and 3G cellular networks, Introduction to wireless networks, Differences between wireless and fixed telephone networks, Introduction to Global system for mobile (GSM), GSM services and features.		

TEXT BOOKS

1. H Taub, D. Schilling and Gautam Sahe, ―Principles of Communication Systems‖, TMH, 2007, 3rd Edition.
2. George Kennedy and Bernard Davis, ―Electronics & Communication System‖, 4th Edition, TMH 2009.

REFERENCE BOOKS

1. Simon Haykin, ―Principles of Communication Systems‖, John Wiley, 2nd Edition.
2. Sham Shanmugam, ―Digital and Analog communication Systems‖, Wiley-India edition,2006.
3. Theodore. S.Rapport, ―Wireless Communications‖, Pearson Education, 2nd Edition,2002.

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B.Tech III Year II semester

ELECTRIC DRIVES
(Professional Elective-III)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0230T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PEC**

Course Outcomes:

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

CO1: Evaluate the characteristics and operational aspects of drives operating in different modes.-**L3**

CO2: Analyze the operational aspects of various controlled rectifiers fed DC drives operating in different sustainable modes of operation.-**L3**

CO3: Analyze the operational aspects of various controlled chopper fed DC drives operating in different sustainable modes of operation**.-L3**

CO4: Analyze the operational aspects of various asynchronous motor drives operating in different sustainable modes of operation. **-L3**

CO5: Analyze the operational aspects of synchronous motor and stepper motor drives operating in different sustainable modes of operation**. -L3**

UNIT-I	Introduction To Electric Drives	**10hrs**

Electrical drives — block diagram, advantages of electric drive, parts of electric drives, choice of electrical drives, the status of DC and AC drives. Dynamics of electrical drives-fundamental torque equations, speed-torque conventions, and multi-quadrant operation; Equivalent values of drive parameters - loads with rotational and translational motion; Load torques — components, nature and classification. Concept of steady-state stability. Electric braking methods — regenerative, dynamic and plugging. Modes of operation of electrical drives — steady state, acceleration including starting and deceleration including stopping. Speed control and drive classifications, closed-loop control of drives — current limit control, torque control, speed control and position control (Block diagram only).

UNIT-II	Single-Phase and Three Phase Converter Fed DC Drives	9hrs

Control of DC separately excited motor by single-phase and three-phase half and full bridged converters — voltage and current waveforms for continuous and discontinuous conduction, speed-torque expressions and characteristics. Single phase half-controlled rectifier fed DC series motor — voltage and current waveforms for continuous and discontinuous conduction, speed-torque expressions and characteristics. Multi-quadrant operation of DC separately excited DC motor fed from fully controlled rectifier - mechanical reversible switch in armature, dual converter and field current reversal.

UNIT-III	DC Chopper Fed Drives	9hrs

Control of DC separately excited motor by one ,two and four quadrant choppers - voltage and current waveforms for continuous conduction (motoring, regenerative and dynamic braking), speed-torque expressions and characteristics. Chopper control of DC series motor—operation, speed-torque expressions and characteristics. Closed loop chopper control of separately excited DC motor (Block diagram only).

UNIT-IV	Induction Motor Drives	10hrs

Three phase induction motors — Introduction, Stator variable voltage control — speed-torque characteristics, AC voltage controllers and efficiency of induction motor under voltage control. Stator variable voltage and variable frequency control — slip speed control, torque-power limitations and modes of operation. Voltage Source Inverters (VSIs) and Current Source Inverters (CSIs) fed induction motor and closed loop operation of induction motor drives (Block diagram only).Comparison of VSI and CSI fed drives. Static rotor resistance control, slip power recovery schemes – static scherbius and kramer drive, speed-torque characteristics.

UNIT-V	**Synchronous and Stepper Motor Drives**	10hrs

Synchronous Motor Drives: Separate control and self-control of synchronous motors — operations of self-controlled synchronous motors by VSI and CSI. Load commutated CSI fed Synchronous motor—operation and speed torque characteristics. Closed loop control operation of synchronous motor drives (Block diagram only). Stepper Motor Drives: Variable reluctance and permanent magnet operation — features of stepper motor — torques Vs stepping rate characteristics and drive circuits. BLDC motor operation and control.

TEXT BOOKS:

1. Gopal K. Dubey, Fundamentals of Electric Drives, Narosa Publications, Alpha Science International Ltd, 2nd Edition, 2002.
2. M. H. Rashid (2003), Power Electronic Circuits, Devices and applications, 3rd edition, Prentice Hall of India, New Delhi, India.
3. Krishnan, Ramu. Electric motor drives: modeling, analysis, and control, 1st Edition, Pearson, 2015.

REFERENCE BOOKS:

1. M. D. Singh, K. B. Khanchandani (2008), Power Electronics, 2nd Edition, Tata McGraw Hill Publications, New Delhi.
2. VedamSubramanyam (2008), Thyristor Control of Electric drives, 1st Edition, Tata McGraw Hill Publications, New Delhi, India.
3. S. K. Pillai (2007), A First course on Electrical Drives, 2nd Edition, New Age International (P) Ltd.,NewDelhi
4. P.C. Sen, Principles of Electrical Machines and Power Electronics, Wiley, 3rdEdition, 2013.

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B.Tech III Year II semester

RENEWABLE AND DISTRIBUTED ENERGY TECHNOLOGIES
(Professional Elective-III)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0231T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PEC**

Course Objectives:

1. To This course explores each of the principal renewable energy sources in turn. Each technology is examined in terms of the relevant physical principles; the main technologies involved; environmental impact; the size of the potential renewable resource; and the future prospects of green energy.
2. This Distributed Generation course is intended to provide knowledge of the benefits of renewable energy generation, availability of distributed generation technology, electricity generation technologies, issues related to grid interconnection, and methods of analyzing the technical and economic feasibility.

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

CO1: Comprehend the renewable energy scenario, anticipate future energy demand and to understand the abstraction concept of electrical energy from Solar Energy. -**L3**

CO2: Understand the abstraction concept of electrical energy from wind, bio-mass and Tidal energy sources. -**L2**

CO3: Understand electrical energy storage along with working of Green Energy.-**L2**

CO4: Exemplify rudimentary idea of Distributed Generation.-**L3**

CO5: Comprehend the technical impact, control, and economic aspects of Distributed

UNIT-I	Energy Scenario and Solar Energy	**10hrs**

Introduction: Fundamentals of renewable energy sources, Types of energy, Renewable and Non-renewable energy, SWOT analysis, Global warming and climate change, World energy transformation by 2050, Prospects of renewable energy in the world, Renewable energy availability in India.

Solar Energy Fundamentals: Solar Spectrum, propagation of solar radiation from the sun to earth; solar radiation geometry: sun-earth geometry, extra-terrestrial and terrestrial radiation.

UNIT-II	Wind and Other Energy Systems	9hrs

Wind Energy: Air, Wind, Global and Local Wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Classification of wind energy conversion system (WECS)- Horizontal axis- single, double and multiblade system. Vertical axis- Savonius and darrieus types.

UNIT-III	Energy Storage and Green Energy	10hrs

Energy Storage: Stationary Battery Storage – Basics of Lead-Acid batteries, Battery Storage Capacity, Coulomb efficiency instead of energy efficiency, Battery Sizing. Different Battery storage technologies and comparison of their performance. Introduction to Super capacitors.

Green Energy: Historical Development, Basic Operation of a Fuel Cell, Fuel Cell Thermodynamics, Entropy and the theoretical efficiency of Fuel Cells, Gibbs Free Energy and Fuel Cell efficiency, Electrical output of an Ideal Cell, Electrical Characteristics of Real Fuel Cells, Types of Fuel Cells, H_2: Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy.

UNIT-IV	Introduction to DG and its Grid Integration	9hrs

Introduction: Need for Distributed generation, renewable sources in distributed generation, current scenario in Distributed Generation, Planning of DGs – Siting and sizing of DGs – optimal placement of DG sources in distribution systems.

Grid integration of DGs: Different types of interfaces - Inverter based DGs and rotating machine-based interfaces - Aggregation of multiple DG units. Energy storage elements: Batteries, ultracapacitors, flywheels

UNIT-V	**Technical Impact, Economic and Control aspects of DG**	9hrs

Technical impacts of DGs: Transmission systems, Distribution systems, De-regulation – Impact of DGs upon protective relaying – Impact of DGs upon transient and dynamic stability of existing distribution systems

Economic and control aspects of DGs: Market facts, issues, and challenges - Limitations of DGs. Voltage control techniques, Reactive power control, Harmonics, Power quality issues. Reliability of DG based systems – Steady-state and Dynamic analysis.

Text Book:

1. Muhammad Kamran, Muhammad Rayyan Fazal, "*Renewable Energy Conversion Systems*", First Edition, Elsevier Academic Press, 2021.
2. G. D. Rai, *Non-Conventional Sources of Energy*, Khanna Publisher, 2004

Reference Books:

1. G N Tiwari, *Solar Energy: Fundamentals, Design, Modeling and Applications*, Narosa, 2002.
2. Mukund R Patel, *Wind and Solar Power Systems: Design, Analysis, and Operation*, 2nd Edition, Taylor & Francis, 2006.
3. H. Lee Willis, Walter G. Scott, ―*Distributed Power Generation – Planning and Evaluation*‖, Marcel Decker Press, 2000.
4. Gilbert M. Masters, ―*Renewable and Efficient Electric Power Systems*‖, 2nd Edn., IEEE Press, Wiley, 2013.
5. N. Jenkins, J.B. Ekanayake and G. Strbac, ―*Distributed Generation*‖, 1st Edn, The Institution of Engineering and Technology, London, 2010.

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B.Tech III Year II semester

DISASTER MANAGEMENT
(Open Elective – II)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0150T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

The objectives of this course are to make the student :

1. To understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
2. To analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
3. To apply wind engineering principles and computational techniques in designing wind-resistant structures.
4. To evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
5. To assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

Course Outcomes:

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

1. Understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
2. Analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
3. Apply wind engineering principles and computational techniques in designing wind-resistant structures.
4. Evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
5. Assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

UNIT-I		**10hrs**

Introduction to Natural Disasters– Brief Introduction to Different Types of Natural Disasters, Occurrence of Disasters in Different Climatic and Geographical Regions, Hazard Maps (Earthquake and Cyclone) of The World and India, Regulations for Disaster Risk Reduction, Post-Disaster Recovery and Rehabilitation (Socioeconomic Consequences).

UNIT-II		9hrs

Cyclones and Their Impact– Climate Change and Its Impact On Tropical Cyclones, Nature of Cyclonic Wind, Velocities and Pressure, Cyclone Effects, Storm Surges, Floods, and Landslides. Behavior of Structuresin Past Cyclones and Windstorms, Case Studies. Cyclonic Retrofitting, Strengthening of Structures, and Adaptive Sustainable Reconstruction. Life-Line Structures Such as Temporary Cyclone Shelters.

UNIT-III		10hrs

Wind Engineering and Structural Response– Basic Wind Engineering, Aerodynamics of Bluff Bodies, Vortex Shedding, and Associated Unsteadiness Along and Across Wind forces. Lab: Wind Tunnel Testing and Its Salient Features. Introduction to Computational Fluid Dynamics (CFD). General Planning and Design Considerations Under Windstorms and Cyclones. Wind Effects On Buildings, towers, Glass Panels, Etc., and Wind-Resistant Features in Design. Codal Provisions, Design Wind Speed, Pressure Coefficients. Coastal Zoning Regulations for Construction and Reconstruction in Coastal Areas. Innovative Construction Materials and Techniques, Traditional Construction Techniques in Coastal Areas.

UNIT-IV		9hrs

Seismology and Earthquake Effects– Causes of Earthquakes, Plate Tectonics, Faults, Seismic Waves; Magnitude, Intensity, Epicenter, Energy Release, and Ground Motions. Earthquake Effects– On Ground, Soil Rupture, Liquefaction, Landslides. Performance of Ground and Buildings in Past Earthquakes– Behavior of Various Types of Buildings and Structures, Collapse Patterns; Behavior of Non-Structural Elements Such as Services, Fixtures, and Mountings – Case Studies. Seismic Retrofitting– Weakness in Existing Buildings, Aging, Concepts in Repair, Restoration, and Seismic Strengthening.

UNIT-V		10hrs

Planning and Design Considerations for Seismic Safety– General Planning and Design Considerations; Building forms, Horizontal and Vertical Eccentricities, Mass and Stiffness Distribution, Soft Storey Effects, Etc.; Seismic Effects Related to Building Configuration. Plan and Vertical Irregularities, Redundancy, and Setbacks. Construction Details– Various Types of Foundations, Soil Stabilization, Retaining Walls, Plinth Fill, Flooring, Walls, Openings, Roofs, Terraces, Parapets, Boundary Walls, Underground and Overhead Tanks, Staircases, and Isolation of Structures. Innovative Construction Materials and Techniques. Local Practices– Traditional Regional Responses. Computational Investigation Techniques.

TEXT BOOKS:

1. David Alexander, *Natural Disasters*, 1st Edition, CRC Press, 2017.
2. Edward A. Keller and Duane E. DeVecchio, *Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes*, 5th Edition, Routledge, 2019.

REFRENCE BOOKS:

1. Ben Wisner, J.C. Gaillard, andIlanKelman (Editors), *Handbook of Hazards and Disaster Risk Reduction and Management*, 2nd Edition, Routledge, 2012.
2. Damon P. Coppola, *Introduction to International Disaster Management*, 4th Edition, Butterworth- Heinemann, 2020.
3. BimalKanti Paul, *Environmental Hazards and Disasters: Contexts, Perspectives and Management*, 2nd Edition, Wiley-Blackwell, 2020.

Online Learning Resources:

https://nptel.ac.in/courses/124107010
https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

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B.Tech III Year II semester

SUSTAINABILITY IN ENGINEERING PRACTICES
(OE – II)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0151T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

The objectives of this course are to make the student :

1. To understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
2. To analyze sustainable construction materials, their durability, and life cycle assessment.
3. To apply energy calculations in construction materials and assess their embodied energy.
4. To evaluate green building standards, energy codes, and performance ratings.
5. To assess the environmental effects of energy use, climate change, and global warming.

Course Outcomes:

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

1. Understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
2. Analyze sustainable construction materials, their durability, and life cycle assessment.
3. Apply energy calculations in construction materials and assess their embodied energy.
4. Evaluate green building standards, energy codes, and performance ratings.Assess the environmental effects of energy use, climate change, and global warming.

UNIT-I	**INTRODUCTION**	**10hrs**

Introduction and Definition of Sustainability - Carbon Cycle - Role of Construction Material: Concrete and Steel, Etc. - CO_2Contribution From Cement and Other Construction Materials.

UNIT-II	**MATERIALS USED in SUSTAINABLE CONSTRUCTION**	**9hrs**

Construction Materials and Indoor Air Quality - No/Low Cement Concrete - Recycled and Manufactured Aggregate - Role of QC and Durability - Life Cycle and Sustainability.

UNIT-III	**ENERGY CALCULATIONS**	**9hrs**

Components of Embodied Energy - Calculation of Embodied Energy for Construction Materials - Energy Concept and Primary Energy - Embodied Energy Via-A-Vis Operational Energy in Conditioned Building - Life Cycle Energy Use

UNIT-IV	**GREEN BUILDINGS**	**10hrs**

Control of Energy Use in Building - ECBC Code, Codes in Neighboring Tropical Countries - OTTV Concepts and Calculations – Features of LEED and TERI – GRIHA Ratings - Role of Insulation and Thermal Properties of Construction Materials - Influence of Moisture Content and Modeling - Performance Ratings of Green Buildings - Zero Energy Building

UNIT-V	**ENVIRONMENTAL EFFECTS**	**10hrs**

Non-Renewable Sources of Energy and Environmental Impact– Energy Norm, Coal, Oil, Natural Gas - Nuclear Energy - Global Temperature, Green House Effects, Global Warming - Acid Rain: Causes, Effects and Control Methods - Regional Impacts of Temperature Change.

TEXTBOOKS:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016

REFERENCE BOOKS:

1. Craig A. Langston & Grace K.C. Ding, Sustainable Practicesin the Built Environment, Butterworth Heinemann Publishers, 2011.

2. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2012

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/105/105105157/

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B.Tech III Year II semester

AUTOMATION AND ROBOTICS
(Open Elective – II)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0334Tb	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course objectives: The objectives of the course are to

1. Fundamentals of industrial automation, production types, automation strategies, and hardware elements used in modern manufacturing processes.
2. Understanding of automated manufacturing systems, and strategies for improving productivity and flexibility in industrial automation.
3. Knowledge of industrial automation and robotics, sensors, and end-effector design for modern manufacturing environments.
4. Explain industrial automation and robotics, and trajectory planning for intelligent and efficient manufacturing applications.
5. Familiarity of industrial automation and robotics, and practical applications in manufacturing processes.

COURSE OUTCOMES On successful completion of this course the student will be able to

1. Understand and analyze the structure and functions of automated manufacturing systems, and evaluate hardware components for efficient production. *L2,L4,L5*
2. Analyze and design automated flow lines with or without buffer storage, perform quantitative evaluations, apply assembly line balancing techniques. L4,L5,L6
3. Classify robot configurations, select suitable actuators and sensors, analyze and apply automation and robotics principles to optimize production efficiency and flexibility. L2,L3,L4
4. Apply kinematic and dynamic modeling using D-H notation and select appropriate hardware and control strategies for real-world industrial scenario to analyze and design automated and robotic systems. L3,L4,L5
5. Assign, program, and implement robotic systems, understand and apply robotics technology to manufacturing tasks. L1,L3,L6

UNIT-I	**Introduction to Automation:**	**10hrs**

Introduction to Automation, Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

UNIT-II	**Automated flow lines**:	**10hrs**

Automated flow lines, Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines. Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT-III	**Introduction to Industrial Robotics:**	**9hrs**

Introduction to Industrial Robotics, Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers. Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

UNIT-IV	Manipulator Kinematics:	**9hrs**

Manipulator Kinematics, Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics.
Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton – Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

UNIT-V	**Robot Programming:**	**10hrs**

Robot Programming, Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages.
Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

Text Books:

1. Automation , Production systems and CIM,M.P. Groover /Pearson Edu.
2. Industrial Robotics - M.P. Groover, TMH.

References:

1. Robotics , Fu K S, McGraw Hill, 4th edition, 2010.
2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. Robotic Engineering , Richard D. Klafter, Prentice Hall
4. Robotics, Fundamental Concepts and analysis – Ashitave Ghosal ,Oxford Press, 1/e, 2006
5. Robotics and Control , Mittal R K &Nagrath I J , TMH.

Online Learning Resources:

https://www.youtube.com/watch?v=yxZm9WQJUA0&list=PLRLB5WCqU54UJG45UnazSYmnmhl-gt76o

https://www.youtube.com/watch?v=6f3bvIhSWyM&list=PLRLB5WCqU54X5Vy4DwjfSODT3ZJgwEjy

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B.Tech III Year II semester

DIGITAL ELECTRONICS
(Open Elective –II)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0443T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

1. To Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. To analyze combinational circuits like adders, subtractors, and code converters.
3. To explore combinational logic circuits and their applications in digital design.
4. To understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. To gain knowledge about programmable logic devices and digital IC‘s.

Course Outcomes:

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

1. Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. Analyze combinational circuits like adders, subtractors, and code converters.
3. Explore combinational logic circuits and their applications in digital design.
4. Understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. Gain knowledge about programmable logic devices and digital IC‘s.

UNIT-I	**Logic Simplification and Combinational Logic Design**	**10hrs**

Review of Boolean Algebra and De Morgan‘s Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT-II	**Introduction to Combinational Design 1**	**9hrs**

Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.

UNIT-III	**Combinational Logic Design 2**	**9hrs**

Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

UNIT-IV	**Sequential Logic Design**	**10hrs**

Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers.

UNIT-V	**Programmable Logic Devices**	**10hrs**

ROM, Programmable Logic Devices (PLA and PAL).

Digital IC’s: Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de-multiplexer (74x155), comparator (74x85).

TEXT BOOKS:

1. Digital Design, M.Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999.
2. Switching theory and Finite Automata Theory, ZviKohavi and NirahK.Jha, 2nd Edition, Tata McGraw Hill, 2005.

REFERENCE BOOKS:

1. Fundamentals of Logic Design, Charles H Roth,Jr., 5th Edition, Brooks/cole Cengage Learning, 2004.

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B.Tech III Year II semester

Fundamentals of Operating Systems (Open Elective-II)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0548T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives: The main objectives of the course is to make student

1. Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
2. Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
3. Illustrate different conditions for deadlock and their possible solutions.

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

1. Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication. (L1)
2. Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection. (L2)
3. Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system. (L3)
4. Illustrate different conditions for deadlock and their possible solutions. (L2) Analyze the memory management and its allocation policies. (L4)
5. Able to design and implement file systems, focusing on file access methods, directory structure, free space management, and also explore various protection mechanisms,

UNIT-I	**Operating Systems Overview, System Structures**	**10hrs**

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.

UNIT-II	**Process Concept, Multithreaded Programming, Process Scheduling, Inter-process**	**10hrs**

Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues, Examples. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples. Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem.

UNIT-III	**Memory-Management Strategies, Virtual Memory Management**	**9hrs**

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples.

UNIT-IV	**Deadlocks, File Systems**	**10hrs**

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection And recovery, Deadlock avoidance, Deadlock prevention. File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

UNIT-V	**System Protection, System Security**	**9hrs**

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows.

Textbooks:

1. Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2016.
2. Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (Topics: Inter-process Communication and File systems.)

Reference Books:

1. Tanenbaum A S, Woodhull A S, Operating Systems Design and Implementation, 3rd edition, PHI, 2006.
2. Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw Hill, 2012.
3. Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009
4. Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004

Online Learning Resources:

https://nptel.ac.in/courses/106/106/106106144/ http://peterindia.net/OperatingSystems.html

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B.Tech III Year II semester

MACHINE LEARNING
(Open Elective-II)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0529T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

1. To introduce the fundamental concepts and types of machine learning.
2. To develop a deep understanding of supervised and unsupervised learning algorithms.
3. To understand mathematical foundations of learning models and algorithms.
4. To evaluate model performance using appropriate statistical and analytical tools.
5. To apply machine learning techniques to solve real-world problems using tools such as Scikit-learn

Course Outcomes:

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

1. Understand and distinguish among different types of learning methods.
2. Apply supervised and unsupervised learning algorithms to datasets.
3. Analyze model performance using cross-validation and error metrics.
4. Build, test, and improve machine learning models for classification and prediction.
5. Use Python-based libraries (e.g., Scikit-learn) to implement ML algorithms.

UNIT-I	Introduction to Machine Learning and Linear Models	**10hrs**

Definition and Scope of Machine Learning, Applications and Types of Learning: Supervised, Unsupervised, Reinforcement, Linear Regression: Least Squares, Cost Function, Gradient Descent, Polynomial Regression and Overfitting, Evaluation Metrics: RMSE, MAE, R^2 Score, Bias-Variance Trade off.

UNIT-II	Classification Algorithms	**9hrs**

Classification Overview and Decision Boundaries, Logistic Regression: Sigmoid Function and Cost, K-Nearest Neighbors (KNN), Naïve Bayes Classifier, Decision Trees and Random Forests, Model Evaluation: Confusion Matrix, Precision, Recall, F1-Score.

UNIT-III	Support Vector Machines and Ensemble Methods	**9hrs**

Support Vector Machines: Concepts, Kernels, Hyperplane and Margin Concepts, Kernel Tricks: RBF and Polynomial, Ensemble Learning: Bagging, Boosting, and Voting, Gradient Boosting, AdaBoost, and XGBoost, Model Tuning and Hyperparameter Optimization.

UNIT-IV	Unsupervised Learning Techniques	**10hrs**

Clustering Overview: Applications, K-Means Clustering Algorithm, Hierarchical Clustering, DBSCAN and Density- Based Methods, Principal Component Analysis (PCA) for Dimensionality Reduction, Silhouette Score, Davies-Bouldin Index for Cluster Validation.

UNIT-V	**Advanced Topics and Applications**	**10hrs**

Reinforcement Learning Basics and Markov Decision Processes, Introduction to Neural Networks and Deep Learning, Cross-Validation Techniques: k-Fold, Leave-One-Out, Feature Engineering and Feature Selection, Deployment of ML Models (Flask, Streamlit, etc.), Case Studies: Medical Diagnosis, Spam Detection, Credit Scoring.

Textbooks:

1. Tom Mitchell, Machine Learning, McGraw-Hill Education.
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media.
3. Ethem Alpaydin, Introduction to Machine Learning, MIT Press

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer.
2. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press.
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer

Online Learning Resources:

1. Coursera – Machine Learning by Andrew Ng (Stanford University)
2. Scikit-learn Documentation
3. Kaggle Learn – Machine Learning
4. Google's Machine Learning Crash Course YouTube – StatQuest with Josh Starmer

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B.Tech III Year II semester

OPTIMIZATION TECHNIQUES FOR ENGINEERS
(Open Elective -II)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0030T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Outcomes:

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

1. Understand the meaning, purpose, tools of Operations Research and linear programming in solving practical problems in industry. L2, L3
2. Interpret the transportation models' solutions and infer solutions to the real-world problems.L3, L5
3. Develop mathematical skills to analyze and solve nonlinear programming models arising from a wide range of applications.L3
4. Apply the concept of non-linear programming for solving the problems involving non-linear constraints and objectives L2, L3
5. Apply the concept of unconstrained geometric programming for solving the problems involving non-linear constraints and objectives. L3,L5

UNIT-I	Linear programming I	10hrs

Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two phase Simplex Method, Big-M method.

UNIT-II	Linear programming II: Duality in Linear Programming	9hrs

Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method, Transportation Problem and assignment problem, Complementary slackness Theorem

UNIT-III	Non-linear programming: Unconstrained optimization techniques	10hrs

Introduction: Classification of Unconstrained minimization methods,

Direct Search Methods: Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method

UNIT-IV	Non-linear programming: Constrained optimization techniques	10hrs

Introduction, Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

UNIT-V	Geometric Programming	9hrs

Unconstrained Minimization Problems: solution of unconstrained geometric programming using differential calculus and arithmetic-geometric inequality.

Constrained minimization Problems: Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints.

TEXT BOOK:

1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.
2. J. C. Panth, Introduction to Optimization Techniques, (7-e) Jain Brothers, New Delhi

REFERENCES:

1. Harvey M. Wagner, Principles of Operation Research, Printice-Hall of India Pvt. Ltd. New Delhi.
2. Peressimi A.L., Sullivan F.E., Vhl, J. J. Mathematics of Non-linear Programming, Springer – Verlag.

Web Reference:

- https://onlinecourses.nptel.ac.in/noc24_ee122/preview
- https://archive.nptel.ac.in/courses/111/105/111105039/
- https://onlinecourses.nptel.ac.in/noc21_ce60/preview

Derpartment of Electrical and Electronics Engineering

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B.Tech III Year II semester

MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES
Open Elective – II

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0029T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

1. To provide students with essential linear algebra foundations including vector spaces, inner products, and operators for quantum mechanical applications.
2. To develop understanding of the transition from finite-dimensional systems to infinite-dimensional function spaces and Hilbert space concepts.
3. To establish quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution principles.
4. To enable students to apply quantum mechanical principles to solve problems in simple quantum systems and understand statistical interpretation.
5. To introduce advanced concepts in composite systems, measurement processes, and modern perspectives in quantum mechanics.

Course Outcomes:

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

1. Understand vector spaces, inner products, and linear operators with applications to quantum systems. L1, L2 (Understand, Comprehend)
2. Apply linear algebra concepts to function spaces and analyze the transition from finite to infinite dimensional systems. L3, L4 (Apply, Analyze)
3. Analyze quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution. L4 (Analyze)
4. Apply quantum mechanical principles to solve problems in simple quantum systems and evaluate statistical interpretations. L3, L5 (Apply, Evaluate)
5. Evaluate advanced concepts in composite systems and synthesize understanding of measurement processes and modern quantum theory.

UNIT-I	**Linear Algebra Foundation for Quantum Mechanics (10 hours)**	**10hrs**

Vector spaces definition and examples (R^2, R^3, function spaces), Inner products (dot product, orthogonality, normalization), Linear operators (matrices, eigenvalues, eigenvectors), Finite-dimensional examples (2×2 matrices, spin- 1/2 systems), Dirac notation introduction ($|\psi\rangle$, $\langle\varphi|$, $\langle\varphi|\psi\rangle$), Change of basis (transformations, unitary matrices).

UNIT-II	**From Finite to Infinite Dimensions**	**10hrs**

Function spaces (L^2 space, square-integrable functions), Inner products for functions ($\int\psi^*\varphi\, dx$), Orthogonal function sets (Fourier series, basis functions), Introduction to Hilbert space concept (complete inner product spaces), Position and momentum representations (wave functions), Operators on functions (d/dx, multiplication by x).

UNIT-III	**Quantum Mechanical Formalism**	**10hrs**

Mathematical formulation (states as vectors, observables as operators), Measurement theory (Born rule, expectation values, probabilities), Uncertainty relations (mathematical derivation from commutators), Time evolution (Schrödinger equation, unitary evolution).

UNIT-IV	**Applications and Statistical Interpretation**	**9hrs**

Simple applications (infinite square well, harmonic oscillator), Statistical interpretation (ensembles, pure vs mixed states), Measurement process (von Neumann measurement scheme).

UNIT-V	**Advanced Topics**	**9hrs**

Composite systems (tensor products basic introduction), Reversibility and irreversibility (unitary evolution vs measurement), Thermodynamic connections (equilibrium states, entropy), Modern perspectives (decoherence, measurement problem conceptual).

Textbooks:

1. David J. Griffiths, Darrell F. Schroeter, ―Introduction to Quantum Mechanics‖, 3rd Edition, Cambridge University Press (2018).
2. R. Shankar, Principles of Quantum Mechanics, 2nd Edition, Kluwer Academy/Plenum Publishers (1994).

Reference Books:

1. George. F. Simmons, ―Introduction to Topology and Modern Analysis‖,MedTech Science Press.
2. Gilbert Strang, Linear Algebra and Its Applications, 4th Edition, Cengage Learning (2006).
3. John von Neumann and Robert T Beyer, Mathematical Foundations of Quantum Mechanics,Princeton Univ. Press (1996).

Web Resources

1. https://eclass.uoa.gr/modules/document/file.php/CHEM248/Griffiths%20-%20Introduction%20to%20Quantum%20Mechanics%203rd%20ed%202018.pdf
2. https://fisica.net/mecanica-quantica/Shankar%20-%20Principles%20of%20quantum%20mechanics.pdf

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B.Tech III Year II semester

PHYSICS OF ELECTRONIC MATERIALS AND DEVICES
(Common to all branches)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0035T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives

1. To make the students to understand the concept of crystal growth, defects in crystals and thin films.
2. To provide insight into various semiconducting materials and their properties.
3. To develop a strong foundation in semiconductor physics and device engineering.
4. To elucidate excitonic and luminescent processes in solid-state materials.
5. To understand the principles, technologies, and applications of modern display systems

UNIT-I	**Fundamentals of Materials Science**	**10hrs**

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. The basic idea of point, line, and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

UNIT-II	**Semiconductors**	**10hrs**

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron- hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects

UNIT-III	**Physics of Semiconductor Devices:**	**9hrs**

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Heterojunctions, Transistors, MOSFETs.

UNIT-IV	**Excitons and Luminescence:**	**10hrs**

Luminescence: Different types of luminescence, basic definitions, Light emission in solids, Inter-band luminescence, Direct and indirect gap materials.

UNIT-V	**Display devices :**	**9hrs**

LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro- Opto-Electro-Mechanical Systems) and MEMS displays.

Textbooks:

1. Principles of Electronic Materials and Devices-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd.,4th edition, 2021.
2. Semiconductor physics & devices: basic principles, 4th Edition, McGraw-Hill, 2012.

Reference Books:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning,6th edition
2. Electronic Materials Science- Eugene A. Irene, Wiley, 2005
3. Electronic Components and Materials, Grover and Jamwal, DhanpatRai and Co., New Delhi., 2012.
4. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes,

Course Outcomes

1. Understand crystal growth and thin film preparation L1,L2
2. Summarize the basic concepts of semiconductorsL1,L2
3. Illustrate the working of various semiconductor devicesL1,L2, L3
4. Analyze various luminescent phenomena and the devices based on these conceptsL1,L2, L3
5. Explain the working of different display devicesL1,L2

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B.Tech III Year II semester

CHEMISTRY OF POLYMERS AND APPLICATIONS
(Common to all branches)
Open Elective-II

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0041T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives

1 To understand the basic principles of polymers
2 To understand natural polymers and their applications.
3 o impart knowledge to the students about synthetic polymers, their preparation and importance.
4 To enumerate the applications of hydogel polymers
5 To enumerate applications of conducting and degradable polymers in engineering.

Course Outcomes

1. Classify the polymers, Explain polymerization mechanism, Differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer
2. Describe the physical and chemical properties of natural polymers and Modified cellulosics.
3. Differentiate Bulk, solution, Suspension and emulsion polymerization, Describe fibers and elastomers, Identify the thermosetting and thermo polymers.
4. Identify types of polymer networks, Describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery,
5. Explain classification and mechanism of conducting and degradable polymers.

UNIT-I	**Polymers-Basics and Characterization**	**10hrs**

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

UNIT-II	**Natural Polymers & Modified cellulosics**	**10hrs**

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

UNIT-III	**Synthetic Polymers**	**9hrs**

Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization.

Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers(PE,PVC), Butadiene polymers(BUNA-S,BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

UNIT-IV	**Hydrogels of Polymer networks**	**9hrs**
Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels**,** Applications of hydrogels in drug delivery		
UNIT-V	**Conducting and Degradable Polymers**	**10hrs**
Conducting polymers: Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping,Applications. **Degradable polymers**: Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, Nylon-6, Polyesters, applications.		

Text Books:

1. A Text book of Polymer science, Billmayer
2. Polymer Chemistry – G.S.Mishra
3. Polymer Chemistry – Gowarikar

References Books:

1. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
2. Advanced Organic Chemistry, B.Miller, Prentice Hall
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

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B.Tech III Year II semester

ACADEMIC WRITING AND PUBLIC SPEAKING
(Common to All Branches of Engineering) OPEN ELECTIVE - II

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0045T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

1. To encourage all round development of the students by focusing on writing skills
2. To make the students aware of non-verbal skills
3. To develop analytical skills
4. To deliver effective public speeches

Course Outcomes (CO):

By the end of the program students will be able to

1. Understand various elements of Academic Writing
2. Identify sources and avoid plagiarism
3. Demonstrate the knowledge in writing a Research paper
4. Analyse different types of essays
5. Assess the speeches of others and know the positive strengths of speakers
6. Build confidence in giving an impactful presentation to the audience

UNIT-I	Introduction to Academic Writing	**10hrs**

Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing

UNIT-II	**Academic Journal Article**	**10hrs**

Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing lication for internship, Technical/Research/Journal Paper Writing – Conference Paper writing - Editing, Proof ding - Plagiarism

UNIT-III	**Essay & Writing Reviews**	**9hrs**

Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample ays – Writing Book Report, Summarizing, Book/film Review- SoP

UNIT-IV	Public Speaking	**10hrs**

Introduction, Nature, characteristics, significance of Public Speaking – Presentation – 4 Ps of Presentation – ge Dynamics – Answering Strategies –Analysis of Impactful Speeches- Speeches for Academic events

UNIT-V	Public Speaking and Non-Verbal Delivery	**9hrs**

Body Language – Facial Expressions-Kinesics – Oculesics – Proxemics – Haptics – Chronomics - Paralanguage - Signs

Textbooks:

1. *Critical Thinking, Academic Writing and Presentation Skills*: MG University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010)
2. Pease, Allan & Barbara. *The Definitive Book of Body Language*RHUS Publishers, 2016

Reference Books:

1. Alice Savage, Masoud Shafiei *Effective Academic Writing,**2Ed.,***2014 Oxford University Press.
2. Shalini Verma, *Body Language*, S Chand Publications 2011.
3. Sanjay Kumar and Pushpalata,*Communication Skills* 2E 2015, Oxford.
4. Sharon Gerson, Steven Gerson,*Technical Communication Process and Product*, Pearson, New Delhi, 2014
5. *Elbow, Peter. Writing with Power. OUP USA, 1998*

Online Learning Resources:

1. https://youtu.be/NNhTIT81nH8
2. phttps://www.youtube.com/watch?v=478ccrWKY-A
3. https://www.youtube.com/watch?v=nzGo5ZC1gMw
4. https://www.youtube.com/watch?v=Qve0ZBmJMh4

5. https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12-nonverbal-aspects-of-delivery/
6. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
7. https://archive.nptel.ac.in/courses/109/107/109107172/#
8. https://archive.nptel.ac.in/courses/109/104/109104107/

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B.Tech III Year II semester

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LAB
(Professional Core)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0233P	0: 0:3:0	1.5	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives: To make the students learn about

1. Calibration of various electrical measuring instruments
2. Accurate determination of inductance and capacitance using AC Bridges
3. Measurement of resistance for different range of resistors using bridges
4. Performance of transducers and sensors

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

1. Determine the unknown Resistance, Inductance and Capacitance using AC and DC bridges.-L3
2. Understand the calibration of single phase energy meter.-L2
3. Understand the measurement of power, power factor in a single phase circuit and real, reactive Power in a three phase circuit. -L2
4. Extend the range of Ammeter and Voltmeter. -L5
5. Understand the working of Transducers, Measure distance, temperature, current, voltage and humidity using sensors. -L2

CHOOSE ANY TEN FROM THE FOLLOWING LIST:

1. Measurement of resistance using Wheatstone bridge and Kelvin‘s Double Bridge.
2. Measurement of inductance using Maxwell‘s bridge, Anderson bridge.
3. Measurement of capacitance using De-Sauty's bridge, Schering bridge.
4. Calibration of single phase energy meter using direct loading method.
5. Calibration of energy meter using Phantom load kit.
6. Measurement of Power using 3-Voltmeter and 3-Ammeter methods in a single phase Circuit.
7. Measurement to Real and Reactive Power in a three phase circuit.
8. Extension of range of given Ammeter and Voltmeter.
9. Measurement of displacement using LVDT.
10. Study of CRO: Measurement of voltage, current, frequency using lissajous patterns.
11. Measurement of different ranges of temperatures using i)RTD ii)Thermocouple
12. Measurement of strain with the help of strain gauge transducers

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B.Tech III Year II semester

MICROPROCESSORS AND MICROCONTROLLERS LAB

(Professional Core)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0415P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

1. To become skilled in 8086 Assembly Language programming.
2. To understand the detailed software and hardware structure of the microprocessor.
3. Train their practical knowledge through laboratory experiments.
4. To understand and learn 8051 Microcontroller.
5. To acquire knowledge on microprocessors and microcontrollers, interfacing various peripherals, and configuring.

Course Outcomes:

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

1. Formulate a program and implement algorithms using Assembly language.L2
2. Describe an Assembly language program for the 8086 Microprocessor. L3
3. Develop programs for different applications in the 8086 Microprocessor. L4
4. Interface peripheral devices with 8086 and 8051. L4
5. Use an Assembly/Embedded C programming approach for solving real-world problems. L3

List of Experiments: (Any TEN of the experiments are to be conducted)

1. **Programs for 16 Bit Arithmetic Operations** (Using various addressing modes)
   a) Write an ALP to Perform Addition and Subtraction of Multi precision numbers.
   b) Write an ALP to Perform Multiplication and division of signed and unsigned Hexadecimal numbers.
   c) Write an ALP to find square, cube and factorial of a given number.

2. **Programs Involving Bit Manipulation Instructions**
   a) Write an ALP to find the given data is positive or negative.
   b) Write an ALP to find the given data is odd or even.
   c) Write an ALP to find Logical ones and zeros in a given data.

3. **Programs on Arrays for 8086**
   a) Write an ALP to find Addition/subtraction of N no_s.
   b) Write an ALP for finding largest/smallest no.
   c) Write an ALP to sort given array in Ascending/descending order.\

4. **Programs on String Manipulations for 8086**
   a) Write an ALP to find String length.
   b) Write an ALP for Displaying the given String.
   c) Write an ALP for Comparing two Strings.
   d) Write an ALP to reverse String and Checking for palindrome.

5. **Programs for Digital Clock Design Using 8086**
   a) Write an ALP for Designing clock using INT 21H Interrupt.
   b) Write an ALP for Designing clock using DOS Interrupt Functions.

c) Write an ALP for Designing clock by reading system time.

6. Interfacing Stepper Motor with 8086

a) Write an ALP to 8086 processor to Interface a stepper motor and operate it in clockwise by choosing variable step-size.
b) Write an ALP to 8086 processor to Interface a stepper motor and operate it in Anti-clockwise by choosing variable step-size.

7. Interfacing ADC/DAC with 8086

a) Write an ALP to 8086 processor to Interface ADC.
b) Write an ALP to 8086 processor to Interface DAC and generate Square Wave/Triangular Wave/Step signal.

8. Communication between Two Microprocessors

a) Write an ALP to have Parallel communication between two microprocessors using 8255
b) Write an ALP to have Serial communication between two microprocessor kits using 8251.

9. Programs using Arithmetic and Logical Instructions for 8051

a) Write an ALP to 8051 Microcontroller to perform Arithmetic operations like addition, subtraction,
b) Multiplication and Division.
c) Write an ALP to 8051 Microcontroller to perform Logical operations like AND, OR and XOR.
d) Programs related to Register Banks.

10. Programs to Verify Timers/Counters of 8051

a) Write a program to create a delay of 25msec using Timer0 in mode 1 and blink all the Pins of P0.
b) Write a program to create a delay of 50 µsec using Timer1 in mode 0 and blink all the Pins of P2.
c) Write a program to create a delay of 75msec using counter0 in mode 2 and blink all the Pins of P1.
d) Write a program to create a delay of 80 µsec using counter1 in mode 1 and blink all the Pins of P3.

11. UART Operation in 8051

a) Write a program to transfer a character serially with a baud rate of 9600 using UART.
b) Write a program to transfer a character serially with a baud rate of 4800 using UART.
c) Write a program to transfer a character serially with a baud rate of 2400 using UART.

12. Interfacing LCD with 8051

a) Develop and execute the program to interface16*2 LCD to 8051.
b) Develop and execute the program to interface LCD to 8051 in 4-bit or 8-bit mode.

Reference Books:

1. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning,2010.
2. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition2006.
3. The 8051 Microcontroller and Embedded Systems: Using Assembly and C by Muhammad AliMazidi, Janice Gillispie Mazidi, Second Edition

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B.Tech III Year II semester

APPLICATIONS OF SOFT COMPUTING TOOLS IN ELECTRICAL ENGINEERING
(Skill Enhancement Course)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0234P	0: 1:2:0	2	CIE: 30 SEE:70	3 Hours	SEC

Course Objectives:

The objectives of this course include:

- Understand the basic concepts of Electrical Engineering.
- Apply the concepts to design MATLAB models.
- Analyse various Electrical engineering applications through MATLAB.
- Develop real time models using MATLAB.

Course Outcomes:

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

CO1: Understand the basic concepts of Electrical Engineering. **-L2**

CO2: Apply the concepts to design MATLAB models. **-L4**

CO3: Analyze various Electrical engineering applications through MATLAB. **L3**

CO4: Develop real time models using MATLAB. **-L5**

CO5: Design virtual PMU **-L5**

Theory:

MATLAB-Introduction, different tool boxes, creation of program files, creation of simulink files, GUI, commonly used blocks, Simpower system toolbox, control system toolbox, Sim Drive lines, Creation of functions, Project implementation through MATLAB

CHOOSE ANY TEN FROM THE FOLLOWING LIST:

1. Transient analysis of given electrical network
2. Simulation of 1-phase and 3-phase transformers
3. Study of the dynamics of second order system
4. Implementation of buck and boost dc-dc converters
5. Study on the design of PI controllers and stability analysis for a DC-DC buck Converter
6. Sine-PWM techniques for single-phase half-bridge, full-bridge and three-phase inverters
7. Economic Load Dispatch of (i) Thermal Units and (ii) Thermal Plants using Conventional method
8. Transient Stability Analysis of Power Systems using Equal Area Criterion (EAC)
9. Reactive Power Control in a transmission system (Ferranti effect, Effect of shunt Inductor)
10. Fault studies using Z_{bus} matrix
11. Design of virtual PMU
12. Wide area control of Two area Kundur system

Online Learning Resources/Virtual Labs:

1. **http://vem-iitg.vlabs.ac.in/**
2. **https://vp-dei.vlabs.ac.in/Dreamweaver/**

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B.Tech III Year II semester

TECHNICAL PAPER WRITING AND INTELLECTUAL PROPER RIGHTS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0053T	**2: 0:0:0**	**_**	**CIE: 30 SEE:70**	**3 Hours**	**ACC**

Course Objectives:·

1. To enable the students to practice the basic skills of research paper writing
2. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
3. To practice the basic skills of performing quality literature review
4. To help them in knowing the significance of real life practice and procedure of Patents.
5. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

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

1. Identify key secondary literature related to their propose technical paper writing
2. Explain various principles and styles in technical writing
3. Use the acquired knowledge in writing a research/technical paper
4. Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc.
5. Evaluate different forms of IPR available at national & international level
6. Develop skill of making search of various forms of IPR by using modern tools and techniques.

UNIT-I

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence andlogical sequence in writing-avoiding ambiguity- repetition, and vague language -highlighting your findings-discussing your limitations -hedging and criticizing -plagiarism and paraphrasing

UNIT-II

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature- Problemsand Framing Research Questions- Synopsis

UNIT-III

Process of research: publication mechanism: types of journals- indexing-seminars- conferences- proof reading –plagiarism style; seminar & conference paper writing; Methodology-discussion-results- citation rules

UNIT-IV

Introduction to Intellectual property: Introduction, types of intellectual property, International organizations, ncies and treaties, importance of intellectual property rights
de Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting evaluating trade mark, trade mark registration processes.

UNIT-V

Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.Patent law, intellectual property audits.

Textbooks:

1. Deborah. E. Bouchoux, *Intellectual Property Rights*, Cengage Learning India, 2013

2. Meenakshi Raman, Sangeeta Sharma. *Technical Communication:Principles and practices.*Oxford.

Reference Books:

1. R.Myneni, *Law of Intellectual Property*, 9th Ed, Asia law House, 2019.
2. Prabuddha Ganguli,*Intellectual Property Rights* Tata Mcgraw Hill, 2001
3. P.Naryan,*Intellectual Property Law,* 3rd Ed ,Eastern Law House, 2007.
4. Adrian Wallwork. *English for Writing Research Papers*Second Edition. Springer Cham Heidelberg New York ,2016
5. Dan Jones, Sam Dragga, *Technical Writing Style*

Online Resources

1. **https://theconceptwriters.com.pk/principles-of-technical-writing/**
2. **https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html**
3. **https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html**
4. **https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper-journal/**
5. **https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf**
6. **https://lawbhoomi.com/intellectual-property-rights-notes/**
7. **https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf**

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B.Tech IV Year I semester

Department of Electrical and Electronics Engineering

Course Structure (RG23)

B.Tech IV Year I semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1.	Professional Core	23A0235T	Power System Operation and Control	3	0	0	3
2.	Management Course- II Elective	23A0049T 23A0050T 23A0048T	1. Business Ethics and Corporate Governance 2. E-Business 3. Management Science	2	0	0	2
3.	Professional Elective-IV	23A0451T 23A0236T 23A0237T	1. Digital Signal Processing 2. Electric Vehicle Technology 3. HVDC & FACTS	3	0	0	3
4.	Professional Elective-V	23A0238T 23A0239T 23A0240T	1. Modern Control Theory 2. Switched Mode Power Conversion 3. Electrical Distribution System	3	0	0	3
5.	Open Elective - III			3	0	0	3
6.	Open Elective-IV			3	0	0	3
7.	Skill Enhancement Course	23A0243P	Power Systems and Simulation Lab	0	0	4	2
8.	Audit Course	23A0054T	Gender Sensitization	2	0	0	-
9.	Internship	23A0244	Evaluation of Industry Internship	-	-	-	2
						Total credits	**21**

Open Elective – III

S.No	Course Code	Course Name	Offered by the Dept.
1	23A0152T	Building Materials and Services	CIVIL
2	23A0121T	Environmental Impact Assessment	
3	23A0335T	3D Printing Technologies	ME
4	23A0416T	Microprocessors and Microcontrollers	ECE
5	23A0512T	Data Base Management Systems	CSE & Allied/IT
6	23A0532Tb	Cyber Security	
7	23A0031T	Wavelet transforms and its Applications	Mathematics
8	23A0036T	Smart Materials And Devices	Physics
9	23A0037T	Introduction to Quantum Mechanics	
10	23A0042T	Green Chemistry And Catalysis For Sustainable Environment	Chemistry
11	23A0046T	Employability Skills	Humanities

Open Elective – IV

S.No	Course Code	Course Name	Offered by the Dept.
1	23A0153T	Geo-Spatial Technologies	CIVIL
2	23A0154T	Solid Waste Management	
3	23A0334Td	Total Quality Management	ME
4	23A0444T	Transducers and Sensors	ECE
5	23A0520T	Computer Networks & Internet Protocols	CSE & Allied/IT
6	23A0450T	Internet of Things	
7	23A3315a	Introduction to Quantum Computing	Mathematics
8	23A0032T	Financial Mathematics	Physics
9	23A0038T	Sensors And Actuators For Engineering Applications	
10	23A0043T	Chemistry Of Nanomaterials and Applications	Chemistry
11	23A0047T	Literary Vibes	Humanities

Member Secretary **BOS Chairman**

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B.Tech IV Year I semester

POWER SYSTEM OPERATION AND CONTROL
(Professional Core)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0235T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PCC**

Course Objectives: The objectives of the course are to make the students learn about:

1. Optimal Operation of Thermal Power Stations.
2. Hydrothermal Scheduling.
3. Modelling of Turbines and Generators.
4. Load frequency control of Single Area and Two Area Systems.
5. The Shunt and Series Reactive Power Compensations in Power Systems.
6. The Key Aspects of Power System Deregulation.

Course Outcomes:

CO1: To Understand the Thermal Station Characteristics and Economic Dispatch Problem of Thermal Units and Understand the Optimal Scheduling of Hydro-Thermal Station with minimization of cost of Thermal station– **L3.**

CO2: To Develop the First Order Models of Turbine, Governor and Generator Load Model – **L4.**

CO3: To Evaluate the Steady State & Dynamic Analysis of Single Area and Two Area Load Frequency Control **– L3.**

CO4: To Analyse the Series & Shunt Reactive Power Compensation in Transmission and Load Systems **– L3.**

CO5: To Understand the Aspects of Power System Deregulation – **L2.**

UNIT-I	Optimum Operation Thermal Power Station:	10hrs

Optimum Operation of Thermal Power Station: Heat Rate Curve – Cost Curve – Incremental Fuel Rate – Incremental Fuel Cost and Production Cost, Input – Output Characteristics of Thermal Power Stations and Hydro Power Stations. Optimum Generation Allocation of Thermal Units without Transmission Line Losses and Optimum Generation Allocation with effect of Transmission Line Losses. Transmission Line Loss Formula, Loss coefficients, Numerical Problems.

UNIT-II	Economic Operation of Hydro – Thermal Scheduling:	10hrs

Optimum Operation of Hydrothermal Power Stations:
Hydrothermal Coordination Methods – Optimal power flow problem formulation for loss and cost minimization, Solution of optimal power flow problem using Newton‘s method and Linear Programming technique – Numerical problems.

UNIT-III	Load Frequency Control:	9hrs

Modelling of Turbine & Governor:
The first order Turbine model, Block Diagram representation of Steam Turbines and approximate Linear models, Mathematical Modelling of Speed Governing Systems – Derivation of small Signal Transfer function – Block Diagram.

Single Area Load Frequency Control:

Necessity of Keeping Frequency constant, Definition of Control Area – Single Area Control – Block Diagram representation of an Isolated Power System – Steady State Analysis – Dynamic Response – Controlled & Uncontrolled case.

Two Area Load Frequency Control:

Load Frequency control of Two Area system – Controlled and Uncontrolled case, Tie – Line Bias Control. Proportional Plus Integral Control of Single Area and Its Block Diagram Representation, Steady State Response – Load Frequency Control and Economic Dispatch Control.

UNIT-IV	**Reactive Power Control:**	**9hrs**

Overview of Reactive Power Control – Reactive Power Compensation in Transmission Systems – Advantages and Disadvantages of Different Types of Compensating Equipment for Transmission Systems; Load Compensation – Specifications of Load Compensator, Uncompensated and Compensated Transmission Lines: Shunt and Series Compensation.

UNIT-V	**Power System Deregulation:**	**10hrs**

Principle of economics, utility functions, power exchanges, electricity market models, market power indices, ancillary services, transmission and distribution charges, principles of transmission charges, transmission pricing methods, demand-side management, regulatory framework – Numerical problems.

Textbooks:

1. Modern Power System Analysis, D.P.Kothari and I.J.Nagrath, Tata McGraw Hill Publishing Company Ltd.,
2. Electric Energy Systems Theory: An Introduction, Olle I. Elgerd, TMH Publishing Company Ltd., New Delhi, 2nd edition, 1983.

References:

1. Power Generation, Operation and Control, Allen J. Wood and Bruce F. Wollenberg, John Wiley & Sons, Inc., New York, 2nd edition, 1996.
2. Reactive Power Control in Electric Systems, T J E Miller, John Wiley & Sons, New York, 1982.
3. Power System Analysis Operation and Control, Abhijit Chakrabarti and Sunita Halder, PHI Learning Pvt. Ltd.,, 3rd Edition, 2010.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/108/104/108104052/
2. http://kcl.digimat.in/nptel/courses/video/108104191/L01.html
3. https://nptel.ac.in/courses/108101040

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B.Tech IV Year I semester

BUSINESS ETHICS AND CORPORATE GOVERNANCE
Management Course- II

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0049T	2: 0:0:0	2	CIE: 30 SEE:70	3 Hours	MEC

COURSE OBJECTIVES : The objectives of this course are

1 To make the student understand the principles of business ethics
2 To enable them in knowing about the ethics in management
3 To facilitate the student‘ role in corporate culture
4 To impart knowledge about the fair-trade practices
5 To encourage the student in knowing about the corporate governance

UNIT-I	Ethics	10hrs

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior.. Value systems - Business Ethics - Types, Characteristics, Factors, Contradictions and Ethical Practices in Management - Corporate Social Responsibility – Issues of Management – Crisis Management.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the meaning of loyalty and ethical Behavior
- Explain various types of Ethics
- Analyze issues & crisis of management

UNIT-II	ETHICS IN MANAGEMENT	10hrs

Introduction- Ethics in production, finance, Human resource management and Marketing Management - The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures - Culture and Individual Ethics – professional ethics and technical ethics.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the meaning of Ethics in various areas of management
- Compare and contrast professional ethics and technical ethics
- Develop ethical values in self and organization

UNIT-III	CORPORATE CULTURE	9hrs

Introduction - Meaning, definition, Nature, and significance – Key elements of corporate culture, shared values, beliefs and norms, rituals, symbols and language - Types of corporate culture, hierarchical culture, market driven culture – Organization leadership and corporate culture, leadership styles and their impact on culture, transformational leadership and culture change.

LEARNING OUTCOMES:- After completion of this unit student will

- Define corporate culture
- Understand the key elements of corporate culture
- Analyze organization leadership and corporate culture

UNIT-IV	LEGAL FRAME WORK	9hrs

Law and Ethics -Agencies enforcing Ethical Business Behavior - Legal Impact – Environmental Protection, Fair Trade Practices, legal Compliances, Safeguarding Health and wellbeing of Customers – Corporate law, Securities and financial regulations, corporate governance codes and principles.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand Law and Ethics

- Analyze Different fair trade practices
- Make use of Environmental Protection and Fair Trade Practices

UNIT-V	**CORPORATE GOVERNANCE**	**10hrs**

Introduction - Meaning – Corporate governance code, transparency & disclosure -Role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work - Corporate scams - Committees in India and abroad, corporate social responsibility. BoDs composition, Cadbury Committee - Various committees - Reports - Benefits and Limitations.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand corporate governance code
- Analyze role of auditors, board of directors and shareholders in corporate governance
- Implementing corporate social responsibility in India.

Text books.

1. Murthy CSV: Business Ethics and Corporate Governance, HPH July 2017
2. Bholananth Dutta, S.K. Podder – Corporation Governance, VBH. June 2010

Reference books

1. Dr. K. Nirmala, KarunakaraReaddy. *Business Ethics and Corporate Governance*, HPH
2. H.R.Machiraju: *Corporate Governance*, HPH, 2013
3. K. Venkataramana, *Corporate Governance*, SHBP.
4. N.M.Khandelwal. *Indian Ethos and Values for Managers*

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_mg46/
2. https://archive.nptel.ac.in/courses/110/105/110105138/
3. https://onlinecourses.nptel.ac.in/noc21_mg54/
4. https://onlinecourses.nptel.ac.in/noc22_mg54/
5. https://archive.nptel.ac.in/courses/109/106/109106117/

COURSE OUTCOMES: At the end of the course, students will be able to

CO1 Understand the Ethics and different types of Ethics.
CO2 Understand business ethics and ethical practices in management
CO3 Understand the role of ethics in management
CO4 Apply the knowledge of professional ethics & technical ethics
CO5 Analyze corporate law, ethics, codes & principles
CO6 Evaluate corporate governance & corporate scams

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B.Tech IV Year I semester

E-BUSINESS
Elective-2 (VII - SEMESTER)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0050T	2: 0:0:0	2	CIE: 30 SEE:70	3 Hours	MEC

Course Objectives: The Objectives of this course are

1 To provide knowledge on emerging concept on E-Business related aspect.
2 To understand various electronic markets & business models.
3 To impart the information about electronic payment systems & banking.
4 To create awareness on security risks and challenges in E-commerce.
5 To the students aware on different e-marketing channels & strategies.

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

CO1 Remember E-Business & its nature, scope and functions.
CO2 Understand E-market-Models which are practicing by the organizations
CO3 Apply the concepts of E-Commerce in the present globalized world.
CO4 Analyze the various E-payment systems & importance of net banking.
CO5 Evaluate market research strategies & E-advertisements.
CO6 Understand importance of E-security & control

UNIT-I	Electronic Business	10hrs

Introduction – Nature, meaning, significance, functions and advantages - Definition of Electronic Business - Functions of Electronic Commerce (EC)-Advantages & Disadvantages of E-Commerce –E-Commerce and E-Business, Internet Services, Online Shopping- E-Commerce Opportunities for Industries.

Learning Outcomes: -After completion of this unit student

- Understand the concept of E-Business
- Contrast and compare E-Commerce & E-Business
- Evaluate opportunities of E-commerce for industry

UNIT-II	Electronic Markets and Business Models	10hrs

Introduction –E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals - Business Models- Business to Business (B2B)-Business to Customers(B2C) - Business to Government(B2G)-Auctions- B2B Portals in India

Learning Outcomes: -After completion of this unit student will

- Understand the concept of business models
- Contrast and compare Vertical portal and Horizontal portals
- Analyze the B2B,B2C and B2G model

UNIT-III	Electronic Payment Systems:	9hrs

Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, e-wallets, UPI, and crypto currencies -Smart cards and digital wallets: Features and usage -Electronic Fund Transfer (EFT): Role in business transactions -Infrastructure requirements and regulatory aspects of e-payments

Learning Outcomes: -After completion of this unit student will

- Understand the Electronic payment system
- Contrast and compare EFT and smart cards
- Analyze debit card and credit cards

UNIT-IV	E-Security	9hrs

Security risks and challenges in electronic commerce - Cyber threats - Phishing, hacking, identity theft, and malware - Digital Signatures & Certificates - Security protocols over public networks (HTTP, SSL,

TLS) -Firewalls in securing e- business platforms.

Learning Outcomes: -After completion of this unit student will

- Understand E-Security
- Contrast and compare security protocols and public network
- Evaluate on Digital signature

UNIT-V	**E-Marketing:**	**10hrs**

Introduction – Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Market Research– – E-marketing planning: Online branding, social media marketing, and email marketing - E-business strategies: Digital advertising, content marketing, and analytics – E-Customer Relationship Management (eCRM) E-supply chain management (e-SCM)

Learning Outcomes: -After completion of this unit student will

- Understand the concept of online marketing
- Apply the knowledge of online marketing
- Compare e-CRM and e-SCM

Text Books:

1. Arati Oturkar&Sunil Khilari. *E-Business*. Everest Publishing House, 2022
2. P.T.S Joseph. *E-Commerce*, Fourth Edition, Prentice Hall of India, 2011

References:

1. Debjani, Kamalesh K Bajaj. *E-Commerce*, Second Edition Tata McGraw-Hill's, 2005
2. Dave Chaffey.*E-Commerce E-Management*, Second Edition, Pearson, 2012.
3. Henry Chan. *E-Commerce Fundamentals and Application*, RaymondLeathamWiley India 2007
4. S. Jaiswal. *E-Commerce* GalgotiaPublication Pvt Ltd., 2003.

BTL = Bloom's Taxonomy Level

Online Resources:

https://www.slideshare.net/fatimahAlkreem/e-businessppt-67935771
https://www.slideshare.net/VikramNani/e-commerce-business-models
https://www.slideshare.net/RiteshGoyal/electronic-payment-system
https://www.slideshare.net/WelingkarDLP/electronic-security
https://www.slideshare.net/Ankitha2404/emarketing-ppt

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B.Tech IV Year I semester

Management Science
Elective-2 (VII - SEMESTER)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0048T	2: 0:0:0	2	CIE: 30 SEE:70	3 Hours	MEC

COURSE OBJECTIVES : The objectives of this course are

1 To provide fundamental knowledge on Management, Administration, Organization & its concepts.
2 To make the students understand the role of management in Production
3 To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
4 To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
5 To make the students aware of the contemporary issues in modern management

COURSE OUTCOMES: At the end of the course, students will be able to

CO1 Remember the concepts & principles of management and designs of organization in a practical world
CO2 Understand the knowledge of Work-study principles & Quality Control techniques in industry
CO3 Apply the process of Recruitment & Selection in organization.
CO4 Analyze the concepts of HRM & different training methods.
CO5 Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
CO6 Create awareness on contemporary issues in modern management & technology.

UNIT-I	INTRODUCTION TO MANAGEMENT	10hrs

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor‘s Scientific Theory-Henry Fayol‘s principles - Elton Mayo‘s Human relations - **Organizational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization
- Project Organization - Committee form of Organization - Social responsibilities of Management.

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- Understand the concept of management and organization
- Apply the concepts & principles of management in real life industry.
- Analyze the organization chart & structure of an enterprise.

UNIT-II	OPERATIONS MANAGEMENT	10hrs

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- **Material Management** - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - **Marketing Management** - Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- Understand the core concepts of Operations Management
- Apply the knowledge of Quality Control, Work-study principles in real life industry.
- Evaluate Materials departments & Determine EOQ
- Analyze Marketing Mix Strategies for an enterprise.
- Create and design advertising and sales promotion

UNIT-III	HUMAN RESOURCES MANAGEMENT (HRM)	9hrs

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process - Employee Training and Development - methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

LEARNING OUTCOMES: At the end if the Unit, the students will be able to

- Understand the concepts of HRM, Recruitment, Selection, Training & Development
- Analyze the need of training
- Evaluate performance appraisal

Design the basic structure of salaries and wages

UNIT-IV	STRATEGIC & PROJECT MANAGEMENT	10hrs

Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management** - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost-Analysis - Project Crashing (Simple problems).

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- Understand Mission, Objectives, Goals & strategies for an enterprise
- Apply SWOT Analysis to strengthen the project
- Analyze Strategy formulation and implementation
- Evaluate PERT and CPM Techniques

UNIT-V	CONTEMPORARY ISSUES IN MANAGEMENT	9hrs

Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management – employee engagement and retention - Business Process Re-engineering and Bench Marking - Knowledge Management – change management – sustainability and corporate social responsibility.

LEARNING OUTCOMES At the end if the Unit, the students will be able to

- Understand modern management techniques
- Apply Knowledge in Understanding in TQM, SCM
- Analyze CRM, BPR
- Evaluate change management & sustainability

Text Books:

1. Frederick S. Hillier, Mark S. Hillier. *Introduction to Management Science*, October 26, 2023
2. A.R Aryasri, *Management Science*, TMH, 2019

References:

1. Stoner, Freeman, Gilbert.*Management*, Pearson Education, New Delhi, 2019.
2. Koontz & Weihrich, *Essentials of Management*, 6/e, TMH, 2005.
3. Thomas N.Duening & John M.Ivancevich, *Management Principles and Guidelines*, Biztantra.
4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
5. Samuel C.Certo, *Modern Management*, 9/e, PHI, 2005

ONLINE RESOURCES:

1. https://www.slideshare.net/slideshow/introduction-to-management-and-organization-231308043/231308043
2. https://nptel.ac.in/courses/112107238
3. https://archive.nptel.ac.in/courses/110/104/110104068/
4. https://archive.nptel.ac.in/courses/110/105/110105069/
5. https://onlinecourses.nptel.ac.in/noc24_mg112/

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B.Tech IV Year I semester

DIGITAL SIGNAL PROCESSING
(Professional Elective - IV)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0451T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

1. To get familiar with the properties of discrete time signals, systems and z-transform.
2. To learn the importance of FFT algorithm for computation of Discrete Fourier Transform and Fast Fourier Transform with decimations.
3. To understand the implementations of digital filter structures.
4. To analyse the FIR filter design using Fourier series and windowing methods.
5. To gain the knowledge on Programmable DSP Devices.

Course Outcomes:

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

1. Familiar with the properties of discrete time signals, systems and z-transform. L2
2. Learn the importance of FFT algorithm for computation of Discrete Fourier Transform and Fast Fourier Transform with decimations. L3
3. Understand the implementations of digital filter structures. L1
4. Analyse the FIR filter design using Fourier series and windowing methods. L3
5. Gain the knowledge on Programmable DSP Devices. L2

UNIT-I **10hrs**

Introduction to discrete time signals and systems: Introduction to digital signal processing, Review of discrete-time signals and systems, Analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems.

Z–Transform: Definition, ROC, Properties, Poles and Zeros in Z-plane, the inverse Z-Transform, System analysis, Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions, Illustrative Problems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.

UNIT-II **10hrs**

Discrete Fourier Transform : Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT.

Fast Fourier Transform: Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).

UNIT-III **9hrs**

IIR Filters : Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods, Frequency transformations, Basic structures of IIR Filters - Direct form-I, Direct form-II, Cascade form and Parallel form realizations.

UNIT-IV **9hrs**

FIR Filters: Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Raised Cosine, Hanging, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations.

UNIT-V		**10hrs**

Architectures for Programmable DSP Devices: Architecture of TMS320C5X: Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals.

Textbooks:

1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education, 2007.
2. A.V.Oppenheim and R.W. Schaffer, Discrete Time Signal Processing ,PHI

References:

1. S.K.Mitra, Digital Signal Processing – A practical approach , 2nd Edition, Pearson Education, New Delhi, 2004.
2. MH Hayes, Digital Signal Processing, Schaum‘s Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using Matlab, Thomson, 2007.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee99/preview,
2. https://nptel.ac.in/courses/108105055

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B.Tech IV Year I semester

ELECTRIC VEHICLE TECHNOLOGY
(Professional Elective - IV)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0236T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

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

CO1: Illustrate electric vehicles**. (L2)**

CO2: Understand drive-train topologies**. (L2)**

CO3: Classify various electrical drives **(L2)**

CO4: Classify energy storage technologies. **(L2)**

CO5: Classify different energy management strategies**. (L2)**

UNIT-I	Introduction To Electric Vehicles:	10hrs

History of electric vehicles, social and environmental importance of electric vehicles, impact of modern drive-trains on energy supplies.

CASE STUDY

Comparison by efficiency of Conventional, Hybrid, Electric and Fuel cell Vehicles.

UNIT-II	Electric Drive-Trains:	9hrs

Basic concept of electric traction, Introduction to various electric drive-train topologies, Power flow control in electric drive-train topologies.

UNIT-III	Electric Drives & Control:	9hrs

Introduction to electric components used in electric vehicles, Control of BLDC Motor, Control of Induction Motor Drive, Permanent Magnet (PM) motor Drive & Switched Reluctance Motor (SRM) Drive.

UNIT-IV	Energy Storage:	10hrs

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its modeling, SOC, Different Types of Batteries, Super Capacitor based energy storage and its analysis, Fuel Cells, Hybridization of different energy storage devices.

UNIT-V	Energy Management Strategies & Charging Infrastructure:	10hrs

Introduction to energy management strategies used in electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies, Types of EV charging Infrastructure & Standardized Communication protocols for EV charging.

CASE STUDIES

Current issues in electric Vehicles, Thermal Protection of Battery.

TEXT BOOKS:

1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, ―Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design‖, CRC Press, 2 nd Edition, 2017. (Unit-I, II)
2. Ali Emadi, ―Advanced Electric Drive Vehicles (Energy, Power Electronics, and Machines)‖, CRC Press, 2015. (Unit-III)
3. John G. Hayes and A. Goodarzi, ―Electric Powertrain - Energy Systems, Power electronics and drives for Hybrid, electric and fuel cell vehicles‖, Wiley, 2018. (Unit-IV & V)

REFERENCES:

1. James Larminie, John Lowry, ―Electric Vehicle Technology Explained‖, Wiley, 2 nd Edition 2012.

WEB RESOURCES:

1. https://nptel.ac.in/courses/108106170
2. https://onlinecourses.nptel.ac.in/noc22_ee53
3. https://onlinecourses.nptel.ac.in/noc21_ee112

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B.Tech IV Year I semester

HVDC AND FACTS
(Professional Elective -IV)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0237T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives: To get the student exposed to:

1. High voltage DC transmission systems
2. Flexible AC transmission systems
3. Various configurations of the above, Principle of operation, Characteristics of various FACTS devices

Course Outcomes:

CO1: Remember various conventional control mechanisms, transmission networks. **-L1**

CO2: Understand the necessity of HVDC systems as emerging transmission networks**. -L2**

CO3: Understand the necessity of reactive power compensation devices. **-L2**

CO4: Design equivalent circuits of various HVDC system configurations. **-L5**

CO5: Design and analysis of various FACTS devices. **-L5**

UNIT-I	Introduction:	10hrs

Electrical Transmission Networks, Conventional Control Mechanisms-Automatic Generation Control, Excitation Control, Transformer Tap-Changer Control, Phase-Shifting Transformers; Advances in Power-Electronic Switching Devices, Principles and Applications of Semiconductor Switches; Limitations of Conventional Transmission Systems, Emerging Transmission Networks, HVDC and FACTS. Concepts of virtual inertia

UNIT-II	High Voltage Dc Transmission – I:	10hrs

Types of HVDC links - Monopolar, Homopolar, Bipolar and Back-to-Back, Advantages and disadvantages of HVDC Transmission, Analysis of Graetz circuit, Analysis of bridge circuit without overlap, Analysis of bridge with overlap less than 60^0, Rectifier and inverter characteristics, complete characteristics of rectifier and inverter, Equivalent circuit of HVDC Link.

UNIT-III	High Voltage DC Transmission – II:	9hrs

Desired features and means of control, control of the direct current transmission link, Constant current control, Constant ignition angle control, Constant extinction angle control, Converter firing- angle control-IPC and EPC, frequency control and Tap changer control, Starting, Stopping and Reversal of power flow in HVDC links.

UNIT-IV	Flexible AC Transmission Systems-I:	9hrs

Types of FACTS Controllers, brief description about various types of FACTS controllers, Operation of 6-pulse converter, Transformer Connections for 12-pulse, 24-pulse and 48-pulse operation, principle of operation of various types of Controllable shunt VAR Generation, Principle of switching converter type shunt compensator, principles of operation of various types of Controllable Series VAR Generation, Principle of Switching Converter type series compensator.

UNIT-V	Flexible AC Transmission Systems-II:	10hrs

Unified Power Flow Controller (UPFC) – Principle of operation, Transmission Control Capabilities, Independent Real and Reactive Power Flow Control; Interline Power Flow Controller (IPFC) – Principle of operation and Characteristics, UPFC and IPFC control structures (only block diagram description), objectives and approaches of voltage and phase angle regulators

Textbooks:

1. Narain G. Hingorani and Laszlo Gyugyi, Understanding FACTS: Concepts and Technology of

Flexible AC Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2000.
2. E.W. Kimbark, Direct current transmission, Vol. I, Wiley Interscience, New York, 1971.

Reference Books:

1. KR Padiyar, FACTS Controllers in Power Transmission and Distribution, New
2. AnriqueAcha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Pérez and César Angeles-Camacho, FACTS: Modelling and Simulation in Power Networks, John Wiley & Sons, West Sussex, 2004.
3. R Mohan Mathur and Rajiv K Varma, Thyristor-Based FACTS Controllers for Electrical Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2002.

Online Learning Resources:

1. https://nptel.ac.in/courses/108104013,

2. https://nptel.ac.in/courses/108107114

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B.Tech IV Year I semester

MODERN CONTROL THEORY
(Professional Elective-V)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0238T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Preamble:

This subject aims to study state space, design of state feedback controllers and state observers, describing function and stability analysis including controllability and observability. It also deals with modern control and optimal control systems.

Course Objectives:

1. To familiarize the state space representation in controllable, observable, diagonal and Jordan canonical forms. L2
2. Introduce the concept of controllability and observability teststhrough canonical forms and design of state feedback controller by pole placement technique and State Observer design. L3
3. Analysis of a nonlinear system using describing function approach. L4
4. Illustrate the Lypanov's method of stability analysis for linear and non-linear continuous time autonomous systems. L4
5. Formulation of Euler Laugrange equation for the optimization of typical functional and solutions. L4

Course Outcomes:

After the completion of the course the student should be able to:

CO1: Analyse different canonical forms - solution of State equation. -L4
CO2: Design of control system using the pole placement technique is given after introducing the concept of controllability and observability.-L5
CO3: Analyze nonlinear system using describing function technique and phase plane analysis. -L4
CO4: Examine the stability analysis using Lyapunov method. -L3
CO5: Illustrate the Minimization of functional using calculus of variation - state and quadratic regulator problems. -L3

UNIT-I	State Space Analysis:	10hrs

State Space Representation – Canonical forms – Controllable canonical form – Observable canonical form - Jordan Canonical Form - Solution of state equation – State transition matrix

UNIT-II	Controllability - Observability and Design of Pole Placement:	10hrs

Tests for controllability and observability for continuous time systems – Time varying case – Minimum energy control – Time invariant case – Principle of duality – Controllability and observability form Jordan canonical form and other canonical forms – Effect of state feedback on controllability and observability – Design of state feedback control through pole placement

UNIT-III	Nonlinear Systems:	9hrs

Introduction to nonlinear systems - Types of nonlinearities. Introduction to phase–plane analysis - Singular points; Describing function - basic concepts - Describing functions of non- linearities.

UNIT-IV	Stability Analysis By Lyapunov Method:	9hrs

Stability in the sense of Lyapunov – Lyapunov's stability and Lyapunov's instability theorems – Direct method of Lyapunov for the linear and nonlinear continuous time autonomous systems.

UNIT-V	Calculus Of Variations:	10hrs

Minimization of functional of single function – Constrained minimization – Minimum principle – Control variable inequality constraints – Control and state variable inequality constraints –Euler lagrangine equation.

Text Books:

1. Modern Control System Theory – by M. Gopal - New Age International Publishers - 2ndedition – 1996
2. Modern Control Engineering – by K. Ogata - Prentice Hall of India - 3rd edition - 1998.

Reference Books:

1. Automatic Control Systems by B.C. Kuo - Prentice Hall Publication.
2. Control Systems Engineering by I.J. Nagarath and M.Gopal - New Age International (P) Ltd.
3. Digital Control and State Variable Methods – by M. Gopal - Tata Mc Graw–Hill Companies - 1997.
4. Systems and Control by Stainslaw H. Zak - Oxford Press - 2003.
5. Optimal control theory: an Introduction by Donald E.Kirk by Dover publications.

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B.Tech IV Year I semester

SWITCHED MODE POWER CONVERSION
(Professional Elective -V)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0239T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives: By the end of the course, the student will be able to

1. Understand basic concepts of DC-DC converters
2. Understand the concepts of resonant converters and their classification, various types of multilevel inverters, power conditioners, UPS and filters.
3. Apply various modulation and harmonic elimination techniques over the converters.
4. Analyze the state space modelling of various types of converters.
5. Design inductor and transformer for various power electronic applications.

Course Outcomes:

CO1: Remember basic concepts of various converters. -L1
CO2: Understand the problems and to design of various DC-DC converters, advanced converters of SMPCs. -L2
CO3: Evaluate the performance of resonant converters. -L3
CO4: Analyze the performance characteristics of 1-ϕ and 3-ϕ inverters with single/multi levels, power conditioners, UPS and filters. -L3
CO5:Design various applications of the above in Power Systems, EVE, Renewable Energy Systems, etc. -L5

UNIT-I	DC-DC Converters:	9hrs

Principles of step-down and step-up converters – Analysis and state space modelling of Buck, Boost, Buck- Boost and Cuk converters – Numerical Examples

UNIT-II	Switching Mode Power Converters:	9hrs

Analysis and state space modelling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques – Numerical Examples

UNIT-III	Resonant Converters:	10hrs

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control – Numerical Examples

UNIT-IV	DC-AC Converters:	10hrs

Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

UNIT-V	Power Conditioners, UPS & Filters:	10hrs

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

Textbooks:

1. Power Electronics: Essentials and Applications by L. Umanand, Wiley, 2009
2. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.
3. Course material on Switched Mode Power Conversion by V Ramanarayanan, Dept. of Electrical Engg. IISc. Bangalore

Reference Books:

1. Philip T. Krein, ―Elements of Power Electronics‖, Oxford University Press, 2012
2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters, Applications and design, 3rd Edition, John Wiley and Sons, 2006
3. M.H. Rashid, Power Electronics circuits, devices and applications, 3rd Edition Prentice Hall of India New Delhi, 2007.

Online Learning Resources:

1. https://nptel.ac.in/courses/108108036
2. https://nptel.ac.in/courses/108105180

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B.Tech IV Year I semester

ELECTRICAL DISTRIBUTION SYSTEM
(Professional Elective-V)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0240T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives: To make the students:

1. To know about fundamental aspects of distribution system, principle of distribution substations.
2. To know about classification of various loads.
3. To understand difference between conventional load flow studies of power system and distribution system load flow.
4. To know about evaluation of voltage droop and power loss calculations, distribution automation and management system, SCADA.

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO1: Understand fundamental aspects of distribution system and various factors affecting the distribution systems. **-L2**

CO2: Analysis of substations and modelling of loads. **-L3**

CO3: Understand difference between conventional load flow studies of power system and distribution system load flow. **-L2**

CO4: Evaluation of voltage drop and power loss calculations and capacitor location and cost analysis**.-L3**

CO5: Analyse the concepts of SCADA, Automation distribution system and management**. -L3**

UNIT-I	Distribution System Fundamentals:	10hrs

Brief description about electrical power transmission and distribution systems, Different types of distribution sub-transmission systems, Substation bus schemes, Factors effecting the substation location, Factors effecting the primary feeder rating, types of primary feeders, Factors affecting the primary feeder voltage level, Factors effecting the primary feeder loading.

UNIT-II	Distribution System Substations and Loads:	10hrs

Substations: Rating of a distribution substation for square and hexagonal shaped distribution substation, Service area with ―n‖ primary feeders, K constant, Radial feeder with uniformly and non-uniformly distributed loading. Benefits derived through optimal location of substations.

Loads: Various types of loads, Definitions of various terms related to system loading, Distribution transformer loading, feeder loading, Relationship between the Load Factor and Loss Factor, Modelling of star and delta connected loads.

UNIT-III	Distribution System Load Flow:	9hrs

Exact line segment model, Modified line model, approximate line segment model, Step-Voltage Regulators, Line drop compensator, Forward/Backward sweep distribution load flow algorithm – Numerical problems

UNIT-IV	Voltage Drop and Power Loss Calculation:	10hrs

Analysis of non-three phase primary lines, concepts of four-wire multi-grounded common-neutral distribution system, Percent power loss calculation, Distribution feeder cost calculation methods, Capacitor installation types, Series and Shunt Capacitors, Types of three-phase capacitor-bank connections, Procedure for best capacitor location, Economic justification for capacitors – Numerical problems.

UNIT-V	Distribution Automation:	9hrs

Distribution automation, distribution management systems, distribution automation system functions, Basic SCADA system, Consumer Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR), Outage management, decision support applications, substation automation, control feeder automation.

Textbooks:

1. Distribution System Modelling and Analysis, William H. Kersting, CRC Press, Newyork, 2002.
2. Electric Power Distribution System Engineering, TuranGonen, McGraw-Hill Inc., New Delhi, 1986.

Reference Books:

1. Control and automation of electrical power distribution systems, James Northcote-Green and Robert Wilson, CRC Press (Taylor & Francis), New York, 2007.
2. Biswarup Das, Power distribution Automation, IET publication, 2016.
3. Dr. M. K. Khedkar, Dr. G.M. Dhole, Electric Power Distribution Automation, Laxmi Publications, First edition, 2017.

Online Learning Resource:

1. https://onlinecourses.nptel.ac.in/noc22_ee126/preview

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B.Tech IV Year I semester

BUILDING MATERIALS AND SERVICES
(OPEN ELECTIVE – III)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0152T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

The objectives of this course are to make the student :

1. To understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.
2. To analyze the composition, manufacturing process, and properties of cement and admixtures.
3. To apply knowledge of building components such as lintels, arches, walls, stairs, floors, roofs, foundations, and joinery.
4. To evaluate masonry, mortars, finishing techniques, and formwork systems.
5. To assess various building services including plumbing, ventilation, air conditioning, acoustics, and fire protection.

Course Outcomes:

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

1. Understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.
2. Analyze the composition, manufacturing process, and properties of cement and admixtures.
3. Apply knowledge of building components such as lintels, arches, walls, stairs, floors, roofs, foundations, and joinery.
4. Evaluate masonry, mortars, finishing techniques, and formwork systems.
5. Assess various building services including plumbing, ventilation, air conditioning, acoustics, and fire protection.

UNIT-I **10hrs**

StonesandBricks, Tiles: Building Stones – Classifications and Quarrying – Properties – Structural Requirements – Dressing. Bricks – CompositionofBrick Earth – Manufacture and Structural Requirements, Fly Ash, Ceramics. Timber, Aluminum, Glass, PaintsandPlastics: Wood - Structure – Types and Properties –
Seasoning – Defects; Alternate Materials for Timber – GI / Fibre – Reinforced Glass Bricks, Steel & Aluminum, Plastics.

UNIT-II **10hrs**

Cement &Admixtures: Types of Cement - Ingredients of Cement – Manufacture – Chemical Composition – Hydration - Field & Lab Tests – Fineness – Consistency – Initial &Final Setting – Soundness . Admixtures – Mineral & Chemical Admixtures – Uses

UNIT-III **9hrs**

Building Components: Lintels, Arches, Walls, Vaults – Stair Cases – Types of Floors, Types of Roofs – Flat, Curved, Trussed; Foundations – Types; Damp Proof Course; Joinery – Doors – Windows – Materials – Types.

UNIT-IV **10hrs**

Mortars, MasonryandFinishing‘s Mortars: Lime and Cement Mortars Brick Masonry – Types – Bonds; Stone Masonry – Types; Composite Masonry – Brick-Stone Composite; Concrete, Reinforced Brick. Finishers:
Plastering, Pointing, Painting, Claddings – Types – Tiles – ACP.form Work: Types: Requirements – Standards – Scaffolding – Design; Shoring, Underpinning.

UNIT-V **9hrs**

Building Services: Plumbing Services: Water Distribution, Sanitary – Lines &Fittings; Ventilations: Functional Requirements Systems of Ventilations. Air-Conditioning - Essentials andTypes; Acoustics – Characteristic – Absorption – Acoustic Design; Fire Protection – Fire Hazards – Classification of Fire Resistant Materials and Constructions.

TEXT BOOKS:

1. Building Materials and Construction – Arora&Bindra, Dhanpat Roy Publications.
2. Building Materials and Construction by G C Sahu, Joygopal Jena McGraw hill Pvt Ltd 2015.

REFERENCE BOOKS:

1. Building Construction by B. C. Punmia, Ashok Kumar Jain andArun Kumar Jain - Laxmi Publications (P) ltd., New Delh
2. P. C. Varghese, Building Materials, Prentice Hall of India, 2015.
3. N.Subramanian ,‖Building Materials Testing and Sustainability‖, Oxford Higher Education, 2019.
4. R. Chudley, Construction Technology, Longman Publishing Group, 1973
5. S. K. Duggal, Building Materials, Oxford & IBH Publishing Co. Ltd., New Delhi, 2019

Online Learning Resources:
https://archive.nptel.ac.in/courses/105/102/105102088/

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B.Tech IV Year I semester

ENVIRONMENTAL IMPACT ASSESSMENT
(OPEN ELECTIVE – III)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0121T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the principles, methodologies, and significance of Environmental Impact Assessment (EIA).
2. Analyze the impact of developmental activities on land use, soil, and water resources.
3. Evaluate the impact of development on vegetation, wildlife, and assess environmental risks.
4. Develop environmental audit procedures and assess compliance with environmental regulations.
5. Understand and apply environmental acts, notifications, and legal frameworks in EIA studies.

Course Outcomes (COs):

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

1. Apply various methodologies for conducting Environmental Impact Assessments.
2. Analyze the impact of land-use changes on soil, water, and air quality.
3. Evaluate the environmental impact on vegetation, wildlife, and conduct risk assessments.
4. Develop environmental audit reports and assess compliance with environmental policies.
5. Interpret and apply environmental acts and regulations related to EIA.

UNIT-I	Concepts and methodologies of EIA	10hrs

Initial Environmental Examination, Elements of EIA, - Factors Affecting E-I-A Impact Evaluation and Analysis, Preparation of Environmental Base Map, Classification of Environmental Parameters- Criteria for The Selection of EIA Methodology, E I A Methods, Ad-Hoc Methods, Matrix Methods, Network Method Environmental Media Quality Index Method, Overlay Methods and Cost/Benefit Analysis.

UNIT-II	Impact of Developmental Activities and Land Use	10hrs

Introduction and Methodology for The Assessment of Soil and Ground Water, Delineation of Study Area, Identification of Actives. Procurement of Relevant Soil Quality, Impact Prediction, Assessment of Impact Significance, Identification and Incorporation of Mitigation Measures. E I Ain Surface Water, Air and Biological Environment: Methodology for The Assessment of Impacts On Surface Water Environment, Air Pollution Sources, Generalized Approach for Assessment of Air Pollution Impact.

UNIT-III	Assessment of Impact On Vegetation, Wildlife and Risk Assessment	9hrs

Introduction - Assessment of Impact of Development Activities On Vegetation and Wildlife, Environmental Impact of Deforestation – Causes and Effects of Deforestation - Risk Assessment and Treatment of Uncertainty-Key Stages in Performing An Environmental Risk Assessment- Advantages of Environmental Risk Assessment

UNIT-IV	Environmental Audit	9hrs

Introduction - Environmental Audit & Environmental Legislation Objectives of Environmental Audit, Types of Environmental Audit, Audit Protocol, Stages of Environmental Audit, Onsite Activities, Evaluation of Audit Data and Preparation of Audit Report

UNIT-V	Environmental Acts and Notifications	10hrs

The Environmental Protection Act, The Water Preservation Act, The Air (Prevention &Control of Pollution Act), Wild Life Act - Provisions in The EIA Notification, Procedure for Environmental Clearance, Procedure for Conducting Environmental Impact Assessment Report- Evaluation of EIA Report. Environmental Legislation Objectives, Evaluation of Audit Data and Preparation of Audit Report. Post Audit Activities, ConceptofISO and ISO 14000.

TEXT BOOKS:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B. S. Publication, Hyderabad 2nd edition 2011
2. Environmental Impact Assessment, by Canter Larry W., McGraw-Hill education Edi (1996)

REFERENCES:

1. Environmental Engineering, by Peavy, H. S, Rowe, D. R, Tchobanoglous, G.Mc-Graw Hill International Editions, New York 1985.
2. Environmental Science and Engineering, by Suresh K. Dhaneja, S.K., Katania& Sons Publication, New Delhi
3. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers.
4. Environmental Pollution and Control, by H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi

Online Learning Resources:
https://archive.nptel.ac.in/courses/124/107/124107160/

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B.Tech IV Year I semester

3D PRINTING TECHNOLOGIES
(Open Elective-III)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0335T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course objectives: The objectives of the course are to

1. **Understand** the fundamental concepts of prototyping and distinguish between traditional and rapid prototyping methods.
2. **Demonstrate** the working principles, materials, and applications of solid-, liquid-, and powder-based RP systems.
3. **Define** the processes and classifications of rapid tooling and reverse engineering techniques.
4. **Identify** common errors in 3D printing and evaluate pre-processing, processing, and post-processing issues.
5. **Familiarize** RP-related software and its role in applications such as design, manufacturing, and medical fields.

Course Outcomes: On successful completion of the course, the student will be able to,

1 Define and explain the evolution and need for rapid prototyping in modern product development.
2 Compare and contrast various 3D printing technologies based on working principles, materials, and limitations.
3 Apply knowledge of rapid tooling and reverse engineering techniques for industrial and design applications.
4 Diagnose and interpret different types of errors encountered in 3D printing processes and recommend solutions.
5 Use RP-specific software tools to manipulate STL files and prepare models for printing in real-world scenarios.

UNIT-I	Introduction to 3D Printing	9hrs

Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

UNIT-II	Solid and Liquid Based RP Systems	9hrs

Working Principle, Materials, Advantages, Limitations and Applications of Fusion Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Stereo lithography (SLA), Direct Light Projection System (DLP) and Solid Ground Curing (SGC).

UNIT-III	Powder Based & Other RP Systems	10hrs

Powder Based RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS) and Electron Beam Melting (EBM).
Other RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Three Dimensional Printing (3DP), Ballastic Particle Manufacturing (BPM) and Shape Deposition Manufacturing (SDM).

UNIT-IV	Rapid Tooling & Reverse Engineering	10hrs

Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.
Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development

UNIT-V	Errors in 3D Printing and Applications:	10hrs

Pre-processing, processing and post-processing errors, Part building errors in SLA, SLS, etc. Software: Need for software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP. Applications: Design,

Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Textbooks:

1. Chee Kai Chua and Kah Fai Leong, ―3D Printing and Additive Manufacturing Principles and Applications‖ 5/e, World Scientific Publications, 2017.
2. Ian Gibson, David W Rosen, Brent Stucker, ―Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing‖, Springer, 2/e, 2010.

Reference Books:

1. Frank W.Liou, ―Rapid Prototyping & Engineering Applications‖, CRC Press, Taylor & Francis Group, 2011.
2. Rafiq Noorani, ―Rapid Prototyping: Principles and Applications in Manufacturing‖, John Wiley&Sons, 2006.

Online Learning Resources:

- NPTEL Course on Rapid Manufacturing.
- https://nptel.ac.in/courses/112/104/112104265/
- https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/
- https://slideplayer.com/slide/6927137/
- https://www.mdpi.com/2073-4360/12/6/1334
- https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-
- %20FDM.pdf
- https://lecturenotes.in/subject/197
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdfcompressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- https://www.youtube.com/watch?v=NkC8TNts4B4

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B.Tech IV Year I semester

MICROPROCESSORS AND MICROCONTROLLERS

(Open Elective –III)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0416T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

1. To comprehend the architecture, operation, and configurations of the 8086 microprocessors.
2. To get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
3. To study the interfacing of 8086 with memory, peripherals, and controllers for various applications.
4. To learn the architecture, instruction set, and programming of the 8051 microcontrollers.
5. To understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

Course Outcomes:

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

1. Gain knowledge on the architecture, operation, and configurations of the 8086 microprocessors.
2. Get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
3. Know the interfacing of 8086 with memory, peripherals, and controllers for various applications.
4. Learn the architecture, instruction set, and programming of the 8051 microcontrollers.
5. Understand microcontroller interfacing techniques, peripheral programming, and processor comparisons

UNIT-I	**8086 Architecture**:	10hrs

Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT-II	**8086 Programming**:	9hrs

Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT-III	**8086 Interfacing**:	10hrs

Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNIT-IV		9hrs

Microcontroller - Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT-V		10hrs

Interfacing Microcontroller - Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

Textbooks:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rdEdition,1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw

Hill Education, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

References:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.

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B.Tech IV Year I semester

DATA BASE MANAGEMENT SYSTEM
(Open Elective-III)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0512T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

1. To introduce the fundamental concepts of database systems and data modeling.
2. To provide knowledge on relational databases and SQL for data retrieval and manipulation.
3. To understand database design principles using normalization and ER modeling.
4. To study transaction management, concurrency control, and database recovery.
5. To explore emerging database technologies and architectures including NoSQL

Course Outcomes (COs):

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

CO1: Understand the basic concepts of database systems and their architecture.
CO2: Apply ER modeling and relational algebra for database design.
CO3: Analyze and implement normalization techniques for schema refinement.
CO4: Evaluate transaction management techniques, concurrency control, and recovery.
CO5: Explore non-relational databases and recent trends in database systems

UNIT-I	Introduction to Databases	**10hrs**

Database System Applications and Purpose, View of Data: Data Abstraction and Data Independence, Database Users and Administrators, DBMS Architecture and Data Models, ER Model: Entities, Attributes, Relationships, ER Diagrams, Reduction of ER Model to Tables

UNIT-II	Relational Model and Algebra	**10hrs**

Structure of Relational Databases, Relational Model Concepts and Integrity Constraints, Relational Algebra: Selection, Projection, Set Operations, Joins, Tuple Relational Calculus, Introduction to SQL: DDL, DML, DCL, Advanced SQL: Sub queries, Joins, Views, Indexes

UNIT-III	**Database Design and Normalization**	**9hrs**

Schema Design and Logical Database Design, Functional Dependencies, Normal Forms: 1NF, 2NF, 3NF, BCNF, Decomposition and Lossless Join, Dependency Preservation, Multi-Valued and Join Dependencies.

UNIT-IV	**Transaction Management and Concurrency Control**	**9hrs**

Concept of a Transaction, ACID Properties, Serializability and Schedules, Concurrency Control: Lock-Based, Timestamp-Based Protocols, Deadlock Handling, Recovery Techniques: Log-Based, Shadow Paging

UNIT-V	Advanced Topics and NoSQL Databases	**10hrs**

Distributed Databases and Parallel Databases, Introduction to NoSQL: Types – Document, Columnar, Key-Value, Graph, CAP Theorem, MongoDB: Basics and CRUD Operations, Big Data and New SQL Overview, Case Studies on Real- World Databases

TEXTBOOKS:

1. **Abraham Silberschatz, Henry F. Korth, S. Sudarshan** – *Database System Concepts*, 7th Edition, McGraw Hill
2. **Ramez Elmasri, Shamkant B. Navathe** – *Fundamentals of Database Systems*, 7th Edition, Pearson Education

REFERENCE BOOKS:

1. **C.J. Date** – *An Introduction to Database Systems*, 8th Edition, Addison-Wesley
2. **'Raghu Ramakrishnan, Johannes Gehrke** – *Database Management Systems*, 3rd Edition, McGraw Hill

3. **Pramod J. Sadalage & Martin Fowler** – *NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence*, Pearson

Online Resources & Courses:

1. NPTEL – Database Management Systems by IIT Madras
2. Coursera – Databases by Stanford University
3. Khan Academy – Intro to SQL
4. MongoDB University – Free Courses on NoSQL Databases
5. W3Schools SQL Tutorial
6. GeeksforGeeks – DBMS Concepts and Practice Problems

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B.Tech IV Year I semester

CYBER SECURITY
(Open Elective-III)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0532Tb	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

1. To introduce the concept of cybercrime and its impact on information security, and provide an overview of cybercriminal behavior and various classifications of cybercrimes.
2. To explore the methodologies used by cybercriminals to plan and execute attacks, including techniques like social engineering, botnets, and cloud-related threats.
3. To understand the security risks associated with mobile and wireless devices, and examine countermeasures for securing mobile computing in organizational environments.
4. To familiarize students with the tools and techniques used in committing cybercrimes, such as phishing, malware, DoS/DDoS attacks, and code-based exploits.
5. To analyze the implications of cybercrime for organizations, including the cost of cyber attacks, intellectual property issues, and challenges posed by social computing and web-based threats.

Course Outcomes:

After completion of the course, students will be able to

1. Understand the fundamentals of cybercrime and information security, and explain the legal and global perspectives, especially with reference to Indian IT Act 2000.
2. Analyze how cybercriminals plan and execute cyber offenses using techniques like social engineering, cyber stalking, and botnets, including threats posed by cloud computing.
3. Evaluate the security challenges of mobile and wireless devices and formulate measures to secure mobile environments within an organization.
4. Identify and explain various cyber attack tools and methods such as phishing, keyloggers, Trojans, and SQL injection used in committing cybercrimes.
5. Assess the organizational implications of cybercrimes, including IPR issues, social media risks, and formulate strategies to mitigate security and privacy challenges

UNIT-I	Introduction to Cybercrime	9hrs

Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT-II	Cyber Offenses: How Criminals Plan Them	9hrs

Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

UNIT-III	Cybercrime: Mobile and Wireless Devices	10hrs

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones,

Mobile Devices:

Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.

UNIT-IV	Tools and Methods Used in Cybercrime	10hrs

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT-V	Cyber Security: Organizational Implications	10hrs

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Textbooks:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J.DavidIrwin.CRC Press T&F Group

Online Learning Resources:

http://nptel.ac.in/courses/106105031/40
http://nptel.ac.in/courses/106105031/39
http://nptel.ac.in/courses/106105031/38

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B.Tech IV Year I semester

WAVELET TRANSFORMS AND ITS APPLICATIONS
(Open Elective-III)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0031T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

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

CO1: Understand wavelets and wavelet basis and characterize continuous and discrete wavelet transforms
CO2: Illustrate the multi resolution analysis ad scaling functions
CO3: Implement discrete wavelet transforms with multirate digital filters
CO4: Understand multi resolution analysis and identify various wavelets and evaluate their time- frequency resolution properties.
CO5: Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields

UNIT-I	Wavelets	10hrs

Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets -effectiveness of Wavelet Analysis -The Discrete Wavelet Transform- The Discrete-Time and Continuous Wavelet Transforms.

UNIT-II	A Multiresolution Formulation of Wavelet Systems	10hrs

Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

UNIT-III	Filter Banks and the Discrete Wavelet Transform	10hrs

Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - -Different Points of View.

UNIT-IV	Time-Frequency and Complexity	9hrs

Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.

UNIT-V	Bases and Matrix Examples	9hrs

Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example
Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example

TEXT BOOK:

1. C. Sidney Burrus, Ramesh A. Gopinath, ―Introduction to Wavelets and Wavelets Transforms‖, Prentice Hall, (1997).
2. James S. Walker, ―A Primer on Wavelets and their Scientific Applications‖, CRC Press, (1999)

REFERENCES:

1. RaghuveerRao, ―Wavelet Transforms‖, Pearson Education, Asia
2. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc

1. http://users.rowan.edu/~polikar/WAVELETS/WTtutorial.html
2. http://www.wavelet.org/
3. http://www.math.hawaii.edu/~dave/Web/Amara's%20Wavelet%20Page.htm
4. https://jqichina.wordpress.com/wp-content/uploads/2012/02/ten-lectures-of-waveletsefbc88e5b08fe6b3a2e58d81e8aeb2efbc891.pdf

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B.Tech IV Year I semester

SMART MATERIALS AND DEVICES
(Common to all branches)
Open Elective-III

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0036T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives

1 To provide exposure to smart materials and their engineering applications.
2 To impart knowledge on the basics and phenomenon behind the working of smart materials
3 To explain the properties exhibited by smart materials
4 To educate various techniques used to synthesize and characterize smart materials
5 To identify the required smart material for distinct applications/devices

Course Outcomes

CO1: Identify key discoveries that led to modern applications of shape memory materials, describe the two phases in shape memory alloys.
CO2: Describe how different external stimuli (light, electricity, heat, stress, and magnetism) influence smart material properties.
CO3: Summarize various types of synthesis of smart materials
CO4: Analyze various characterization techniques used for smart materials
CO5: Interpret the importance of smart materials in various devices

UNIT-I	Introduction to Smart Materials	10hrs

Historical account of the discovery and development of smart materials, Shape memory materials, chromoactive materials, magnetorheological materials, photoactive materials, Polymers and polymer composites (Basics).

UNIT-II	Properties of Smart Materials	10hrs

Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials

UNIT-III	Synthesis of Smart Materials	10hrs

Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

UNIT-IV	Characterization Techniques	9hrs

Powder X-ray diffraction, Raman spectroscopy (RS), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM).

UNIT-V	Smart Materials based Devices	9hrs

Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

Textbooks:

1. YaserDahman, Nanotechnology and Functional Materials for Engineers-, Elsevier, 2017
2. E. Zschech,C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer-Verlag London Limited 2005

Reference Books:

1. Gauenzi,P.,Smart Structures, Wiley, 2009.
2. MahmoodAliofkhazraei, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014
3. Handbook of Smart Materials, Technologies, and Devices: Applications of Industry,4.0,Chaudhery MustansarHussain, Paolo Di Sia, Springer,2022.
4. Fundamentals of Smart Materials,Mohsen Shahinpoor, Royal Society of Chemistry, 2020

NPTEL course link: https://onlinecourses.nptel.ac.in/noc22_me17/preview

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B.Tech IV Year I semester

INTRODUCTON TO QUANTUM MECHANICS
Open Elective – III

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0037T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

COURSE OBJECTIVES

1 To understand the fundamental differences between classical and quantum mechanics.
2 To study wave-particle duality, uncertainty principle, and their implications.
3 To learn and apply Schrödinger equations to basic quantum systems.
4 To use operator formalism and mathematical tools in quantum mechanics.
5 To explore angular momentum, spin and their quantum mechanical representations.

CourseOutcomes

After completing this course, students will be able to:

CO1: Explain the key principles of quantum mechanics and wave-particle duality
CO2: Apply Schrödinger equations to solve one-dimensional quantum problems
CO3: Solve quantum mechanical problems using operator and matrix methods.
CO4: **E**valuate quantum states using Dirac notation and expectation values.
CO5: Analyze angular momentum and spin systems using Pauli matrices and operators.

UNIT-I	PRINCIPLES OF QUANTUM MECHANICS	10hrs

Introduction: Limitations of classical Mechanics, Difficulties with classical theories of black body radiation and origin of quantum theory of radiation.Wave-particle duality: de Broglie wavelength, Heisenberg uncertainty principle.Schrödinger time independent and time dependent wave equation, Solution of the time dependent Schrödinger equation, Concept of stationary states, Physical significance of wave function (ψ), Orthogonal, Normalized and Orthonormal functions

UNIT-II	ONE DIMENSIONAL PROBLEMS AND SOLUTIONS	9hrs

Potential step – Reflection and Transmission at the interface. Potential well: Square well potential with rigid walls, Square well potential with finite walls. Potential barrier: Penetration of a potential barrier (tunneling effect). Periodic potential and Harmonic oscillator, Energy eigen functions and eigen values.

UNIT-III	OPERATOR FORMALISM	9hrs

Operators, Operator Algebra, Eigen values and Eigen vectors, Postulates of quantum mechanics, Matrix representation of wave functions and linear operators.

UNIT-IV	MATHEMATICAL TOOLS FOR QUANTUM MECHANICS	10hrs

The concept of row and column matrices, Matrix algebra,Hermitian operators – definition. Dirac‘s bra and ket notation, Expectation values, Heisenberg (operator) representation of harmonic oscillator, Ladder operators and their significance.

UNIT-V	ANGULAR MOMENTUM AND SPIN	10hrs

Angular momentum operators: Definition. Eigen functions and Eigen values of AM operators. Matrix representation of angular momentum operators, System with spin half(1/2), Spin angular momentum, Pauli‘s spin matrices. Clebsch- Gordon coefficients. Rigid Rotator: Eigen functions and Eigen values.

BOOKS FOR STUDY:

1. Quantum Mechanics. Vol 1, A. MessaiaNoth-Holland Pub. Co., Amsterdam,(1961).
2. A Text Book of Quantum Mechanics. P.M.Mathews and K.Venkatesam, Tata McGraw Hill, New Delhi,(1976).
3. Introduction to Quantum Mechanics. R.H.Dicke and J.P.Witke, Addison-Wisley Pub.Co.Inc.,London, (1960).
4. Quantum Mechanics. S.L.Gupta, V.Kumar, H.V.Sarama and R.C.Sharma, Jai PrakashNath& Co, Meerut, (1996).

REFERENCE BOOKS:

1. Quantum Mechanics. L.I. Schiff, McGraw Hill Book Co., Tokyo, (1968).
2. Introduction to Quantum Mechanics. Richard L. Liboff, Pearson Education Ltd (Fourth Edn.) 2003.

NPTEL courses link :

1. https://archive.nptel.ac.in/courses/115/101/115101107/
2. https://archive.nptel.ac.in/courses/122/106/122106034/
3. https://nptel.ac.in/courses/115106066

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B.Tech IV Year I semester

GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT
(Common to all branches)
Open Elective-III

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0042T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives

1 To understand principle and concepts of green chemistry.
2 To understand the types of catalysis and industrial applications.
3 To apply green solvents in chemical synthesis.
4 To enumerate different sourced of green energy.
5 To apply alternative greener methods foe chemical reactions

Course Outcomes

CO1: Apply the Green chemistry Principles for day to day life as well as synthesis, describe the sustainable development and green chemistry, Explain economic and un-economic reactions, Demonstrate Polymer recycling.
CO2: Explain Heterogeneous catalyst and its applications in Chemical and Pharmaceutical Industries, Differentiate Homogeneous and Heterogeneous catalysis, Identify the importance of Bio and Photo Catalysis, Discuss Transition metal and Phase transfer Catalysis
CO3: Demonstrate Green solvents and importance, Discuss Supercritical carbondioxide, Explain Supercritical water, recycling of green solvents.
CO4: Describe importance of Biomass and Solar Power, Illustrate Sonochemistry, Apply Green Chemistry for Sustainable Development; discuss the importance of Renewable resources, mechanochemical synthesis.
CO5: Discuss Alternative green methods like Photoredox catalysis, single electron transfer reactions (SET), Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

UNIT-I	PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY	10hrs

Introduction, Green chemistry Principles, sustainable development and green chemistry, E factor, atom economy, atom economic Reactions: Rearrangement and addition reactions and atom un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling

UNIT-II	CATALYSIS AND GREEN CHEMISTRY	10hrs

Introduction, Types of catalysis, Heterogeneous catalysis: Basics of Heterogeneous Catalysis, Zeolite and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, and Phase transfer catalysis, Bio-catalysis and Photo-catalysis with examples.

UNIT-III	GREEN SOLVENTS IN CHEMICAL SYNTHESIS	9hrs

Green Solvents: Concept, Tools and techniques for solvent selection, supercritical fluids: Super critical carbondioxide, super critical water, Polyethylene glycol (PEG), Ionic liquids, Recyling of green solvents.

UNIT-IV	EMERGING GREENER TECHNOLOGIES	9hrs

Biomass as renewable resource, Energy: Energy from Biomass, Solar Power, Chemicals from Renewable Feedstock‘s, Chemicals from Fatty Acids, Polymers from Renewable Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency, Mechanochemical synthesis.

UNIT-V	**ALTERNATIVE GREENER METHODS**	**10hrs**

Photochemical Reactions - Examples, Advantages and Challenges, Photoredox catalysis, single electron transfer reactions (SET), Examples of Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

Text Books :

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

References :

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.
2. Edited by AlvisePerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8:
3. Green Nanoscience, wiley-VCH, 2013

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B.Tech IV Year I semester

EMPLOYABILITY SKILLS
OPEN ELECTIVE-III

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0046T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

1. To encourage all round development of the students by focusing on productive skills
2. To make the students aware of Goal setting and writing skills
3. To enable them to know the importance of presentation skills in achieving desired goals.
4. To help them develop organizational skills through group activities To function effectively with heterogeneous teams

Course Outcomes (CO):

CO1: Understand the importance of goals and try to achieve them
CO2: Explain the significance of self-management
CO3: Apply the knowledge of writing skills in preparing eye-catchy resumes
CO4: Analyse various forms of Presentation skills
CO5: Judge the group behaviour appropriately
CO6: Develop skills required for employability.

UNIT-I	Goal Setting and Self-Management	10hrs

Definition, importance, types of Goal Setting – SMART Goal Setting – Advantages-Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOC Analysis

UNIT-II	Writing Skills	10hrs

Definition, significance, types of writing skills – Resume writing Vs CV Writing - E-Mail writing, Cover Letters - E-Mail Etiquette -SoP (Statement of Purpose)

UNIT-III	Technical Presentation Skills	10hrs

Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics –Anxiety in Public speaking (Glossophobia)- PPT & Poster Presentation

UNIT-IV	Group Presentation Skills	9hrs

Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality Manifestation-Group Discussion-Debate –Corporate Etiquette

UNIT-V	Job Cracking Skills	9hrs

Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success – Job searching skills - STAR method - FAQs- Answering Strategies – Mock Interviews

TEXT BOOKS:

1. Sabina Pillai, Agna Fernandez. Soft Skills & Employability Skills,2014.Cambridge Publisher.
2. Alka Wadkar. Life Skills for Success, Sage Publications, 2016.

REFERENCE BOOKS:

1. Gangadhar Joshi. Campus to Corporate Paperback , Sage Publications. 2015
2. Sherfield Montogomery Moody,Cornerstone Developing Soft Skills, Pearson Publications. 4 Ed. 2008
3. Shikha Kapoor. Personality Development and Soft Skills - Preparing for Tomorrow .1 Edition, Wiley, 2017.
4. M. Sen Gupta, Skills for Employability, Innovative Publication, 2019.
5. Steve Duck and David T McMahan, The Basics f Communication Skills A Relational Perspective,Sage press, 2012.

Online Learning Resources:

1. https://youtu.be/gkLsn4ddmTs
2. https://youtu.be/2bf9K2rRWwo
3. https://youtu.be/FchfE3c2jzc
4. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
5. https://www.youtube.com/c/skillopedia/videos
6. https://onlinecourses.nptel.ac.in/noc25_hs96/preview
7. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

8. https://archive.nptel.ac.in/courses/109/107/109107172/#
9. https://archive.nptel.ac.in/courses/109/104/109104107/

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B.Tech IV Year I semester

GEO-SPATIAL TECHNOLOGIES
(OPEN ELECTIVE – IV)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0153T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

The objectives of this course are to make the student :

1. To understand raster-based spatial analysis techniques, including query, overlay, and cost-distance analysis.
2. To analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
3. To apply network analysis techniques for geocoding, shortest path analysis, and location-allocation problems.
4. To evaluate surface andgeostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
5. To assess GIS customization, Web GIS, and mobile mapping techniques for real-world applications.

Course Outcomes:

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

1. Understand raster-based spatial analysis techniques, including query, overlay, and cost-distance analysis.
2. Analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
3. Apply network analysis techniques for geocoding, shortest path analysis, and location-allocation problems.
4. Evaluate surface andgeostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
5. Assess GIS customization, Web GIS, and mobile mapping techniques for real-world applications.

UNIT-I	RASTER ANALYSIS	9hrs

Raster Data Exploration: Query Analysis - Local Operations: Map Algebra, Reclassification, Logical and Arithmetic Overlay Operations—Neighborhood - Operations: Aggregation, Filtering – Extended Neighborhood-Operations- Zonal Operations - Statistical Analysis – Cost-Distance Analysis-Least Cost Path.

UNIT-II	VECTOR ANALYSIS	9hrs

Non-Topological Analysis: Attribute Database Query, Structured Query Language, Co-Ordinate Transformation, Summary Statistics, Calculation of Area, Perimeter and Distance – topological Analysis: Reclassification, Aggregation, Overlay Analysis: Point-In-Polygon, Line-In-Polygon, Polygon-On-Polygon: Clip, Erase, Identity, Union, Intersection – Proximity Analysis: Buffering

UNIT-III	NETWORK ANALYSIS	10hrs

Network – Introduction - Network Data Model – Elements of Network - Building A Network Database - Geocoding – Address Matching - Shortest Path in A Network – Time and Distance Based Shortest Path Analysis – Driving Directions – Closest Facility Analysis – Catchment / Service Area Analysis-Location-Allocation Analysis

UNIT-IV	SURFACE and GEOSTATISTICAL ANALYSIS	10hrs

Surface Data – Sources of X,Y, Z Data – DEM, TIN – Terrain Analysis – Slope, Aspect, Viewshed, Watershed Analysis: Watershed Boundary, Flow Direction, Flow Accumulation, Drainage Network, Spatial Interpolation: IDW, Spline, Kriging, Variogram.

UNIT-V	CUSTOMISATION, WEB GIS, MOBILE MAPPING	10hrs

Customisation of GIS: Need, Uses, Scripting Languages –Embedded Scripts – Use of Python Script - Web GIS: Web GIS Architecture, Advantages of Web GIS, Web Applications- Location Based Services: Emergency and Business Solutions - Big Data Analytics.

TEXTBOOKS:

1. Kang – Tsung Chang, Introduction to Geographical Information System, 4th Ed., Tata McGraw Hill Edition, 2008.
2. Lo, C.P. andYeung, Albert K.W., Concepts and Techniques of Geographic Information Systems Prentice Hall, 2002

REFERENCE BOOKS:

1. Michael N. Demers, Fundamentals of Geographic Information Systems, Wiley,2009
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasaraju, ―An Introduction to Geographical Information Systems, Pearson Education, 2nd Edition, 2007.
3. John Peter Wilson, The Handbook of Geographic Information Science, Blackwell Pub.,2008

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/105/105105202/
https://onlinecourses.nptel.ac.in/noc19_cs76/preview

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B.Tech IV Year I semester

SOLID WASTE MANAGEMENT
(OPEN ELECTIVE – IV)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0154T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

The objectives of this course are to make the student :

1. To understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
2. To analyze engineering systems for solid waste collection, storage, and transportation.
3. To apply resource and energy recovery techniques for sustainable solid waste management.
4. To evaluate landfill design, construction, and environmental impact mitigation strategies.
5. To assess hazardous waste management techniques, including biomedical and e-waste disposal.

Course Outcomes:

1. Understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
2. Analyze engineering systems for solid waste collection, storage, and transportation.
3. Apply resource and energy recovery techniques for sustainable solid waste management.
4. Evaluate landfill design, construction, and environmental impact mitigation strategies.
5. Assess hazardous waste management techniques, including biomedical and e-waste

UNIT-I **10hrs**

Solid Waste: Definitions, Types of Solid Wastes, Sources of Solid Wastes, Characteristics, and Perspectives; Properties of Solid Wastes, Sampling of Solid Wastes, Elements of Solid Waste Management - Integrated Solid Waste Management, Solid Waste Management Rules 2016.

UNIT-II **10hrs**

Engineering SystemsforSolid Waste Management: Solid Waste Generation; On-Site Handling, Storage and Processing; Collection of Solid Wastes; Stationary Container System and Hauled Container Systems – Route Planning - Transfer and Transport; Processing Techniques;

UNIT-III **10hrs**

Engineering Systems for Resource and Energy Recovery: Processing Techniques; Materials Recovery Systems; Recovery of Biological Conversion Products – Composting, Pre and Post Processing, Types of Composting, Critical Parameters, Problems With Composing - Recovery of Thermal Conversion Products; Pyrolisis, Gasification, RDF - Recovery of Energy From Conversion Products; Materials and Energy Recovery Systems.

UNIT-IV **9hrs**

Landfills: Evolution of Landfills – Types and Construction of Landfills – Design Considerations – Life of Landfills- Landfill Problems – Lining of Landfills – Types of Liners – Leachate Pollution and Control – Monitoring Landfills – Landfills Reclamation.

UNIT-V **9hrs**

Hazardous Waste Management: – Sources and Characteristics, Effects On Environment, Risk Assessment Disposal of Hazardous Wastes – Secured Landfills, Incineration - Monitoring – Biomedical Waste Disposal, E- Waste Management, Nuclear Wastes, Industrial Waste Management

TEXTBOOKS:

1. Tchobanoglous G, Theisen H and Vigil SA _Integrated Solid Waste Management, Engineering Principles and Management Issues‘ McGraw-Hill, 1993.
2. Vesilind PA, Worrell W and Reinhart D, _Solid Waste Engineering‘ Brooks/Cole Thomson Learning Inc., 2002.

REFERENCE BOOKS:

1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, _Environmental Engineering‘, McGraw Hill Inc., New York, 1985.

2. Qian X, Koerner RM and Gray DH, _Geotechnical Aspects of Landfill Design and Construction' Prentice Hall, 2002.

https://archive.nptel.ac.in/courses/105/103/105103205/
https://archive.nptel.ac.in/courses/120/108/120108005/

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B.Tech IV Year I semester

TOTAL QUALITY MANAGEMENT
(Open Elective-IV)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0334Td	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course objectives: The objectives of the course are to

1 Familiarize the basic concepts of Total Quality Management.
2 Expose with various quality issues in Inspection.
3 Gain Knowledge on quality control and its applications to real time..
4 Understand the extent of customer satisfaction by the application of various quality concepts.
5 Demonstrate the importance of Quality standards in Production

Course Outcomes: On successful completion of the course, the student will be able to,

CO1: Define and develop on quality Management philosophies and analyze quality costs frameworks.
CO2: Understanding of the historical development of Total Quality Management (TQM), implementation, and real-world applications through case studies.
CO3: Evaluate the cost of poor quality, process effectiveness and efficiency to analyze areas for improvement.
CO4: Apply benchmarking and business process reengineering to improve management processes.
CO5: Demonstrate the set of indications to evaluate performance excellence of an organization

UNIT-I	Introduction:	9hrs

Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

UNIT-II	Historical Review:	10hrs

Historical Review: Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

UNIT-III	TQM Principles:	10hrs

Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures Basic Concepts, Strategy, Performance Measure Case studies.

UNIT-IV	TQM Tools:	10hrs

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

UNIT-V	Quality Systems:	9hrs

Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

Text Books:

1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd.,

2005.
3. Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017.

Reference Books:

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.
2. Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993.
3. Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015
4. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995

Online Learning Resources:

- https://www.youtube.com/watch?v=VD6tXadibk0
- https://www.investopedia.com/terms/t/total-quality-management-tqm.asp
- https://blog.capterra.com/what-is-total-quality-management/
- https://nptel.ac.in/courses/110/104/110104080/
- https://onlinecourses.nptel.ac.in/noc21_mg03/preview
- https://nptel.ac.in/courses/110/104/110104085/
- https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-mg39/

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B.Tech IV Year I semester

TRANSDUCERS AND SENSORS

(Open Elective –IV)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0444T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

1. To understand characteristics of Instrumentation System and the operating principle of motion transducers.
2. To explore working principles, and applications of different temperature transducers and
3. To provide knowledge on flow transducers and their applications.
4. To study the working principles of pressure transducers.
5. To introduce working principle and applications of force and sound transducers

Course Outcomes:

After completing the course, the student will be able to,

1. Understand characteristics of Instrumentation System and the operating principle of motion transducers.
2. Explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
3. Gain knowledge on flow transducers and their applications.
4. Learn the working principles of pressure transducers.
5. Understand the working principle and applications of force and sound transducers.

UNIT-I **10hrs**

Introduction: General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification.

Motion Transducers: Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo-electric transducers, seismic displacement pick-ups, vibrometers and accelerometers.

UNIT-II **10hrs**

Temperature Transducers: Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics.

Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors

UNIT-III **10hrs**

Flow Transducers: Bernoulli‘s principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

UNIT-IV **9hrs**

Pressure Transducers: Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high and low pressure measurement.

UNIT-V **9hrs**

Force and Sound Transducers: Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone**.**

TEXT BOOKS

1. A.K. Sawhney, ―A course in Electrical and Electronics Measurements and Instrumentation‖, Dhanpat Rai& Co. 3rd edition Delhi, 2010.

2. Rangan C.S, Sarma G.R and Mani V S V, ―Instrumentation Devices and Systems‖, TATA McGraw Hill publications, 2007.

REFERENCE BOOKS

1. Doebelin. E.O, ―Measurement Systems Application and Design‖,McGraw Hill International, New York, 2004.
2. Nakra B.C and ChaudharyK.K , ―Instrumentation Measurement and Analysis‖, Second Edition, Tata McGraw-Hill Publication Ltd.2006.

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B.Tech IV Year I semester

COMPUTER NETWORKS & INTERNET PROTOCOLS
(Open Elective-IV)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0520T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

The course is designed to:

1. Understand the basic concepts of Computer Networks.
2. Introduce the layered approach for design of computer networks
3. Expose the network protocols used in Internet environment
4. Explain the format of headers of IP, TCP and UDP
5. Familiarize with the applications of Internet
6. Elucidate the design issues for a computer network

Course Outcomes:

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

1. Identify the software and hardware components of a computer network
2. Design software for a computer network
3. Develop error, routing, and congestion control algorithms
4. Assess critically the existing routing protocols
5. Explain the functionality of each layer of a computer network
6. Choose the appropriate transport protocol based on the application requirements.

UNIT-I	Computer Networks and the Internet	10hrs

What Is the Internet? Network Edge, The Network Core, Delay, Loss, and Throughput in Packet Switched Networks (Textbook 2), Reference Models, Multimedia Networks, Guided Transmission Media, Wireless Transmission (Textbook 1)

UNIT-II	The Data Link Layer, Access Networks, and LANs	9hrs

Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols (Textbook

Retrospective: A Day in the Life of a Web Page (Packet) (Textbook 2)

UNIT-III	The Network Layer	9hrs

Routing Algorithms, Internetworking, The Network Layer in The Internet (Textbook 1)

UNIT-IV	The Transport Layer	10hrs

Connectionless Transport: UDP (Textbook 2), The Internet Transport Protocols: TCP, Congestion Control (Textbook 1)

UNIT-V	The Application Layer	10hrs

Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet‘s Directory Service, Peer-to-Peer Applications, Video Streaming and Content Distribution Networks (Textbook 2)

Textbooks:

1. Andrew S. Tanenbaum, David J. Wetherall, *Computer Networks*, 6th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, *Computer Networking: A Top-Down Approach*, 6th Edition,

Pearson, 2019.

Reference Books:

1. Forouzan, *Data Communications and Networking*, 5th Edition, McGraw Hill Publication.
2. Youlu Zheng, Shakil Akhtar, *Networks for Computer Scientists and Engineers*, Oxford Publishers, 2016.

Online Learning Resources:

1. https://nptel.ac.in/courses/106105183/25
2. https://www.nptelvideos.in/2012/11/computer-networks.html
3. https://nptel.ac.in/courses/106105183/3

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B.Tech IV Year I semester

INTERNET OF THINGS (Open Elective-IV)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0450T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

1. Understand the basics of Internet of Things and protocols.
2. Discuss the requirement of IoT technology
3. Introduce some of the application areas where IoT can be applied.
4. Understand the vision of IoT from a global perspective, understand its applications, determine its market perspective using gateways, devices and data management

Course Outcomes:

After completion of the course, students will be able to

1. Understand general concepts of Internet of Things.
2. Apply design concept to IoT solutions
3. Analyze various M2M and IoT architectures
4. Evaluate design issues in IoT applications
5. Create IoT solutions using sensors, actuators and Devices

UNIT-I	**Introduction to IoT**	**9hrs**

Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates

UNIT-II	**Prototyping IoT Objects using Microprocessor/Microcontroller**	**10hrs**

Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

UNIT-III	**IoT Architecture and Protocols**	**10hrs**

Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

UNIT-IV	**Device Discovery and Cloud Services for IoT**	**10hrs**

Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

UNIT-V	**UAV IoT**	**9hrs**

Introduction toUnmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)-Case study FlytBase.

Textbooks:

1. Vijay Madisetti and ArshdeepBahga, ― Internet of Things (A Hands-on-Approach)‖, 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis;George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, ― From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence‖, 1st Edition, Academic Press, 2014.
2. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities

Press, 2014.
3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis daCosta, ―Rethinking the Internet of Things: A Scalable Approach to Connecting Everything‖, 1st Edition, Apress Publications, 2013
5. Cuno Pfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 9781-4493- 9357-1
6. DGCA RPAS Guidance Manual, Revision 3 – 2020
7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

Online Learning Resources:

1. *https://www.arduino.cc/*
2. *https://www.raspberrypi.org/*
3. *https://nptel.ac.in/courses/106105166/5*
4. *https://nptel.ac.in/courses/108108098/*4

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B.Tech IV Year I semester

INTRODUCTION TO QUANTUM COMPUTING
Open Elective – IV

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A3315a	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

1. To introduce the principles and mathematical foundations of quantum computation.
2. To understand quantum gates, circuits, and computation models.
3. To explore quantum algorithms and their advantages over classical ones.
4. To develop the ability to simulate and write basic quantum programs.
5. To understand real-world applications and the future of quantum computing in AI, cryptography, and optimization.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Explain the fundamental concepts of quantum mechanics used in computing.
2. Construct and analyze quantum circuits using standard gates.
3. Apply quantum algorithms like Deutsch-Jozsa, Grover‘s, and Shor‘s.
4. Develop simple quantum programs using Qiskit or similar platforms.
5. Analyze applications and challenges of quantum computing in real-world domains.

UNIT-I	Fundamentals of Quantum Mechanics and Linear Algebra	**10hrs**

Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

UNIT-II	Quantum Gates and Circuits	**10hrs**

Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

UNIT-III	Quantum Algorithms and Complexity	**9hrs**

Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover‘s Search Algorithm, Shor‘s Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

UNIT-IV	Quantum Programming and Simulation Platforms	**9hrs**

Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

UNIT-V	Applications and Future of Quantum Computing	**10hrs**

Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

Textbooks:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

Reference Books:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

Online Learning Resources:

1. IBM Quantum Experience and Qiskit Tutorials
2. Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
3. edX – The Quantum Internet and Quantum Computers
4. YouTube – Quantum Computing for the Determined by Michael Nielsen
5. Qiskit Textbook – IBM Quantum

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B.Tech IV Year I semester

FINANCIAL MATHEMATICS
(Open Elective-IV)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0032T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

1. To provide mathematical foundations for financial modelling, risk assessment and asset pricing.
2. To introduce stochastic models and their applications in pricing derivatives and interest rate modelling.
3. To develop analytical skills for fixed-income securities, credit risk, and investment strategies.
4. To equip students with computational techniques for pricing financial derivatives.

Course Outcomes:

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

CO1: Explain fundamental financial concepts, including arbitrage, valuation, and risk

CO2: Apply stochastic models, including Brownian motion and Stochastic Differential Equations (SDEs), in financial contexts.

CO3: Analyze mathematical techniques for pricing options and financial derivatives.

CO4: Evaluate interest rate models and bond pricing methodologies.

CO5: Utilize computational techniques such as Monte Carlo simulations for financial modeling.

UNIT-I	Asset Pricing and Risk Management	10hrs

Fundamental financial concepts: Returns, arbitrage, valuation, and pricing. Asset/Liability management, investment income, capital budgeting, and contingent cash flows. One-period model: Securities, payoffs, and the no-arbitrage principle. Option contracts: Speculation and hedging strategies, CAP Model, Efficient market hypothesis.

UNIT-II	Stochastic Models in Finance	10hrs

Random Walks and Brownian Motion. Introduction to Stochastic Differential Equations (SDEs): Drift and diffusion. Ito calculus: Ito‘s Lemma, Ito Integral, and Ito Isometry.

UNIT-III	Interest Rate and Credit Modelling	9hrs

Interest rate models and bond markets. Short-rate models: Vasicek, Cox-Ingersoll-Ross (CIR), Hull & White models, Credit risk modelling: Hazard function and hazard rate.

UNIT-IV	Fixed-Income Securities and Bond Pricing	9hrs

Characteristics of fixed-income products: Yield, duration, and convexity. Yield curves, forward rates, and zero-coupon bonds. Stochastic interest rate models and bond pricing PDE. Yield curve fitting and calibration techniques, Mortgage Backed Securities.

UNIT-V	Exotic Options and Computational Finance	10hrs

Stochastic volatility models and the Feynman-Kac theorem.Exotic options: Barriers, Asians, and Look backs. Monte Carlo methods for derivative pricing, Black-Scholes-Merton model: Derivation and applications.

Textbooks:

1. Ales Cerny, *Mathematical Techniques in Finance: Tools for Incomplete Markets*, Princeton University Press.
2. S.R. Pliska, *Introduction to Mathematical Finance: Discrete-Time Models*, Cambridge University Press.

Reference Books:

1. IoannisKaratzas& Steven E. Shreve, *Methods of Mathematical Finance*, Springer, New York.
2. John C. Hull, *Options, Futures, and Other Derivatives*, Pearson.

Web References:

- MIT– Mathematics for Machine Learning https://ocw.mit.edu
- Coursera – Financial Engineering and Risk Management (Columbia University) https://www.coursera.org/
- National Stock Exchange (NSE) India – Financial Derivatives https://www.nseindia.com/

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B.Tech IV Year I semester

SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS
(Open Elective-IV) (Common to all branches)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0038T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

COURSE OBJECTIVES

1. To provide exposure to various kinds of sensors and actuators and their engineering applications.
2. To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
3. To explain the operating principles of various sensors and actuators
4. To educate the fabrication of sensors
5. To explain the required sensor and actuator for interdisciplinary application

Course Outcomes

CO1: Classify different types of Sensors and Actuators along with their characteristics
CO2: Summarize various types of Temperature and Mechanical sensors
CO3: Illustrates various types of optical and mechanical sensors
CO4: Analyze various types of Optical and Acoustic Sensors
CO5: Interpret the importance of smart materials in various devices

UNIT-I	Introduction to Sensors and Actuators	9hrs

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching. Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working:

UNIT-II	Temperature and Mechanical Sensors	10hrs

Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors
Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: Strain gauges, Tactile sensors, Pressure sensors: Piezoresistive, Variable Reluctance Sensor (VRP).

UNIT-III	Optical and Acoustic Sensors	10hrs

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo resistors based sensors, Photomultipliers, Infrared sensors: thermal, Passive Infra-Red, Fiber based sensors and Thermopiles
Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones

UNIT-IV	Magnetic and Electromagnetic Sensors	10hrs

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magnetostrictive sensors and actuators.

UNIT-V	Chemical and Radiation Sensors	9hrs

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.
Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

Textbooks:

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2nd Edition, 2015
2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999

Reference Books:

1. Sensors and Transducers- D.Patranabhis, Prentice Hall of India (Pvt) Ltd. 2003
2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999
3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.

NPTEL course link: https://onlinecourses.nptel.ac.in/noc21_ee32/preview

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B.Tech IV Year I semester

CHEMISTRY OF NANOMATERIALS AND APPLICATIONS
(Open Elective-IV) (Common to all branches)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0043T	3: 0:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives

1 To understand basics and characterization of nanomaterials.
2 To understand synthetic methods of nanomatrials.
3 To apply various techniques for charterization of nanomaterials.
4 To understand Studies of Nano-structured Materials
5 To enumerate the applications of advanced nanomaterials in engineering

Course Outcomes

CO1: Classify the nanostructure materials; describe scope of nanoscience and importance technology.
CO2: Describe the top-down approach, Explain aerosol synthesis and plasma arc technique, Differentiate chemical vapor deposition method and electrode position method, Discuss about highenergy ball milling.
CO3: Discuss different technique for characterization of nanomaterial, Explain electron microscopy techniques for characterization of nanomaterial, Describe BET method for surface area analysis.
CO4: Explain synthesis and properties and applications of nanaomaterials, Discuss about fullerenes and carbon nanotubes, Differentiate nanomagnetic materials and thermoelectric materials, nonlinear optical materials.
CO5: Illustrate advance engineering applications of Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

UNIT-I	Basics and Characterization of Nanomaterials	10Hrs

Introduction**,** Scope of nanoscience and nanotecnology, nanoscience in nature, classification of nanostructured materials, importance of nanomaterials.

UNIT-II	Synthesis of nanomaterials	10Hrs

Top-Down approach**,** Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, highenergy ball milling method. Synthetic Methods**:** Bottom-Up approach**,** Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

UNIT-III	Techniques for characterization	9Hrs

Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.

UNIT-IV	Studies of Nano-structured Materials	9hrs

Synthesis, properties and applications of the following nanomaterials -fullerenes, carbon nanotubes, 2D-nanomaterial (Graphene), core-shell, magnetic nanoparticles, thermoelectric materials, non-linear optical materials.

UNIT-V	Advanced Engineering Applications of Nanomaterials	10hrs

Applications of Nano Particle, nanorods, nano wires, Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

TEXT BOOKS:

1. NANO: The Essentials: T Pradeep, MaGraw-Hill, 2007.
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012.

REFERENCE BOOKS:

1. Concepts of Nanochemistry; LudovicoCademrtiri and Geoffrey A. Ozin& Geoffrey A. Ozin,

Wiley-VCH, 2011.
2. **Nanostructures &Nanomaterials; Synthesis, Properties & Applications:** Guozhong Cao, Imperial College Press, 2007.

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B.Tech IV Year I semester

LITERARY VIBES
(Open Elective-IV) (Common to all branches)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0047T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives

1 To inculcate passion for aesthetic sense and reading skills
2 To encourage respecting others' experiences and creative writing
3 To explore emotions, communication skills and critical thinking
4 To educate how books serve as the reflection of history and society
5 To provide practical wisdom and duty of responding to events of the times

Course Outcomes

CO1: Identify genres, literary techniques and creative uses of language in literary texts.

CO2: Explain the relevance of themes found in literary texts to contemporary, personal and cultural values and to historical forces

CO3: Apply knowledge and understanding of literary texts when responding to others' problems and their own and make evidence-based arguments

CO4: Analyze the underlying meanings of the text by using the elements of literary texts

CO5: Evaluate their own work and that of others critically

CO6: Develop as creative, effective, independent and reflective students who are able to make informed choices in process and performance

UNIT-I	Poetry	10Hrs

1. Ulysses- Alfred Lord Tennyson
2. Ain't I woman?-Sojourner Truth
3. The Second Coming-W.B. Yeats
4. Where the Mind is Without Fear-Rabindranath Tagore

UNIT-II	Drama: *Twelfth Night*- William Shakespeare	10Hrs

Shakespeare -life and works

1. Plot & sub-plot and Historical background of the play
2. Themes and Criticism
3. Style and literary elements
4. Characters and characterization

UNIT-III	Short Story	9Hrs

1. The Luncheon - Somerset Maugham
2. The Happy Prince-Oscar Wild
3. Three Questions – Leo Tolstoy
4. Grief –Antony Chekov

UNIT-IV	Prose: Essay and Autobiography	10Hrs

My struggle for an Education-Booker T Washington

1. The Essentials of Education-Richard Livingston
2. The story of My Life-Helen Keller
3. Student Mobs-JB Priestly

UNIT-V	Novel: *Hard Times*- Charles Dickens	9Hrs

1. Charles Dickens-Life and works
2. Plot and Historical background of the novel
3. Themes and criticism
4. Style and literary elements
5. Characters and characterization

Text Books:

1. Charles Dickens.*Hard Times.*(Sangam Abridged Texts) Vantage Press, 1983
2. DENT JC.*William Shakespeare. Twelfth Night.* Oxford University Press,2016.

References:

1. WJ Long.History of English Literature**,** Rupa Publications India; First Edition (4 October 2015)
2. RK Kaushik And SC Bhatia. Essays, Short Stories and One Act Plays, Oxford University Press .2018.
3. Dhanvel, SP. English and Soft Skills, Orient Blackswan,2017.
4. New Horizon, Pearson publications, New Delhi 2014
5. Vimala Ramarao, Explorations Volume-II, Prasaranga Bangalore University,2014**.**
6. Dev Neira, Anjana & Co. Creative Writing: A Beginner's Manual.Pearson India, 2008.

Online Resources

https://www.litcharts.com/poetry/alfred-lord-tennyson/ulysses
https://www.litcharts.com/lit/ain-t-i-a-woman/summary-and-analysis
https://englishliterature.education/articles/poetry-analysis/the-second-coming-by-w-b-yeats-critical-analysis- summary-and-line-by-line-explanation/#google_vignette
https://sirjitutorials.com/where-the-mind-is-without-fear-poem-notes-explanation/
https://www.litcharts.com/lit/twelfth-night/themes
https://smartenglishnotes.com/2021/11/28/the-luncheon-summary-characters-themes-and-irony/

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B.Tech IV Year I semester

POWER SYSTEMS AND SIMULATION LAB
(Skill Enhancement Course)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0243P	0: 0:4:0	2	CIE: 30 SEE:70	3 Hours	SEC

Course Objectives:

The objectives of this course include

1. To do the experiments (in machines lab) on various power system concepts like determination of sequence impedance, fault analysis, finding of subtransient reactance's.
2. To draw the equivalent circuit of three winding transformer by conducting a suitable experiment.
3. To develop the MATLAB program for formation of Y and Z buses. To develop the MATLAB programs for Gauss-Seidel and fast decoupled load flow studies.
4. To develop the SIMULINK model for single area load frequency problem

Course Outcomes:

CO1: Analyze and determine the sequence impedances of both cylindrical rotor and salient pole synchr machines to understand their behavior under various fault conditions. **-L3**

CO2: Conduct fault analysis (LG, LL, LLG, and LLLG) on synchronous machines and interpret the im faults on system stability and performance. **-L2**

CO3: Develop and simulate load flow analysis using various methods (Gauss-Seidel, Newton-Raphson, Decoupled) and formulate the YBus and ZBus for power system networks. **-L5**

CO4: Model load frequency control problems for single and two-area systems, employing both uncontr PI-controlled approaches to evaluate system performance**.- L4**

CO5: Simulate load frequency control problems for single and two-area systems, employing both unco PI-controlled approaches to evaluate system performance**.-L6**

CHOOSE ANY TEN FROM THE FOLLOWING LIST:

1. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine
2. Determination of Sequence Impedances of salient pole Synchronous Machine
3. LG Fault Analysis on an un loaded alternator
4. LL Fault Analysis on conventional phases
5. LLG Fault Analysis
6. LLLG Fault Analysis
7. Determination of Sub transient reactance of salient pole synchronous machine
8. Equivalent circuit of three winding transformer.
9. Y_{Bus} formation using Soft Tools
10. Z_{Bus} formation using Soft Tools
11. Gauss-Seidel load flow analysis using Soft Tools
12. Newton-Raphson load flow analysis using Soft Tools
13. Fast decoupled load flow analysis using Soft Tools
14. Solve the Swing equation and Plot the swing curve
15. Develop a model for a uncontrolled single area load frequency control problem and simulate the same using Soft Tools.

16. Develop a model for PI controlled single area load frequency control problem and simulate the same using Soft Tools.
17. Develop a model for a uncontrolled two area load frequency control problem and simulate the same using Soft Tools.
18. Develop a model for PI controlled two area load frequency control problem and simulate the same using Soft Tools

Online Learning Resource:

1. **https://www.ee.iitb.ac.in/~vlabsync/template/vlab/index.html#**

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B.Tech IV Year I semester

GENDER SENSITIZATION
(Common to All Branches of Engineering)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0054T	2: 0:0:0	0	CIE: 30 SEE:70	3 Hours	ACC

Course Objectives:

1. To enable students to understand the gender related issues, vulnerability of women and men
2. To familiarize them about constitutional safeguard for gender equality
3. To expose the students to debates on the politics and economics of work
4. To help students reflect critically on gender violence
5. To make them understand that gender identities and gender relations are part of culture as they shape the way daily life is lived in the family as well as wider community and the workplace.

Course Outcomes (CO):

CO1: Understand the basic concepts of gender and its related terminology
CO2: Identintify the biological, sociological, psychological and legal aspects of gender.
CO3: Use the knowledge in understanding how gender discrimination works in our society and how to counter it.
CO4: Analyze the gendered division of labour and its relation to politics and economics.
CO5: Appraise how gender-role beliefs and sharing behaviour are associated with more well-being in all culture and gender groups
CO6: Develop students‘ sensibility with regard to issues of gender in contemporary India

UNIT-I UNDERSTANDING GENDER

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

UNIT-II GENDER ROLES AND RELATIONS

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles-Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences- Declining Sex Ratio- Demographic Consequences-Gender Spectrum -

UNIT-III GENDER AND LABOUR

Division and Valuation of Labour-Housework: The Invisible Labor- ―My Mother doesn‘t Work.‖ ―Share the Load.‖-Work: Its Politics and Economics -Fact and Fiction- Unrecognized and Unaccounted work - Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

UNIT-IV **GENDER-BASED VIOLENCE**

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women - Consequences of gender-based violence

UNIT-V GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language- Just Relationships

Prescribed Books

1. A.Suneetha, Uma Bhrugubanda, et al. *Towards a World of Equals: A Bilingual Textbook on Gender*‖, Telugu Akademi, Telangana, 2015.
2. Butler, Judith. *Gender Trouble: Feminism and the Subversion of Identity*. UK Paperback Edn. March 1990

Reference Books

1. Wtatt, Robin and Massood, Nazia, *Broken Mirrors: The dowry Problems in India*,London : Sage Publications, 2011
2. Datt, R. and Kornberg, J.(eds), *Women in Developing Countries, Assessing Strategies for Empowerment*, London: Lynne Rienner Publishers, 2002
3. Brush, Lisa D., *Gender and Governance*, New Delhi, Rawat Publication, 2007
4. Singh, Direeti, *Women and Politics World Wide*, New Delhi, Axis Publications, 2010
5. Raj Pal Singh, Anupama Sihag, *Gender Sensitization: Issues and Challenges* (English, Hardcover), Raj Publications, 2019
6. A.Revathy& Murali, Nandini, *A Life in Trans Activism*(Lakshmi Narayan Tripathi). The University of Chicago Press, 2016

Online Resources:

1. Understanding Gender chrome-extension: //kdpelmjpfafjppnhbloffcjpeomlnpah/https://www.arvindguptatoys.com/arvindgupta/kamla-gender1.pdf https://onlinecourses.swayam2.ac.in/nou24_hs53/preview
2. Gender Roles and Relations https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are-gender-roles-and-stereotypes https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our-relationships-7499408 https://onlinecourses.swayam2.ac.in/cec23_hs29/preview
3. Gender and Labour https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and-how-can-it-be-redressed https://onlinecourses.nptel.ac.in/noc23_mg67/preview
4. **GENDER-BASED VIOLENCE** https://eige.europa.eu/gender-based-violence/what-is-gender-based-violence?language_content_entity=en https://www.worldbank.org/en/topic/socialsustainability/brief/violence-against-women-and-girls https://onlinecourses.swayam2.ac.in/nou25_ge38/preview
5. **GENDER AND CULTURE** https://gender.study/psychology-of-gender/culture-impact-gender-roles-identities/ https://sociology.iresearchnet.com/sociology-of-culture/gender-and-culture/ https://archive.nptel.ac.in/courses/109/106/109106136/

Abdulali Sohaila. ―I Fought For My Life…and Won.‖Available online (at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

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B.Tech IV Year I semester

EVALUATION OF INDUSTRY INTERNSHIP					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0244	**0: 0:0:0**	**2**			

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B.Tech IV Year II semester

Department of Electrical and Electronics Engineering

Course Structure (RG23)

B.Tech IV Year II semester							
Sl. No.	Category	CourseCode	Course Title	Hours per week			Credits
				L	T	P	C
1.	PR	23A0245	Project	-	-	24	8
			Internship and Project	-	-	-	4

COURSES OFFERED FOR HONOURS DEGREE IN EEE (ELECTRIC VEHICLES)

S.No.	Course Code	Course Name	Contact Hours per week		Credits
			L	P	
1	23A0246T	E - Mobility	3	-	3
2	23A0247T	Battery Management Systems	3	-	3
3	23A0248T	Special Machines for Electric Vehicles	3	-	3
4	23A0249T	Grid Interface of Electric Vehicles	3	-	3
5	23A0250T	EV Charging Technologies	3	-	3
6	23A0251T	Project on Electric Vehicles	-	6	3

Member Secretary **BOS Chairman**

HONOURS

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B.Tech IV Year II semester

E - MOBILITY					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0246T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	

Course Objectives:

1. Understand the fundamental concepts and principles of Electric vehicles
2. Apply the concepts to implement battery technology
3. Apply the concepts to implement charging technology
4. Understand the future trends in EVs

Course Outcomes:

The students will be able to:

CO1: Understanding the Fundamentals of Electric Vehicles and Vehicle Dynamics. Choose suitable motors and analyse different power electronics in EVs.

CO2: Analyzing Battery Technologies for Electric Vehicles**.**

CO3: Understanding and Evaluating Charging Technologies for Electric Vehicles**.**

CO4: Exploring Future Trends and Innovations in Electric Vehicles**.**

CO5: Understanding E-Mobility, Policy, and Integration with Smart Grids.

UNIT-I	**Introduction:**	**10Hrs**

Introduction to electric vehicles: EV verses gasoline vehicles, vehicle dynamics fundamentals, e-drivetrain, Electric motor, Power electronic in electric vehicles, Regenerative braking.

UNIT-II	**Battery Technology:**	**10Hrs**

Battery Technology for EVs: Storage technologies for EV, Battery working principles, Battery losses, Li-ion batteries, Battery pack and battery management system.

UNIT-III	**Charging Technology:**	**9Hrs**

Charging Technology of EVs: AC charging - Type 1,2,3, DC charging, Fast charging and its limitations, Smart charging and applications, Vehicle to X(V2X), X2V technology.

UNIT-IV	**FUTURE TRENDS IN EVs:**	**9Hrs**

Future trends in e-Vehicles: Wireless charging of EV, On-road charging of EV, Battery swap technology, Solar powered EVs, Charging EVs from renewables.

UNIT-V	**E-Mobility:**	**10Hrs**

E-mobility: electrification challenges, business, connected mobility and autonomous mobility case study in Indian Roadmap Perspective, Policy- EVs in infrastructure system, integration of EVs in smart grid, social dimensions of EVs.

Textbooks:

1. Iqbal Hussain, ―Electric & Hybrid Vehicles – Design Fundamentals‖, Second Edition, CRC Press, 2011.
2. James Larminie, ―Electric Vehicle Technology Explained‖, John Wiley & Sons, 2003.

Reference Books:

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, ―Modern Electric, Hybrid Electric, and Fuel Cell

Vehicles: Fundamentals‖, CRC Press, 2010.

2. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
3. Sandeep Dhameja, ―Electric Vehicle Battery Systems‖, Newnes, 2000
4. Tariq Muneer and Irene Illescas García, ―The automobile, In Electric Vehicles: Prospects and Challenges‖, Elsevier, 2017.

Online Learning Resources:

1. https://nptel.ac.in/courses/108106170

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B.Tech IV Year II semester

BATTERY MANAGEMENT SYSTEMS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0247T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	

Course Objectives:

1. Understand the basics of batteries and its parameters
2. Apply the concepts to create Battery Management System
3. Create Physical and Simulation models for Battery Management System
4. Design different Battery Management Systems

Course Outcomes:

After completion of this course, student will be able to

CO1: Understand the role of battery management system -**L2**

CO2: Identify the requirements of Battery Management System. **L2**

CO3: Interpret the concept associated with battery charging / discharging process.-**L3**

CO4: Analyze various parameters of battery and battery pack**. L4**

CO5: Design the model of battery pack**. L5**

UNIT-I	**Introduction:**	**10Hrs**

Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging

UNIT-II	**Battery Management System:**	**10Hrs**

Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of charge estimation, Cell total energy and cell total power

UNIT-III	**Battery State Of Charge And State Of Health Estimation:**	**9Hrs**

Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing

UNIT-IV	**Modelling and Simulation:**	**9Hrs**

Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modelling approach, Simulating an electric vehicle, Vehicle range calculations, Simulating constant power and voltage, Simulating battery packs

UNIT-V	**Design Of Battery Management Systems:**	**10Hrs**

Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system

Textbooks:

1. Plett, Gregory L. Battery management systems, Volume I: Battery modelling. Artech House, 2015.
2. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods. Artech House, 2015

Reference Books:

1. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L ―Battery Management Systems -Design by Modelling‖ Philips Research Book Series 2002.
2. Davide Andrea,‖ Battery Management Systems for Large Lithium-ion Battery Packs‖ Artech House, 2010
3. Pop, Valer, et al. Battery management systems: Accurate state-of-charge indication for battery-powered applications. Vol. 9. Springer Science & Business Media, 2008.

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B.Tech IV Year II semester

SPECIAL MACHINES FOR ELECTRIC VEHICLES					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0248T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	

Course Objectives:

1. Understand various Motor Drives useful for EV applications
2. Apply the concepts to implement various designs
3. Analyze performance of various Motor Drives
4. Evaluate the usage of specific drive for EV application

Course Outcomes:

After completion of this course, student will be able to

CO1: Understanding the Fundamentals of Permanent Magnet (PM) Brushless Motor Drives.

CO2: Analyzing Switched Reluctance Motor (SRM) Drives.

CO3: Evaluating Stator-Permanent Magnet (PM) Motor Drives.

CO4: Understanding and Designing Magnetic-Gear Motor Drives.

CO5: Exploring Advanced Magnetless and Multiphase Motor Drives.

UNIT-I	**Permanent Magnet (PM) Brushless Motor Drives:**	**9Hrs**

Structure of PM Brushless Machines, Principle of PM Brushless Machines Modeling of PM Brushless Machines, Inverters for PM Brushless Motors Motor Control, Design Criteria of PM Brushless Motor Drives for EVs, Design Examples of PM Brushless Motor Drives for EVs, Application, Advantages and Limitations for EVs.

UNIT-II	**Switched Reluctance Motor Drive:**	**9Hrs**

Structure of SR Machines, Principle of SR Machines, SR Converters Topologies, SR Motor Control, Design Criteria of SR Motor Drives for EVs, Examples of SR Motor Drives for EVs, Application, Advantages and Limitations for EVs.

UNIT-III	**Stator-PM Motor Drives:**	**10Hrs**

Doubly-Salient PM Motor Drives, Flux-Reversal PM Motor Drives, Flux-Switching PM Motor Drives, Hybrid-Excited PM Motor Drives Flux-Mnemonic PM Motor Drives, Design Criteria of Stator-PM Motor Drives for EVs, Application, Advantages and Limitations for EVs.

UNIT-IV	**Magnetic-Geared Motor Drives:**	**10Hrs**

Principle of MG Machines, Modeling of MG Machines, Inverters for MG Motors, MG Motor Control, Design Criteria of MG Motor Drives for EVs, Application, Advantages and Limitations for EVs

UNIT-V	**Advanced Magnetless Motor Drives and Multiphase Motor Drives:**	**10Hrs**

Introduction of Advanced Magnetless technology, Synchronous Reluctance Motor Drives, Doubly- Salient DC Motor Drives, Flux-Switching DC Motor Drives, Design Criteria of Advanced Magnetless Motor Drives for EVs, Application, Advantages and Limitations for EVs. Multiphase Induction Motor drives –

principle, operation and control, Multiphase PMSM machine – principle, operation and control, Fault tolerant operation of multiphase drives

Textbooks:

1. Mehrdad Ehsani, Yimin Gao, Sebatien Gay and Ali Emadi, ―Modern Electric, Hybrid Electric and Fuel cell vehicles: Fundamentals, Theory and Design‖, CRC Press, 2004.
2. James Larminie and John Loury, ―Electric Vehicle Technology – Explained‖, John Wiley & Sons Ltd, 2003.

Reference Books:

1. Sandeep Dhameja, ―Electric Vehicle Battery Systems‖, Butterworth – Heinemann, 2002.
2. Ronald K Jurgen, ―Electric and Hybrid – Electric Vehicles‖, SAE, 2002.
3. Ron Hodkinson and John Fenton, ―Light Weight Electric/Hybrid Vehicle Design‖, Butterworth – Heinemann, 2001.
4. Iqbal Husain, ―Electric and Hybrid Vehicles- Design Fundamentals‖ CRC Press, 2011.

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B.Tech IV Year II semester

GRID INTERFACE OF ELECTRIC VEHICLES					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0249T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	

Course Objectives:

1. Understand the Grid interfacing concept of EVs
2. Analyze the EV impact on grid
3. Design new types of charging facilities for EVs
4. Evaluate the role of EV as ancillary service

Course Outcomes:

After completion of this course, student will be able to

CO1: Understanding the Fundamentals of Smart Grid and Electric Vehicle Integration Analyze Impact of EV on smart grid

CO2: Analyzing the Impact of EVs and V2G on the Smart Grid and Renewable Energy Systems

CO3: Applying Power Conversion Technologies for Smart Grids and Electric Vehicles

CO4: Designing Control and Management Strategies for PEV Parking Lots

CO5: Evaluating the Role of PEVs as Ancillary Services in Smart Grids

UNIT-I	**Introduction to Smart Grid and PEV:**	**10Hrs**

Introduction to smart grid and microgrid, Impact of PEVs on Distributed Energy Resources in the Smart Grid, V2G Technology and PEVs Charging Infrastructures

UNIT-II	**Impact of V2G and G2V on the Smart Grid and Renewable Energy Systems:**	**9Hrs**

Types of Electric Vehicles, Motor Vehicle Ownership and EV Migration, Impact of Estimated EVs on Electrical Network, Impact on Drivers and the Smart Grid, Standardization and Plug-and-Play

UNIT-III	**Power Conversion Technology in the Smart Grid and EV:**	**10Hrs**

Impacts of EV Penetration on Grid Power Profile, Requirements of Its Control and Monitoring, Hybrid EV Powertrain Architectures, Control, Monitoring and Management Strategies of EV, V2G Communication System, System model of EV, Case study of three phase fault and its impact

UNIT-IV	**Planning, Control and Management Strategies for Parking Lots for PEVs:**	**10Hrs**

Introduction to PEV Charging Facility, Long-Term Planning for PEV Parking Lots, Control and Management of PEV Parking Lots - stages of implementation

UNIT-V	**PEV as Ancillary Service in Smart Grid:**	**9Hrs**

Introduction to Ancillary Services, PEV Charger Optimization, PEV as ancillary source, Control Strategies for PEVs to Follow the Individual Operation Values, Systems and Control Algorithm for Smart PEV Chargers, Avoiding the Harmonic Propagation Within the Grid, Case study

Textbooks:

1. Lu, J. and Hossain, J., Vehicle-to-grid: linking electric vehicles to the smart grid. Institution of

Engineering and Technology, 2015.

2. Rajakaruna, S., Shahnia, F. and Ghosh, A. eds., Plug In Electric Vehicles in Smart Grids: Integration Techniques. Springer, 2014.

Reference Books:

1. Rajakaruna, S., Shahnia, F. and Ghosh, A. eds., Plug in electric vehicles in smart grids: charging strategies. Springer, 2014.
2. Salman, S.K., Introduction to the Smart Grid: Concepts, Technologies and Evolution (Vol. 94). IET., 2017.

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B.Tech IV Year II semester

EV CHARGING TECHNOLOGIES					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0250T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	

Course Outcomes:

CO1: Understanding Battery Basics and Key Parameters-**L2**
CO2: Analyzing Battery Modeling Techniques and Capacity Estimation-**L3**
CO3: Exploring Charging Infrastructure and Regulatory Frameworks-**L4**
CO4: Evaluating Battery Charging Techniques and Performance-**L3**
CO5: Understanding Power Electronics in EV Charging Systems-**L3**

UNIT-I	**Battery Basics:**	**9Hrs**

Battery parameters- Cell and Battery Voltages, Charge (or Amp hour) Capacity, Energy Stored, Specific Energy, Energy Density, Specific Power, Amp hour (or Charge) Efficiency, Energy Efficiency, Self-discharge Rates, Battery Geometry, Battery Temperature, Heating and Cooling Needs 35 3.2.12 Battery Life and Number of Deep Cycles Types of batteries- lead-acid, nickel based sodium based, lithium batteries, metal-air batteries. Refilled Batteries.

UNIT-II	**Battery Modeling:**	**10Hrs**

The Purpose of Battery Modelling, Electrochemical model, black box model, equivalent circuit model - Battery Equivalent Circuit, Modelling Battery Capacity, Simulating a Battery at a Set Power, Calculating the Peukert Coefficient, Approximate Battery Sizing, Battery state of charge estimation.

UNIT-III	**Charging Infrastructure:**	**10Hrs**

EV supply equipment, charging standards, classification of charging infrastructure, connecting EVs to the electricity grid, regulatory framework for EV charging connections, communication protocols for smart charging, Battery Management System.

UNIT-IV	Battery Charging Techniques:	**9Hrs**

Basic Terms for Evaluating Charging Performances, Charging Algorithms for Li- Ion Batteries, Optimal Charging Current Profiles for Lithium- Ion battery, Lithium Titanate Oxide Battery with Extreme Fast Charging Capability. Super Capacitors for battery charging.

UNIT-V	**Power Electronics in EV Charging:**	**10Hrs**

Active front end rectifiers - Forward converters, half and full bridge DC-DC converters, power factor correction converters, decreasing impact on the grid and switches, bidirectional battery chargers, wireless charging

TEXT BOOKS:

1. James Larminie, John Lowry, ―Electric Vehicle Technology Explained‖, Wiley, 2012.
2. RuiXiong, Weixiang Shen, ―Advanced Battery management Technologies for Electric Vehicle‖, Wiley, 2018

REFERENCES:

1. Handbook of Electric Vehicle Charging Infrastructure Implementation, NITI Aayog, Government of India.
2. Chris Mi, M. AbulMasrur, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, Wiley, 2017
3. Bruno Scrosati, Jurgen Garche, Werner Tillmetz, Advances in Battery Technologies for Electric

Vehicles, Wood head Publishing Series in Energy, 2015
4. Sheldon S. Williamson , Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013

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B.Tech IV Year II semester

PROJECT ON ELECTRIC VEHICLES					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0251T	**0: 0:6:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	