MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
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B.Tech -Electrical and Electronics Engineering Course Structure (MLRS-R24)
Applicable From 2024-25 Admitted BatchStructure Breakup

S.No	Category	Break up of credits (Total160credits)
1	Humanities and Social Sciences including Management Courses(HSMC)	7
2	Basic Sciences Courses (BS) including Mathematics, Physics and Chemistry	20
3	Engineering Science Courses (ES), including Workshop, Graphics basics of Electrical/Mechanical/Computer Engineering.	19
4	Professional Core Courses (PC) relevant to the chosen specialization / branch	63
5	Professional Electives(PE), relevant to the chosen specialization / branch	18
6	Open Electives(OE) from other technical and / or emerging areas	9
7	Experiential Learning/ Skill Development Courses (SDC) / Field Based Project/ Internship/ Project work (PROJ) / Seminar	24
8	Mandatory Courses (MC) / Value Added Courses (VAC)	Non-Credit
TOTAL		**160**

I YEAR ISEMESTER

S. No.	Course Code	Course Name	Course Area	Hours per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
		Theory								
1	2410001	Matrices and Calculus	BS	3	1	0	4	40	60	100
2	2410008	Applied Physics	BS	3	0	0	3	40	60	100
3	2410501	Problem Solving using C and C++	ES	3	0	0	3	40	60	100
4	2410010	English for Skill Enhancement	HSMC	3	0	0	3	40	60	100
		Laboratory								
1	2410372	Engineering Workshop	ES	0	1	4	3	40	60	100
2	2410071	Applied Physics Laboratory	BS	0	0	2	1	40	60	100
3	2410571	Problem Solving using C and C++ Laboratory	ES	0	0	2	1	40	60	100
4	2410073	English Language and Communications Skills Laboratory	HSMC	0	0	2	1	40	60	100
		Skill Development Course								
1	2410596	Web Application Development	SDC	0	0	2	1	40	60	100
		Mandatory Course								
1		Foreign Language*	MC	0	0	0	0	-	-	-
		Induction Program	-	-	-	-	-	-	-	-
Total Credits				12	2	12	20	360	540	900

- **Students can choose any one of the foreign language from the given list**
  i)   **24X0FL1 French**
  ii)   **24X0FL2German**
  iii)   **24X0FL3Spanish**
  iv)   **24X0FL4Korean**

I YEAR IISEMESTER

S. No.	Course Code	Course Name	Course Area	Hours per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
		Theory								
1	2420002	Differential Equations and Vector Calculus	BS	3	1	0	4	40	60	100
2	2420009	Engineering Chemistry	BS	3	0	0	3	40	60	100
3	2420502	Essentials of Problem Solving Using Python	ES	3	0	0	3	40	60	100
4	2420221	Electrical Engineering	PC	3	0	0	3	40	60	100
		Laboratory								
1	2420371	Computer Aided Engineering Graphics	ES	1	0	4	3	40	60	100
2	2420072	Engineering Chemistry Laboratory	BS	0	0	2	1	40	60	100
3	2420276	Electrical Engineering Laboratory	PC	0	0	2	1	40	60	100
4	2420572	Essentials of Problem Solving Using Python Laboratory	ES	0	0	2	1	40	60	100
		Skill Development								
1	2420027	Public Speaking Skills	SDC	0	0	2	1	40	60	100
		Mandatory								
1	2420026	Yoga and Inner Engineering	MC	0	0	0	0	-	-	-
		Total Credits		13	1	12	20	360	540	900

*MC-Satisfactory/Unsatisfactory, SDC: Skill Development Course

II YEAR I SEMESTER

S. No.	Course Code	Course Name	Course Area	Hours per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
		Theory								
1	2430224	Electro Magnetic Fields	PC	2	0	0	2	40	60	100
2	2430222	Network Analysis	PC	3	0	0	3	40	60	100
3	2430460	Analog Electronics	PC	3	0	0	3	40	60	100
4	2430223	DC Machines and Tranformers	PC	3	0	0	3	40	60	100
5	2430507	Data Structures	ES	3	0	0	3	40	60	100
6	243ExL1	Design and Innovation	EL	0	0	2	1	40	60	100
		Laboratory								
1	2430277	Network Analysis and Simulation Laboratory	PC	0	0	2	1	40	60	100
2	2430278	DC Machines Laboratory	PC	0	0	2	1	40	60	100
3	2430575	Data Structures Laboratory using Python	ES	0	0	2	1	40	60	100
		Skill Development								
1	2430455	PCB Fabrication	SDC	0	0	2	1	40	60	100
		Project								
1	2430291	Internship-1*	PS	0	0	2	1	100	-	100
		Mandatory								
1		Indian Knowledge System*	MC	0	0	0	0	-	-	-
		Total Credits		**14**	**0**	**12**	**20**	**400**	**600**	**1000**

*MC-Satisfactory/Unsatisfactory, SDC: Skill Development Course

*Students must complete internship-1 during 1-2 semester break (minimum 2 weeks)

***Students can choose any one of the following course

i)   24XIKS1:Indian Science, Engineering and Technology
ii)   24XIKS2:Fundamentals and Applications of Vedic Mathematics
iii)   24XIKS3:Indian Health, Wellness and Psychology- including Ayurved
iv)   24XIKS4:Indian Town Planning and Architecture

II YEAR II SEMESTER

S. No.	Course Code	Course Name	Course Area	Hours per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
		Theory								
1	2440003	Numerical Methods and Complex Variables	BS	3	1	0	4	40	60	100
2	2440225	AC Machines	PC	3	0	0	3	40	60	100
3	2440461	Digital Electronics	PC	3	0	0	3	40	60	100
4	2440226	Control Systems	PC	2	1	0	3	40	60	100
5	2440227	Electrical Power Generation	PC	2	0	0	2	40	60	100
6	244ExL2	Prototype/Model development and Entrepreneurship	EL	0	0	2	1	40	60	100
		Laboratory								
1	2440279	AC Machines Laboratory	PC	0	0	2	1	40	60	100
2	2440280	Control SystemsLaboratory	PC	0	0	2	1	40	60	100
3	2440482	Analog and Digital Electronics Laboratory	PC	0	0	2	1	40	60	100
		Skill Development Course								
1	2440574	Data visualization-Power Bi	SDC	0	0	2	1	40	60	100
		Mandatory Course								
1	2440021	Environmental Science	*MC	0	0	0	0	-	-	-
		Total Credits		13	2	10	20	400	600	1000

*MC-Satisfactory/Unsatisfactory, SDC: Skill Development Course

III YEAR ISEMESTER

S. No.	Course Code	Course Name	Course Area	Hours per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
		Theory								
1	2450228	Power Electronics	PC	3	1	0	4	40	60	100
2	2450428	Microprocessors and Microcontrollers	PC	3	0	0	3	40	60	100
3	2450229	Electrical Transmission and Distribution	PC	3	0	0	3	40	60	100
4		Professional Elective – I	PE	3	0	0	3	40	60	100
5		Open Elective – I	OE	3	0	0	3	40	60	100
		Laboratory								
1	2450475	Microprocessors and Microcontrollers Laboratory	PC	0	0	2	1	40	60	100
2	2450281	Power Electronics Laboratory	PC	0	0	2	1	40	60	100
3	2450592	OOPS through JAVA Laboratory	ES	0	0	2	1	40	60	100
		Project								
1	2450292	Field Based Project	PS	0	0	2	1	100	-	100
		Mandatory								
1	2450022	Gender Sensitization	MC	0	0	0	0	-	-	-
		Total Credits		15	1	8	20	420	480	900

*MC-Satisfactory/Unsatisfactory

*Students must complete Field Based Project during 2-2 semester break (minimum 2 weeks)

III YEAR II SEMESTER

S. No.	Course Code	Course Name	Course Area	Hours per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
		Theory								
1	2460230	Power Electronics Applications to Renewable Energy systems	PC	3	0	0	3	40	60	100
2	2460231	Power System Analysis	PC	3	1	0	4	40	60	100
3	2460232	Electrical Measurements and Instrumentation	PC	3	0	0	3	40	60	100
4		Professional Elective - II	PE	3	0	0	3	40	60	100
5		Open Elective – II	OE	3	0	0	3	40	60	100
		Laboratory								
1	2460477	Smart Sensors and Systems Laboratory	PC	0	0	2	1	40	60	100
2	2460282	Simulation of Power Electronics Applications to Renewable Energy systems Laboratory	PC	0	0	2	1	40	60	100
3	2460483	Electrical Measurements and Instrumentation Laboratory	PC	0	0	2	1	40	60	100
		Skill Development Course								
1	2460293	Introduction to Computer Aided Electrical Drawing	SDC	0	0	2	1	40	60	100
		Mandatory								
1	2460023	Constitution of India	MC	0	0	0	0	-	-	-
		Total Credits		15	1	8	20	360	540	900

*MC-Satisfactory/Unsatisfactory, SDC: Skill Development Course

IV YEAR I SEMESTER

S. No.	Course Code	Course Name	Course Area	Hours per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
		Theory								
1	2470233	Power System Operation and Control	PC	3	0	0	3	40	60	100
2	2470234	Power System Protection	PC	2	0	0	2	40	60	100
3	2470010	Business Economics and Financial Analysis	HSMC	3	0	0	3	40	60	100
4		Professional Elective – III	PE	3	0	0	3	40	60	100
5		Open Elective – III	OE	3	0	0	3	40	60	100
6		Professional Elective - IV	PE	3	0	0	3	40	60	100
		Laboratory								
1	2470284	Electrical Systems Simulation Laboratory	PC	0	0	2	1	40	60	100
2	2470285	Power System Laboratory	PC	0	0	2	1	40	60	100
		Project								
1	2470294	Project Stage - I	PS	0	0	6	3	100	-	100
2	2470295	Internship-2*	PS	0	0	2	1	100	-	100
		Mandatory								
1	2470025	Human Values and Professional Ethics	*MC	0	0	0	0	-	-	-
		Total Credits		17	0	12	23	520	480	1000

*MC-Satisfactory/Unsatisfactory

*Students must complete internship-2 during 3-2 semester break (minimum 2 weeks)

IV YEAR II SEMESTER

S. No.	Course Code	Course Name	Course Area	Hours per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIE)	External (SEE)	Total
1		Professional Elective- V	PE	3	0	0	3	40	60	100
2		Professional Elective-VI	PE	3	0	0	3	40	60	100
		Project								
1	2480296	Technical Seminar	PS	0	0	4	2	100	-	100
2	2480297	Project Stage-II	PS	0	0	18	9	40	60	100
		Total Credits		**6**	**0**	**22**	**17**	**220**	**180**	**400**

Professional Elective(PE) Courses

PEI-Professional Elective I

S.No.	Course Code	CourseTitle
1	2450235	Special Electrical Machines
2	2450236	Wind and Solar Energy Systems
3	2450460	Principles of Signals and Systems
4	2450237	Programmable Logic Controllers

PEII-Professional Elective II

S.No.	Course Code	Course Title
1	2460238	Power Semiconductor Drives
2	2460239	IoT Applications in Electrical Engineering
3	2460240	HVDC Transmission
4	2460241	Renewable Energy Systems

PEIII-Professional Elective III

S.No.	Course Code	Course Title
1	2470242	Industrial Electrical Systems
2	2470243	Smart Grid Technologies
3	2470244	Electric and Hybrid Vehicles
4	2470245	Advanced Control of Electric Drives

PEIV- Professional Elective IV

S.No.	Course Code	Course Title
1	2480246	Modern Control Theory
2	2480461	VLSI Design
3	2480247	Computer Aided Electrical Machine Design
4	2480462	Basics of Digital Signal Processing

PEV –Professional Elective V

S.No.	Course Code	Course Title
1	2480248	Power Quality & Facts
2	2480249	Advanced Power Systems
3	2480463	Embedded Systems Applications
4	2480255	Electrical Safety Management

PEVI- Professional Elective VI

S.No.	Course Code	Course Title
1	2480251	Cyber-Physical Systems
2	2480252	Electrical Distribution Systems
3	2480253	Machine Learning Applications in Electrical Engineering
4	2480254	Digital Control Systems

Open Elective-I

S.No.	Course Code	Course Title
1	2450210	Estimation & Costing of Electrical Systems

Open Elective-II

S.No.	Course Code	Course Title
1	2460211	Utilization of Electrical Energy
2	2460213	Electronic Measurements and Instrumentation

Open Elective-III

S.No.	Course Code	Course Title
1	2470212	Fundamentals of Electrical Vehicles

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2410001: MATRICES AND CALCULUS
(CSE, CSD, CSM, ECE, EEE, MECH, CIVIL)

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

Prerequisites: **Mathematics courses of 10+2 year of study.**

Course Objectives:

1. Types of matrices and their properties, concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
2. Concept of eigen values, eigen vectors and reduction of quadratic form to canonical form by orthogonal transformation.
3. Geometrical approach to the mean value theorems and their application to the mathematical problems. Evaluation of improper integrals using Beta and Gamma functions.
4. Partial differentiation, concept of total derivative and finding maxima and minima of function of two and three variables.
5. Evaluation of multiple integrals and their applications.

Course Outcomes: After Completion of the Course, Students should be able to

1. Recall the concepts of rank, Echelon form, Normal form, and the properties of non singular matrices.

2. Explain the process of finding eigen values and eigenvectors of a matrix and their role in diagonalization.

3. Relate Beta and Gamma functions to standard integrals and solve related problems.

4. Apply Euler's theorem and compute total derivatives for multivariable functions.

5. The methods for changing variables in double and triple integrals, including transformations to polar, spherical, and cylindrical coordinates.

UNIT-I: Matrices

Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations, L-U decomposition method.

UNIT-II: Eigen values and Eigen vectors

Eigen values, Eigen vectors and their properties (without proof), 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

Mean value theorems: Rolle's Theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series (without proofs).

Beta and Gamma functions and their applications (properties without proof).

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

Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence-independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

UNIT-V: Multivariable Calculus (Integration)

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

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

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

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2410008: APPLIED PHYSICS

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

Prerequisites: Intermediate Physics

Course Objectives: The student will try to learn
1. Understand the basic principles of quantum physics and band theory of solids.
2. Understand the underlying mechanism involved in construction and working principles of various semiconductor devices.
3. Study the fundamental concepts related to the dielectric, magnetic materials.
4. Identify the importance of nanoscale, quantum confinement and various fabrications techniques.
5. Study the characteristics of lasers and optical fibers.

Course Outcomes: After Completion of the Course, Students should be able to
1. Illustrate the concepts of the dual nature of matter and the Schrödinger wave equation of a particle confined in a basic system.
2. Classification of semiconductors and their roles in different types of optoelectronic devices utilized in a range of engineering applications.
3. Understand the properties of dielectric and magnetic materials and their applicability in engineering contexts.
4. Explain the key factors, fabrication methods, characterization techniques, and applications of nanomaterials.
5. Relate the concepts of lasers and optical fibers, when used with normal light, in terms of their mechanisms and applications across various fields and scientific practices.

UNIT-I: QUANTUM PHYSICS AND SOLIDS

Quantum Mechanics: Introduction to quantum physics, Blackbody radiation, Photoelectric effect, de-Broglie Hypothesis and matter waves, Davisson and Germer experiment, Heisenberg uncertainty principle, Born interpretation of the wave function, Time independent Schrodinger wave equation, Particle in one dimensional potential box.

Solids: Free electron theory (Drude& Lorentz, Sommerfeld), Bloch's theorem -Kronig- Penney model, Effective mass of electron, Origin of energy bands, Classification of solids.

UNIT - II: SEMICONDUCTORS AND DEVICES

Intrinsic and extrinsic semiconductors, Hall effect, Direct and Indirect band gap semiconductors, Construction, principle of operation and characteristics of P-N Junction diode, Zener diode and Bipolar junction transistor (BJT)

Opto-devices- Light emitting diode (LED), PIN diode, and Solar cell, their structure, materials, working principle and characteristics, Solar cell application- Space craft.

UNIT - III: DIELECTRIC AND MAGNETIC MATERIALS

Dielectric Materials: Introduction to dielectrics, Polarization, Permittivity, Dielectric constant, Types of polarizations (Qualitative), Internal field in Solids, Clausius-Mossotti equation, Ferroelectric, Piezoelectric and Pyroelectric materials, Applications.

Magnetic Materials: Introduction to Magnetism, Magnetization, Permeability, Susceptibility, Classification of Magnetic Materials, Hysteresis curve, Soft and Hard magnetic materials, Magnetostriction, Magneto resistance, Magnetic field sensors and bubble memory devices.

UNIT - IV: NANOTECHNOLOGY

Introduction to magnetic materials, Origin of magnetic moment, Classification of magnetic Nanoscale, Quantum confinement, Surface to volume ratio, Bottom-up fabrication: Sol- gel, Precipitation methods, Top-down fabrication: Ball milling, Physical Vapor Deposition (PVD), Characterization techniques - XRD, SEM and TEM, Applications of nanomaterials.

UNIT - V: Laser and Fibre Optics

Lasers: Laser beam characteristics-three quantum processes-Einstein coefficients and their relations, Lasing action, Population inversion, Pumping methods, Ruby laser, He-Ne laser, CO_2laser, Applications of laser- Medical and Military.

Fiber Optics: Introduction to optical fiber, Total internal reflection, Construction of optical fiber, Acceptance angle, Numerical aperture, Classification of optical fibers, Losses in optical fiber, Optical fiber for communication system, Applications of optical fiber- Endoscopy

TEXT BOOKS:
1. M.N.Avadhanulu, P.G.Kshirsagar & TVSArunMurthy " ATextbook of Engineering Physics", S. Chand Publications, 11th Edition 2019.
2. Engineering Physics by Shatendra Sharma and JyotsnaSharma, Pearson Publication, 2019
3. Semiconductor Physics and Devices-Basic Principle–DonaldA, Neamen, McGraw Hill, 4th Edition, 2021.
4. B.K. Pandeyand S. Chaturvedi, Engineering Physics, Cengage Learning, 2nd Edition, 2022.
5. Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 1stEdition, 2021.

REFERENCE BOOKS:
1. Quantum Physics, H.C.Verma, TBS Publication, 2nd Edition 2012.
2. Fundamentals of Physics–Halliday, Resnick and Walker, John Wiley &Sons,11th Edition, 2018.
3. Introduction to Solid State Physics, Charles Kittel,Wiley Eastern,2019.
4. Elementary Solid State Physics, S.L.Gupta and V.Kumar, Pragathi Prakashan, 2019.
5. A.K.Bhandhopadhya -NanoMaterials, New Age International, 1st Edition,2007

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2410501: Problem Solving Using C and C++

B.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: There are no prerequisites to take this course.

Course Objectives:

The students will try to learn

- Using of structured programming approach in solving problems
- How to use arrays, pointers, strings and structures in solving problems
- Defining of structures in C and classes in C++
- Importance of inheritance in object-oriented programming
- Handling of exceptions in programs

Course Outcomes: After Completion of the Course, Students should be able to

CO1: Develop programs using Control statements and Repetitive statements

CO2: Modularize the code with functions so that they can be reused

CO3: Learn about Object oriented concepts

CO4: Design programs by using Inheritance concepts

CO5: Implement polymorphism and Exception Handling

Module-I: Introduction to programming   [10]

Introduction Procedure Oriented and Object-Oriented Programming. Algorithm, Flowchart, Pseudo code. Creating and Running of C Program. Structure of C program – C character set, C Tokens: Constants, Variables, Keywords, Identifiers, C data types, C operators. Standard I/O in C (scanf, printf), Conditional Control statements (if and Switch) Statements. Repetitive statements: While, Do While and For Loops - Use of Break and Continue Statements.

Module-II: Functions, Arrays, Strings and Pointers   [12]

Arrays: Introduction, Declaration, Creating and Accessing of One-Dimensional Arrays, Two- Dimensional Arrays. Strings and Pointers: Introduction to strings, string handling functions, Arrays of strings, Introduction to pointers, Dynamic Memory allocation.

Functions: Defining Functions – User Defined Functions, Storage Classes, passing parameters: Call By Value, Call By Reference, Recursion, Command-line Arguments.

Module-III: Structures and Classes   [8]

Structures: Defining structures, initializing structures, unions, Array of structures OOPS Concepts: Class, Object, Abstraction, Encapsulation, Inheritance and Polymorphism.

C++ Classes and Data Abstraction: Class definition, Class structure, Class objects, Class scope, this pointer, Friends to a class, Static class members, Constant member functions, Constructors and Destructors, Dynamic creation and destruction of objects, Data abstraction.

Module–IV: Inheritance   [7]

Inheritance: Defining a class hierarchy, Different forms of inheritance, Defining the Base and Derived classes, Access to the base class members, Base and Derived class construction, Destructors, Virtual base class.

Module–V: Polymorphism and Exception Handling   [8]

Virtual Functions and Polymorphism: Static and Dynamic binding, virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

Exception handling: Try, throw and catch.

TEXT BOOKS:

1. Jeri R. Hanly and Elliot B. Koffman, Problem solving and Program Design in C 7th Edition, Pearson.

2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition).

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EMPOWERING THROUGH INNOVATIONS
MLRS

2410010: ENGLISH FOR SKILL ENHANCEMENT

B.Tech. I Year. I Sem.   **L T P C**

3 0 0 3

Prerequisites: There are no prerequisites to take this course.

Course Objectives

1. Improve the language proficiency of students in English with an emphasis on
2. Vocabulary, Grammar, Reading and Writing skills.
3. Develop study skills and communication skills in various professional situations.
4. Equip students to study engineering subjects more effectively and critically
5. using the theoretical and practical components of the syllabus.

Course Outcomes:

After successful completion of the course, student will be able to:

1. Understand the importance of vocabulary and sentence structures.
2. Choose appropriate vocabulary and sentence structures for their oral and
3. written communication.
4. Demonstrate their understanding of the rules of functional grammar.
5. Develop comprehension skills from the known and unknown passages.
6. Take an active part in drafting paragraphs, letters, essays, abstracts, précis and
7. reports in various contexts.

Syllabus:

MODULE – I (No of Hours = 12)

Chapter entitled **'Toasted English'** by R.K. Narayan from "English: Language, Context and Culture" published by Orient BlackSwan, Hyderabad.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes -Acquaintance with Prefixes and Suffixes from Foreign Languages to Form Derivatives - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing concerning Articles and Prepositions.

Reading: Reading and Its Importance- Techniques for Effective Reading.

Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing –Types, Structures and Features of a Paragraph - Creating Coherence Organizing Principles of Paragraphs in Documents.

MODULE – II (No of Hours = 8)

Chapter entitled '**Appro JRD'** by Sudha Murthy from "English: Language, Context and Culture" published by Orient BlackSwan, Hyderabad.

Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing concerning Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice

Writing: Nature and Style of Writing- Defining /Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence.

MODULE – III (No of Hours = 8)

The chapter entitled **'Lessons from Online Learning' by F.Haider Alvi, Deborah Hurst et al** from "English: Language, Context and Culture" published by Orient BlackSwan, Hyderabad.

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

Grammar: Identifying Common Errors in Writing Concerning Misplaced Modifiers and Tenses.

Reading: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice

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

MODULE – IV (No of Hours = 7)

Chapter entitled 'Art and Literature' by Abdul Kalam from "English: Language, Context and Culture" published by Orient BlackSwan, Hyderabad.

Vocabulary: Standard Abbreviations in English

Grammar: Redundancies and Clichés in Oral and Written Communication.

Reading: Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice

Writing: Writing Practices- Essay Writing-Writing Introduction and Conclusion -Précis Writing.

MODULE – V (No of Hours = 10)

Chapter entitled **'Go, Kiss the World' by Subroto Bagchi** from "English: Language, Context and Culture" published by Orient BlackSwan, Hyderabad.

Vocabulary: Technical Vocabulary and their Usage

Grammar: Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous modules)

Reading: Reading Comprehension-Exercises for Practice

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

Note: Listening and Speaking Skills which are given under Module 6 in the AICTE Model Curriculum are covered in the syllabus of the ELCS Lab Course.

> **Note: 1.** As the syllabus of English given in AICTE Model Curriculum-2018 for B.Tech First Year is Open-ended, besides following the prescribed textbook, it is required to prepare teaching/learning materials the teachers collectively in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.

> **Note: 2.** Based on the recommendations of NEP2020, teachers are requested to be flexible in adopting Blended Learning in dealing with the course contents. They are advised to teach 40 per cent of each topic from the syllabus in blended mode.

TEXTBOOK:

1. "English: Language, Context and Culture" by Orient BlackSwan Pvt. Ltd, Hyderabad. 2022. Print.

MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
Accredited by NBA and NAAC with 'A' Grade & Recognized Under Section2(f) & 12(B)of the UGC act,1956

2410372: ENGINEERING WORKSHOP
(Common to all branches)

B.Tech. I Year. I Sem

L T P C
0 1 4 3

Prerequisite: NIL

Course Objective: The student will able to
1. To gain good basic working knowledge required for the production of various engineering products.
2. To study different tools uses and their demonstration.
3. To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in engineering field.
4. To develop a right attitude, team working, precision and safety at work place.
5. It explains the construction, function use and application different working tools and equipments.

Course outcomes: At the end of the course students should able to
1. Explain the design and model different prototype in the trade of carpentry such as Cross lap joint, Dove tail joint.
2. Demonstrate the design and model various basic prototypes in the trade of fitting such as straight fit and V-fit.
3. Understand to make various basic prototypes in the trade of tin smithy such as rectangular tray and open cylinder.
4. Demonstrate the design and model various basic prototype in welding and black smithy.
5. Understand to perform various basic house wiring techniques such as connecting one lamp with one switch, connecting two lamps with one switch.

Course content:
Module -I: CARPENTRY AND FITTING
- Carpentry – Introduction, Carpentry tools, sequence of operations and applications (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
- Fitting – Introduction, fitting tools, sequence of operations and applications (V-Fit, Dovetail Fit & Semi-circular fit)

Module -II: TIN SMITHY AND BLACKSMITHY
- Tin-Smithy – Introduction, Tin smithy tools, sequence of operations and applications (Square Tin, Rectangular Tray & Conical Funnel).
- Blacksmithy- Introduction, Blacksmithy tools, sequence of operations and applications (Round to Square, Fan Hook and S-Hook)

Module -III: HOUSE WIRING AND WELDING
- House-wiring – Introduction, Electrical wiring tools, sequence of Operations and applications (Parallel & Series, Two-way Switch and Tube Light)
- Welding Practice – Introduction, electrode, welding tools, and sequence of Operations. Advantages and applications (Arc Welding).

Text Book:
1. Workshop practice/B.L. Juneja/ Cengage
2. Workshop manual/K.Venugopal/ Anuradha

Reference:
1. Work shop manual /P.Kannaiah/K.L. Narayana
2. Work shop Manual /Venkat Reddy /BSP

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2410071: APPLIED PHYSICS LAB

B.Tech. I Year I Sem.   **L   T P C**

                                                                       0   0 2 1

Prerequisites: Intermediate

Course Objectives: The student will try to

1. Capable of handling instruments related to the Hall effect and photo electric effect Experiment understands their measurements.

2. Understand the characteristics of various devices such as PN junction diode, Zener diode, BJT, LED, solar cell, lasers and optical fiber and measurement of energy gap.

3. Apply the analytical techniques & graphical analysis for Stewart Gees, LCR &RC

4. Understanding the method of least squares fitting.

5. To develop intellectual communication skills through discussion on basic principles o scientific concepts in a group.

Course Outcomes: After Completion of the Course, Students should be able to

1. Demonstrate the Planck's constant using Photo electric effect and identify the Material whether it is n-type or p-type by Hall experiment.
2. Illustrate quantum physics in semiconductor devices and optoelectronics.
3. Understand the properties for dielectric materials.
4. Compare the variation of magnetic field and behavior of hysteresis curve.
5. Interpret data analysis.
6.

List of Experiments:

1. Determination of work function and Planck's constant using photo electric effect.
2. Determination of Hall co-efficient and carrier concentration of a given semiconductor.
3. Characteristics of series and parallel LCR circuits.
4. V-I characteristics of a p-n junction diode and Zener diode.
5. Input and output characteristics of BJT (CE, CB & CC configurations).
6. V-I and L-I characteristics of light emitting diode (LED) and LASER.
7. V-I Characteristics of solar cell.
8. Determination of Energy gap of a semiconductor.
9. To determine the time constant of R-C circuit.
10. Determination of Acceptance Angle and Numerical Aperture of an optical fiber.
11. Understanding the method of least squares–Torsional pendulum as an example.

12. Determination of magnetic field induction along the axis of a current carrying coil.

List of Experiments: (Any 2 experiments are to be performed)
1. To calculate the concentration of charge carriers in the sample using Hall effect -NITK, Surathkal Virtual Lab.
2. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss - IIT Kanpur Virtual Lab.
3. To calculate the beam divergence and spot size of the given laser beam - Amritha Viswa Vidya Peetham Virtual Lab
4. To study various crystals structures - Amritha Viswa Vidya Peetham Virtual Lab

B.Tech.IYear.ISem

L	T	P	C
0	0	2	1

Prerequisites: **There are no prerequisites to take this course.**

Course Objectives:

The students will try to learn

- Using of structured programming approach in solving problems
- How to use arrays, pointers, strings and structures in solving problems
- Defining of structures in C and classes in C++
- Importance of inheritance in object-oriented programming
- Handling of exceptions in programs

Course Outcomes: After Completion of the Course, Students should be able to

CO1: Develop programs using Control statements and Repetitive statements

CO2: Modularize the code with functions so that they can be reused

CO3: Learn about Object oriented concepts

CO4: Design programs by using Inheritance concepts

CO5: Implement polymorphism and Exception Handling

Week1: Algorithm and Flowchart

1. You are designing a flowchart and algorithm for a distance and speed calculator. The flowchart should prompt the user to input the distance traveled and the time taken and calculate the speed using the formula: **Speed = Distance / Time**.

2. You are developing an algorithm and flow chart for a circle area calculator. The flowchart should prompt the user to input the radius of a circle and calculate the area using the formula: **Area = πr^2**

3. You are designing an algorithm and flowchart for a fuel efficiency calculator in a car rental app. The flowchart should prompt the user to input the distance traveled and the amount of fuel consumed and calculate the fuel efficiency in miles per gallon (MPG) using the formula MPG = Distance / Fuel Consumption.

4. You are developing an algorithm and flowchart for a discount calculator in an online shopping app. The flowchart should prompt the user to input the original price and the discount percentage and calculate the discounted price using the formula:

Discounted Price = Original Price - (Original Price * Discount Percentage
/100).

5. You are developing a flowchart and algorithm for a monthly budget tracker. The flowchart should prompt the user to input their income and expenses and calculate the total savings using the formula Total Savings = Income - Total Expenses.

6. You are designing a flowchart for a loan amortization calculator. The flowchart should prompt the user to input the loan amount, interest rate, and duration, and calculate the monthly payment using the

formula Monthly Payment = (Loan Amount * Interest Rate * (1+ Interest Rate)Duration) / ((1 + Interest Rate)Duration-1).

7. You are developing a flowchart and algorithm for a construction materials calculator. The Flow chart should guide the user through the process of inputting the dimensions of a room, including the length, width, and height. The goal is to calculate the surface area of the room using the provided formula: Surface Area=2*(Length*Width+Length *Height+Width* Height).

8. Developa flowchart and analgorithm to convert a given time in hours and minutes to minutes only. Prompt the user to input the time in hours and minutes and display the converted time in minutes.

Skill Oriented Exercise

9. Farmer Thimmayya bought some mules at Rs. 50 each, sheep at Rs. 40 each, goats at Rs. 25 each, and pigs at Rs.10 each. The average price of the animals per head worked to Rs. 30. What is the minimum number of animals of each kind did he buy?

10. A Matter of Rupees and Paisa: I have money pouch containing Rs.700. There are equal   number of 25   paise coins, 50 paise coins and 1 rupee coins. How many of each are there.

11. Develop an algorithm and flowchart that prompts the user to input the initial velocity, acceleration, and time. Calculate and display the final velocity using the formula Final Velocity = Initial Velocity + (Acceleration * Time).

12. Develop an algorithm and flowchart that prompts the user to input the lengths of the three sides of a triangle. Calculate and display the area of the triangle using Heron's formula: Area=√(s*(s -Side1)*(s-Side2)*(s -Side3)),where s=(Side1+Side2+ Side3) / 2.

Week2: Algorithm and Flowchart

1. ABC Company wants to calculate the monthly salary for its employees based on various components such as basic pay, DA, HRA, and deductions for taxes and provident fund. The company follows the following rules for salary calculation:
- The basic pay is a fixed amount each employee receives.
- DA is calculated as 20 percentage of the basic pay.
- HRA is calculated as 10 percentage of the basic pay.

- The gross salary is the sum of the basic pay, DA, and HRA. The net salary is the gross salary minus deductions for taxes and provident fund. Develop an algorithm and flow chart to calculate the gross and net salary of the employee. Include the necessary steps to calculate the net salary.

2. Sarah, a dedicated student, wants to calculate her average grade for a semester. She has received marks in four different subjects and seeks assistance in creating an algorithm to determine her average grade based on these marks. Develop an algorithm and flowchart to help Sarah calculate her average grade for the semester using the marks obtained in these four subjects. Ensure that the algorithm includes the necessary steps to compute the average grade accurately.

3. John is a programmer who wants to convert a given temperature in Celsius to Fahrenheit. Help John in developing an algorithm and flowchart to perform this conversion. Design an algorithm for John to convert a given temperature in Celsius to Fahrenheit. Provide step-by-step instructions for performing the conversion.

4. **The Tall Men Next Door:** Next door to me live four brothers of different heights. Their average height is 74 inches, and the difference in height among the first three

men is two inches. The difference between the third and the fourth man is six inches. Can you tell how tall each brother is?

5. **Driving Through the Country:** I decided to travel through the countryleisurely and on the first day I did only 7 miles. On the last day I did 51 miles, increasing my journey by 4 miles per day. How many days did I travel and how far?

6. There is a beautiful pond in a park, filled with clear water. The park management wants to monitor the water level in the pond regularly to ensure it remains at an optimal level. They have asked you to create an algorithm to help them with this task. Develop an algorithm and flow chart to monitor the water level in the pond and notify the park management if it falls below a certain threshold. (Note: You can assume that the input for the current water level and threshold level is obtained from a monitoring device or sensor).

7. If a participant can make one submission every 45 seconds, and a contest lasts for Y minutes, create an algorithm and flowchart to find the maximum number of submissions that the participant can make during the contest? Assume the participant is allowed to make submissions until the last second of the contest.

Skill Oriented Exercise

8. Michael wants to find the largest number among a set of given numbers. Help Michael write an algorithm to determine the largest number from the given inputs. Create an algorithm and flowchart for Michael to find the largest number among a set of given inputs. Provide step-by-step instructions to identify the largest number.

9. A construction worker needs to paint the exterior walls of a rectangular building. The dimensions of the walls are L meters in length, H meters in height, and W meters in width. If the cost of painting is Rs. 20 per square meter, what will be the total cost of painting the walls? Prepare an algorithm and flowchart to calculate the total cost of painting.

10. An ice cream vendor brings 'i' litre of ice cream to a fair. Each cone requires0.25liters of ice cream. If the vendor sells 80 cones, Develop an algorithm and flowchart to find the number of liters of ice cream left with the vendor.

11. Amanda is planning a party and wants to determine the total number of guests attending. Assist Amanda by writing an algorithm to calculate the total number of guests based on the number of adults and children invited. Create an algorithm and flowchart for Amanda to calculate the total number of guests attending her party, considering the number of adults and children invited. Include the necessary steps to calculate the total number of guests.

Week: 3 Data Types, Console I/O, Operators Storage Classes

1. You are working as a financial analyst at a bank. As part of your job, you need to calculate the maturity amount for fixed deposits (FD) based on the principal amount, interest rate, and duration. For that help me to write a Cprogram that takes theprincipal amount, interest rate, and duration (in years) as input from the user. Calculate and display the maturity amount using the simple interest formula: Maturity Amount = Principal + (Principal * Interest Rate * Duration).

2. Jenny, a budding mathematician, was studying the concept of area and perimeter. She was given a rectangular garden with a known length and width. Jenny wondered if she could find the area without knowing the width. Can you help Jenny derive a formula to calculate the area of a rectangle using only the length and perimeter?

3. Develop a C program that computes the hypotenuse of a right-angled triangle given the lengths of its two perpendicular sides. Prompt the user to enter the lengths and display the result. (Pythagorean theorem: $\text{Hypotenuse}^2 = \text{Side1}^2 + \text{Side2}^2$)

4. Once upon a time, there was a mathematician named Alex. Alex loved solving mathematical problems and puzzles. One day, Alex came across an ancient scroll that contained a secret formula to calculate the sum of the first n natural numbers. The scroll mentioned that by using the formula, one could find the sum of any given number of natural numbers without having to manually add them up. Alex was intrigued and decided to test the formula. Can you help Alex implement a C program that uses the formula to calculate the sum of the first n natural numbers? Instructions:
Write a C program that takes an input integer n from the user and calculates the sum of the first n natural numbers using the formula: **sum=(n*(n+1))/2**

5. Once upon a time in a small town, there were two friends, Kavi and Jei, who were fascinated by the concept of slopes in mathematics. They loved exploring the hills and valleys around their town and wondered how they could calculate the slope of any given landscape. One sunny day, while hiking up a hill, Kavi and Jei discovered an ancient map that had the secret to finding the slope of a line between two points. The map indicated that by using the coordinates of two points, they could determine the slope of the line connecting them. Excited about their discovery, Kavi and Jei decided to create a C program that could calculate the slope for any two points. They wanted to share their program with others so that everyone could explore the slopes of various land scapes. Can you help Kavi and Jei bring their idea to life by implementing a C program that calculates the slope of a line?

Instructions:

Write a C programthat prompts the user to enter the coordinates of two points:(x1,y1) and (x2, y2). The program should thenCalculate, the slope of the line connecting these points using the formula: slope=(y2-y1)/(x2- x1) Finally, the program should displaythe calculated slope to the user.

6.   Ravi and Kavi are on an exciting treasure hunt adventure, following a map with hidden treasures located at different coordinates. They want to calculate the distance between two treasures to determine how far apart they are. Can you help them by writing a C program that performs this calculation?

Instructions:
Write a C program that prompts the user to enter the coordinates of two treasures: Treasure A and Treasure B. The coordinates should be in the form (x, y). Calculate the distance between the treasures using the distance formula:
distance = sqrt ((x2 - x1)^2 + (y2 - y1)^2)
Finally, output a message indicating how far a part the treasures are.

7.   Imagine a scenario where there is a coconut tree with multiple coconuts hanging from it. There is a person standing at a distance of "D" meters away from the tree. The coconuts are positioned at a height of "H" meters from the ground. Could you please help write a C program that calculates the angle at which the person should aim in order to hit the coconuts? (Hint: you can use the inverse tangent function (atan() in C) to determine the angle based on the ratio of the height of the coconuts to the distance from the tree.)

Skill Oriented Exercise
8.   In a faraway kingdom, two treasure hunters named Alex and Bella embarked on a daring quest to find valuable treasures. While exploring a mysterious cave, they stumbled upon two treasure chests, each containing a unique gemstone. Curiosity took over, and they decided to swap the gemstones inside the chests. However, a magical enchantment prevented them from directly swapping the gemstones. To fulfill their quest and restore the treasures to their rightful chests, Alex and Bella realized they could use a third variable and arithmetic operations. Can you help them by writing a C program that takes the values of the

gemstones as input, and swap their values.

9. Emily, a young architect, was working on designing a cylindrical water tank for a new building. As she was finalizing the plans, she needed to calculate the surface area of the cylinder to determine the amount of material required for its construction. However, she was unsure of the exact formula and the steps involved in the calculation. Can you help Emily by writing a C program that assists her in calculating the surface area of a cylinder?(Surface Area = $2\pi r^2 + 2\pi rh$)

10. Hemanthisanarchitectwhowantstodesignagardenwithabeautifulpolygon-shaped fountain at its center. He needs to calculate the area of the polygon so that he can determine the appropriate size for the fountain. Help Hemanth by writing a C program that calculates the area of a regular polygon when given the number of sides and the length of each side.

Area=(num Sides* side Length*side Length)/ (4 *tan(π/ num Sides))

11. Prathima loves ice cream cones and wants to decorate the surface of her favorite ice cream cone with colorful stickers. To know how many stickers she needs, she wants to calculate the surface area of the cone. Help Prathima by writing a C program that calculates the surface area of a cone when given the radius of the base and the slant height, (SurfaceArea=$\pi*r*(r+l)$)

12. RIGHT FOOT FORWARD: A short man takes three steps to a tall man's two steps. They both start out on the left foot. How many steps do they have to take before they are both stepping out on the right foot together?

Week: 4DataTypes, Console I/O, Operators Storage Classes
PREDICT THE OUTPUT:

1.#include<stdio.h>   **Output:**
    int main()
    {
    inta=5;floatb=3.5;
intresult=a+b;printf("%d\n",result);return0;
    }

2. #include<stdio.h>   **Output:**
    intmain(){inta=10;intb=20;
intresult=a*b/4%3;printf("%d\n",result);return0;
    }

3.#include<stdio.h>   **Output:**
    intmain(){inta=15;intb= 10;
intresult=(a>b)&&(b!=0);printf("%d\n",
    result); return0;
    }

4. #include<stdio.h>   **Output:**
    intmain(){inta=10;intb= 5;
intresult=(a>b)||(a==10);printf("%d\n",r
    e sult); return0;
    }

5. #include<stdio.h>
    Output:
    int
  main()
  { int
  x=3,y

```
=
2;
    intresult=x*y-y/x%y;printf("%d\n", result);return 0;
    }
```

6.
```
#include<stdio.h>
 intmain(){
i ntx=5; int
*ptr1 = &x;
int**ptr2=&ptr1;printf("%d\n",**ptr2);return
0;
}
```
Output:

1.
```
#include<stdio.h>

int main(){intx=5;
int*ptr1,*ptr2;ptr1 =&x;
ptr2=ptr1;printf("%d\n",*ptr2);return0;
}
```
Output:

2.
```
#include<stdio.h>
int main(){intx=51;
 int*ptr=&x;
printf("%d\n",*ptr);x=15;
printf("%d\n",*ptr); return 0;
}
```
Output:

3.
```
#include<stdio.h>
intmain(){float*ptr;
printf("Sizeofptr:%lubytes\n",sizeof(ptr));ret
urn0;
}
```
Output:

4.
```
#include<stdio.h>
intmain(){doublearr[5];
printf("Sizeofarr:%lubytes\n",sizeof(arr));ret
urn0;
}
```
Output:

5.
```
#include<stdio.h>
intmain()

{

intx=10;if(x
>5){
printf("Hel
l o\n");
}

printf("Goodbye\n");return0;
}
```
Output:

Skill Oriented Exercise

Find the syntax error, logical errors if any in the following code snippet:

1.
```
#include<stdio.h>                         Errors:
int main(){
printf("Hello,KLUFamily!\n")r
et urn0;
}
```

2.
```
#Include<stdio.h>                         Errors:
intmain(){
int x = 5, y= 0;
intresult=x/y;printf("Theresultis:%d\n",r
e sult); return0;
}
```

3.
```
#include<stdio.h>                         Errors:
intmain(){intx=5;int*ptr;
*ptr=&x;printf("%d\n",*ptr);return0;
}
```

4.
```
#include<stdio.h>                         Errors:
intmain(){intx=-
5;if(x){
printf("xisnotzero\n");
}else
{
printf("xiszero\n";)
}
return0;
}
```

Week5:If else and Ternary Operator

1. Chef and Chefina are playing with dice. In one turn, both of them roll their dice at once. They consider a turn to be good if the sum of the numbers on their dice is greater than 6. Given that in a particular turn Chef and Chefina got Xand Yon their respective dice, find whether the turn was good.

2. Chef has been working hard to compete in MasterChef. He is ranked X out of all contestants. However, only 10 contestants would be selected for the finals. Check whether Chef made it to the top 10 or not?

3. Apple considers any I Phone with a battery health of 80% or above, to be in optimal condition. Given that your iPhone has X% battery health, find whether it is in optimal condition.

4. In a classic chase, Tom is running after Jerry as Jerry has eaten Tom's favorite food. Jerry isrunningataspeedofXmetrespersecondwhileTomischasinghimataspeedof Y metres per second. Determine whether Tom will be able to catch Jerry.
Note that initially Jerry is not at the same position as Tom.

5. Chef has started studying for the upcoming test. The text book has N pages in total. Chef wants to read at most X pages a day for Y days. Find out whether it is possible for

Chef to complete the whole book.

6. Chef has finally got the chance of his life time to drive in the F1 tournament. But, there is one problem. Chef did not know about the 107% rule and now he is worried whether he will be allowed to race in the main event or not. Given the fastest finish time as X seconds and Chef's finish time as Yseconds, determine whether Chef will be allowed to race in the main event or not.
Note that, Chef will only be allowed to race if his finish time is within **107%** of the fastest finish time.

Skill Oriented Exercise

7. ChefwantstohostapartywithatotalofNpeople.However,thepartyhallhasa capacity of X people. Find whether Chef can host the party.

8. Chef has to attend an exam that starts in X minutes, but of course, watching shows takes priority.EveryepisodeoftheshowthatChefiswatching,is24minutes long. Ifhe starts watching a new episode now, will he finish watching it **strictly before** the exam starts?

9. Chef has to travel to another place. For this, he can avail anyone of two cab services.
   • The first cab service charges Xrupees.
   • The second cab service charges Yrupees.
   Chef wants to spend the **minimum** amount of money. Which cab service should Chef take?

10. Chef categorizes an Instagram account as spam, if, the following count of the account is more than 10 times the count of followers. Given the following and follower count of an account as X and Y respectively, find whether it is a spam account.

11. Chef is watching TV. The current volume of the TV is X. Pressing the volume up button of the TV remote increases the volume by 11 while pressing the volume down button decreases the volume by 11. Chef wants to change the volume from X to Y. Find the minimum number of button presses required to do so.

12. Cities on a map are connected by a number of roads. The number of roads between each city is in an array and city0 is the starting location. The number of roads from city0 to city1 is the first value in the array, from city1 to city2 in the second, and soon. How many paths aretherefromcity0to the last city in the list, modulo1234567?

13. Square within Square
WriteaCprogramtodeterminethenumberofsquaresinthegivenillustration below
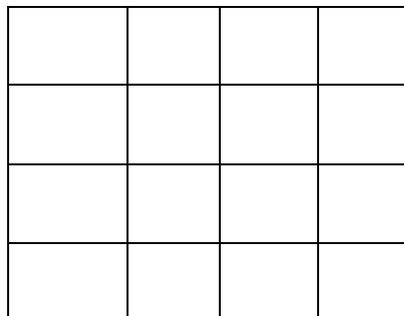
1. Sum of digits of five digit number.
   Given the five digit number print the sum of its digits.
   Input
   10564
   Output
   16

2. Write a program that takes two integers as input, start and end. The program should use for loop to iterate from start to end (both inclusive).

3. Write a C program that takes the input for multiple test cases. For each test case, the program should receive two integers, E and K, representing the energy at the lowest trophic level and the energy reduction factor, respectively. The program should calculate and output the maximum length of the food chain for each test case.

4. Write a program in C that takes an integer, n, as input, representing the number of multiplication tables to be generated. The program should output the multiplication table for each number from 1 to n, up to a multiple of 10.

5. Alice, Bob, and Charlie have different preferences for numbers. Alice likes numbers that are even and multiples of 7, while Bob prefers numbers that are odd and multiples of 9. They have found a number, A, and the task is to determine who takes it home. Write a program that takes an integer, A, as input and outputs the person who takes the number home based on their preferences. If A is an even multiple of 7, Alice takes it home. If A is an odd multiple of 9, Bob takes it home. If neither Alice nor Bob likes the number, Charlie takes it home.

6. Chef owns a car that can run 15 kilometers using 1 litre of petrol. He wants to attend a programming camp at DAIICT, which is a distance of Y kilometers from his house. Chef currently has X litres of petrol in his car. The task is to determine whether Chef can attend the event at DAIICT and return to his home with the given amount of petrol. Write a program that takes two integers, X and Y, as input and outputs whether Chef can complete the round trip with the available petrol.

Skill Oriented Exercise

7. Listen to this story: a boy and his father, a computer programmer, are playing with wooden blocks. They are building a pyramid. Their pyramid is a bit weird, as it is actually a pyramid- shaped wall - it's flat. The pyramid is stacked according to one simple principle: each lower layer contains one block more than the layer above. The figure illustrates the rule used by the builders:

Sample input: 6

Expected output: The height of the pyramid: 3 Sample input:1000

blocks: 6
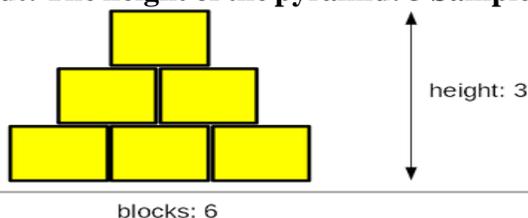
Expected output: The height of the pyramid:44

8. **The Special Number**

   There is a number whose double is greater than its half by 45. Can you find this number?

9. Chef is a student at a university, and the university has a requirement that students must be present for at least 75% of the working days in a semester to pass. The semester has a total of 120 working days. Chef has been taking a lot of holidays and is worried about meeting the attendance requirement. The information about the days Chef has attended or been absent is given as a sequence of N bits: B1, B2,..., BN. If Bi =0, it means Chef was absent on the ith day, and if Bi=1, it means Chef was present on that day. The task is to determine if Chef can pass the attendance requirement by the end of the semester. Write a program that takes an integer N as input, followed by a sequence of Nbits, and out puts whether Chef can hope to pass the attendance requirement or not.

10. There are N piles where the ith pile consists of A$_i$ stones. Chef and Chef in a are playing a game taking alternate turns with Chef starting first. In his/her turn, a player can choose any non-empty pile and remove exactly 1 stone from it. The game ends when exactly 1 pile becomes empty. The player who made the last move wins. Determine the winner if both players play optimally.

11. Write the c program for following pattern

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

12. Write a program to obtain a number N and increment its value by 1 if the number is divisible by 4 otherwise decrement its value by 1.

Week 7: Arrays

1. Given a large integer represented as an integer array digits, where each digits[i] is the i-th digit of the integer, ordered from most significant to least significant in left-to- right order (without any leading zeros), implement a program to increment the large integer by one and return the resulting array of digits.

2. Chef has set a target to solve at least 10 problems every week for a duration of 4 weeks. The input consists of four integers representing the number of problems Chef solved in each week (P1, P2, P3, and P4). The task is to determine the number of weeks in which Chef met his target. The output should be a single integer indicating the count of weeks where Chef solved at least 10 problems.

3. Code Chef recently revamped its practice page to make it easier for users to identify the next problems they should solve by introducing some new features: Recent Contest Problems - contains only problems from the last 2 contests Separate Un- Attempted, Attempted, and All tabs.

4. Problem Difficulty Rating-there commended drop down menu has various difficulty ranges So That you can attempt the problems most suited to you rexperience Popular Topics and Tags. Like most users, Chef didn"t know that he could add problems

to a personal to-do list by clicking on the magic '+' symbol on the top-right of each problem page. But once he found out about it ,he went crazy and added loads of problems to his to-do list without looking at their difficulty rating. Chef is a beginner and should ideally try and solve only problems with difficulty rating strictly lessthan1000.Given a list of difficulty ratings for problems in the Chef's to-do list, please help him identify how many of those problems Chef should remove from his to-dolist,sothat he is only left with problems of difficulty rating less than 1000.

5. You are given an array price where prices[i] is the price of a given stock on the ith day. You want to maximize your profit by choosing a single day to buy one stock and choosing a different day in the future to sell that stock. Return the maximum profit you can achieve from this transaction. If you cannot achieve any profit, return 0.

6. Given a non-empty array of integer's nums, every element appears twice except for one. Find that single one. You must implement a solution with a linear runtime complexity and use only constant extra space.

7. Given an array nums of size n, return the majority element. The majority element is the element that appears more than $\lfloor n / 2 \rfloor$ times. You may assume that the majority element always exists in the array.

8. Write a C program to calculate the factorial of small positive integers. The input consists of an integer 't' representing the number of test cases, followed by 't' lines containing a single integer 'n' (1 <= n <= 100) for each test case. The output should display the factorial of 'n' on a
separate line for each input value of 'n'.

9. (Puzzle)On the Way to Market One morning.
I was on my way to the marketandmetamanwhohad4wives.Eachofthewiveshad4 bags ,containing 4 dogsandeachdoghad4puppies.Taking all things into consideration how many were going to the market?

10. Vasyalikesthenumber239.Therefore,he considers a number pretty if its last digit 2,3 or 9.Vasya wants to watch the numbers between Land R(both inclusive),so he asked you to determine how many pretty numbers are in this range. Can you help him?

11. You are participating in a contest which has 11 problems (numbered 1 through 11). The first eight problems (i.e. problems 1,2,…,8) are scorable, while the last three problems (9,10 and 11) are non-scorable — this means that any submissions you make on any of these problems do not affect your total score.
Your totals core is the sum of your best scores for all scorable problems. That is, for each scorable problem,you look at the score so fall submissions you made on that problem and takethe maximum of these scores(or0if you didn't make any submissions on that problem); the total score is the sum of the maximum scores you took. You know the results of all submissions you made. Calculate your total score.

**12.** WriteaCprogramtohelpJoeandLillymultiplytwomatrices,AandB.Theprogram
should take input for multiple test cases. For each test case, the program should read the dimensions and values of matrices A and B. If the multiplication is possible, the program should print the output matrix values. If the multiplication is not possible, the program should print "IMPOSSIBLE".

13. You are given an m x n integer matrix with the following two properties:
Each row is sorted in non-decreasing order. The first integer of each row is greater than the last integer of the previous row. Given an integer target, return true if target is in matrix or false other wise.

1	3	5	7
10	11	16	20
23	30	34	60

Input :matrix=[[1,3,5,7],[10,11,16,20],[23,30,34,60]],target=3
Output: true

14. You are given an m x n integer grid accounts where accounts[i][j] is the amount of money the ith customer has in the jth bank. Return the wealth that the richest customer has A customer's wealth is the amount of money they have in all their bank accounts. The richest customer is the customer that has the maximum wealth.

15. Given a square matrix mat, return the sum of the matrix diagonals. Only include the sum of all the elements on the primary diagonal and all the elements on the secondary diagonal that are not part of the primary diagonal.
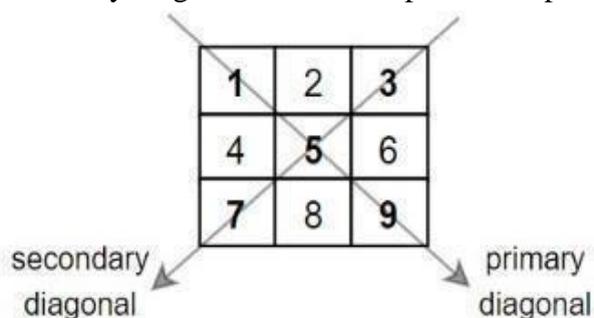

```
Input: mat = [[1,2,3],
              [4,5,6],
              [7,8,9]]
Output: 25
Explanation: Diagonals sum: 1 + 5 + 9 + 3 + 7 = 25
Notice that element mat[1][1] = 5 is counted only once.
```

16. Write a program to perform matrix multiplication. If Multiplication cannot be done for a given matrices then print "NOT POSSIBLE"

$$A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \quad B = \begin{pmatrix} 5 & 6 & 7 \\ 8 & 9 & 10 \end{pmatrix}$$

Multiplication of two matrixes:

$$A * B = \begin{pmatrix} 1*5 + 2*8 & 1*6 + 2*9 & 1*7 + 2*10 \\ 3*5 + 4*8 & 3*6 + 4*9 & 3*7 + 4*10 \end{pmatrix}$$

$$A * B = \begin{pmatrix} 21 & 24 & 27 \\ 47 & 54 & 61 \end{pmatrix}$$

Input:
i.   Read the row & column size of matrix1
ii. Read the matrix1
iii. Read the row & column size of matrix2
iv. Read the mat
     r ix2

Output:
Resultant
Matrix.

Sample Input	Sample Output
22	710
12	1522
34	
22	
12	
34	

17. Given two sorted arrays num s1and num s2of size m and n respectively, return the median of the two sorted arrays.
    Input: nums1 = [1,3], nums2 = [2] Output: 2.00000 Explanation:
    merged array=[1,2,3] and median is 2.

18. Given a m x n grid filled with non-negative numbers, find a path from top left to bottom right, which minimizes the sum of all numbers along its path.
    Note: You can only move either down or right at any point in time.

Input: grid=[[1,3,1],[1,5,1],[4,2,1]]
Output:7
Explanation: Because the path1→3→ 1→1→1 minimizes the um.

19. Given an array nums of size n, return the majority element. The majority element is the element that appears more than ⌊n/2⌋ times. You may assume that the majority element always exists in the array.
    Input: nums=[3,2,3]Output:3

20. Given a sorted array of distinct integers and a target value, return the index if the target is found. If not, return the index where it would be if it were inserted in order.

    Input: nums=[1,3,5,6],target=5Output:2

21. Givenamxnmatrixgridwhichissortedinnon-increasingorderbothrow-wise   and
                                                                                 column-
    wise, return the number of negative numbers in grid.

```
Input: grid = [[4,3,2,-1],[3,2,1,-1],[1,1,-1,-2],[-1,-1,-2,-3]]
Output: 8
Explanation: There are 8 negatives number in the matrix.
```

Example 2:

```
Input: grid = [[3,2],[1,0]]
Output: 0
```

Week8: String Handling

1. Louise joined a social networking site to stay in touch with her friends. The signup page required her to input a name and a password. However, the password must be strong. The website considers a password to be strong if it satisfies the following criteria:

• Its length is at least 6.
• It contains at least one digit.
• It contains at least one lower case English character.
• It contains at least one upper case English character.
• It contains at least one special character. The special characters are: @#$%^&*()-+!

2. As pace explorer's ship crashed on Mars! They send a series of SOS messages to Earth for help.

Letters in some of the SOS messages are altered by cosmic radiation during transmission. Given the signal received by Earth as a string, determine how many letters of the SOS message have been changed by radiation.

s=„SOSTOT"

Example

The original message was SOSSOS. Two of the message's characters were changed in transit.

Function Description

Complete the marsExploration function in the editor below. marsExploration has the following parameter(s): strings: the string as received on Earth

Returns

int: the number of letters changed during transmission

3. Chef has a string S with him. Chef is happy if the string contains a contiguous substring of length strictly greater than 2 in which all its characters are vowels.
   Determine whether Chef is happy or not.
   Note that, in english alphabet, vowels are a, e, i, o, and u.

4. Given two strings needle and haystack, return the index of the first occurrence of needle in haystack, or -1 if needle is not part of haystack.

5. Given a strings consisting of words and spaces, return the length of the last word in the string. A word is a maximal substring consisting of non-space characters only.

6. Given a string S, reverse only all the vowels in the string and return it. The vowels are 'a','e','i','o', and 'u', and they can appear in both lower and upper cases, more than once.

7. You have been given a String S. You need to find and print whether this string is a palindrome or not. If yes, print "YES" (without quotes), else print "NO" (without quotes).

8. Jeff, Chef's younger brother, is learning to read and knows a subset of the Latin alphabet. Chef gave Jeff a book with N words to practice. Jeff can only read words that consist of the letter she knows. The task is to determine which words Jeff can read based on the given letters and output "Yes" or "No" accordingly.

9. Timur loves code forces. That's why he has a string Shaving length 10made containing only lower case Latin letters. Timur wants to know how many indices string s differs from the string "codeforces".

For example strings="coolforsez"differsfrom"codeforces"in4indices, shown in bold.

Up the Ladder
A man wants to reach window which is 40ft above from the ground. And the distance between the foot of the ladder and wall is 9 feet. How long should the ladder be?

10. Given two strings s and t, return true if t is an anagram of s, and false otherwise. An Anagramisawordorphraseformedbyrearrangingthelettersofadifferentword or phrase, typically using all the original letters exactly once. Given strings, find the first non-repeating character in it and return its index. If it does not exist, return -1.

11. A robot starts at the origin (0, 0) on a 2D plane. It is given a sequence of moves represented by the string "moves". Each move is represented by 'R' (right), 'L' (left), 'U' (up), or 'D' (down). The task is to determine if the robot returns to the origin after completing all the moves. The robot's direction is irrelevant, and all moves have the same magnitude. Return true if the robot ends up at the origin, and false otherwise.

12. Chandu is a bad student. Once his teacher asked him to print the reverse of a given string. He took three hours to solve it. The teacher got agitated at Chandu and asked you the same question. Can you solve it?

13. There is a string s of lowercase English letters that is repeated infinitely many times. Given an integer n find and print the number of letter a's in the first n letters ofthe infinite string.

Week9: Recursion

1. Given an integer n, return true if it is a power of three. Otherwise, return false. An integer n is a power of three, if there exists an integer x such that n == 3^x.

2. You are climbing a stair case. It takes n steps to reach the top. Each time you can either climb1or 2steps. In how many distinct ways can you climb to the top?

3. Given an integer n, return true if it is a power of four. Otherwise, return false. An integer n is a power of four, if there exists an integer x such that n == 4^x.

4. You are given an integer N. You need to print N! –the factorial of N.

5. **Input** The first line of the input contains a single integer T denoting the number of test cases. The description of T test cases follows. The first and only line of each test case contains a single integer N.

Output For each test case print a single line containing a single integer N!

5. The Fibonacci numbers, commonly denoted F(n) form a sequence, called the Fibonacci sequence, such that each number is the sum of the two precedingones,startingfrom0and 1

6. Kristenlovesplayingwithandcomparingnumbers.Shethinksthatifshetakestwodifferent positive numbers, the one whose digits sum to a larger number is better than the other. If the sum of digits is equal for both numbers, then she thinks the smaller number is better. For example, Kristen thinks that 13is better than 31and that12is better than 11 .Given an integer, n ,can you find the divisor of n that Kristin will consider to be the best?

7. A perfect number is a positive integer that is equal to the sum of its positive divisors, excluding the number itself. A divisor of an integer x is an integer that can divide x evenly. Given a n integer n, return true if n is a perfect number, other wise return false.

8. Given an integer num, repeatedly add ll its digits until the result has only one digit, and return it.

9. **Something for Profit:** A friend of mine bought a used pressure cooker for Rs. 60. She somehow did not find it useful and so when a friend of hers offered her Rs. 70 she sold it to her. However, she felt bad after selling it and decided to buy it back from her friend' by offering her Rs. 80. After having bought it once again she felt that she did not really need the cooker. So, she sold it at the auction forRs.90.Howmuchprofitdidshemake? Did she a tall make any profit?

10. Given a signed 32-bit integer x, return x with its digits reversed. If reversing x causes the value to go outside the signed 32-bit integer range [-2^{31}, 2^{31} - 1], then return 0.

11. Given an integer array num s, move all 0's to the end of it while maintaining the relative order of the non-zero elements.

12. Writeafunctionthattakesthebinaryrepresentationofanunsignedinteger and returns the number of '1' bits it has (also known as the Hamming weight).

13. Martha is interviewing at Subway. One of the rounds of the interview requires her to cut a bread of size l X b into smaller identical pieces such that each piece is a square having maximum possible side length with no leftover piece of bread.

14. Given N two-dimensional points in space, determine whether they lie on some vertical or horizontal line.
If yes, print YES; otherwise, print NO.

```
#include<stdio.h>voidfoo(int
n){
if(n>0){printf("%d",n);foo(n-
1);printf("%d",n);
} }

intmain(){ foo(3);return0;
}
```

1. What is the output of the above program?
- 321123
- 321
- 123
- 123321

```
#include<stdio.h>intbar(intn){ if (n <= 0)
{ return 0;
}else{ returnn+bar(n-2);
} }

int main(){
intresult=bar(7); printf("%d",result);return0;
}
```

2. What is the output of the above program?
- 20
- 16
- 14
- 12

```
#include<stdio.h>voidbaz(intn){ if (n > 0) { baz(n/2);printf("%d",n%2);
}

}

intmain(){ baz(10);return0;
}
```

3. What is the output of the above program?
- 1010
- 0101
- 00101
- 1101

```
#include<stdio.h> intfactorial(intn){ if (n == 0)
{ return 1;
}else{ returnn*factorial(n-1);}
    intmain(){
    intresult=factorial(5); printf("%d",result);return0;
    }
```

4. What is the output of the above program?
- 120
- 24
- 25
- 20

```
#include<stdio.h>
    intpower(intbase,intexponent){if(exponent=
    =0){return1;
}else{
    returnbase*po
    wer(ba
    se,exponent-
    1);
}

}


intmain(){
    intresult=power(2,4);printf("%d",
    r esult); return0;
}
```

5. What is the output of the above program?
- 16
- 8
- 32
- 64

Week10: Structures

1. You are building a pay roll system for accompany with multiple departments. Design a program using structures that stores employee details such as name, employeeID, and salary. Implement an array of structures to store employee records for each department. Calculate the total salary expenditure for each department and display it. Additionally, identify the department with the highest salary expenditure and acknowledge it as the top-performing department

2. VGP logistics is a premium Cargo service for Sending/receiving parcels from Vijayawada to Singapore. You are appointed as Manager in delivery department and need to maintain the arrival and delivery of the consignments sent/received. Create a structure consignment with the following Members Consignment_id, name, from, to, DOS (Date of Shipment), net weight, Address.
For Example: Consignment_id:1008Name:Haier
Steamer From: Vijayawada To: Singapore
DOS(Date of Shipment):30-may-2023net_weight:28.8kg Address:
Mint Street Chennai

3. You have been assigned the task of developing a student grading system for a prestigious college. Design a program using structures that stores student details, such as name, roll number, and marks in various subjects. Implement an array of structures to store multiple student records and calculate the overall percentage for each student. Additionally, provide a functionality to generate a grade for each student based on their percentage and display it alongside their record.

4. You are developing a soldier management system for an army unit. Each soldier's record consists of the following information: name, rank, and years of service. Implement an array of structures to store the records of multiple soldiers. Write a C program to calculate and display the average years of service for all soldiers in the unit.

5. You are working on a ship management system for a naval fleet. Each ship's record contains the following details: name, type (e.g., aircraft carrier, destroyer), and year of commissioning. Implement an array of structures to store the ship records. Write a C program to search for a specific type of ship within the fleet and display the names of all ships belonging to that type.

6. You have been assigned the task of developing a pilot roster system for an air force squadron. Each pilot's record includes the following information: name, rank, and flight hours. Implement an array of structures to store the pilot records. Write a C program to find and display the pilot with the highest number of flight hours in the squadron.

7. You are working on a reservation system for a luxurious hotel. Create a program using structures that stores guest details, including name, room number, and check-in date. Implement an array of structures to store multiple guest records and allow the hotel staff to search for guests by either their room number or name. Provide an additional feature that calculates the duration of each guest's stay and generates the total revenue earned by the hotel.

Skill Oriented Exercise

8. You have been tasked with developing a library management system for a renowned library. Create a program using structures that stores book information, including title, author, and publication year. Implement an array of structures to store multiple book records and allow the librarian to search for books by either title or author's name. Enhance the system by enabling the librarian to borrow and return books, updating the book status accordingly.

9. You have been assigned the task of creating a customer billing system using an array of structures. Each structure should store the customer's name, account number, and total amount due. Implement functions to add customer records, display all records, and find the customer with the highest amount due.

10. You are working on a car inventory management system using an array of structures. Each structure should hold the details of a car, including the make, model, and year of manufacture. Implement functions to add car records, display all records, and find the newest car in the inventory.

11. You are developing a product inventory management system for a retail store. Each product has a unique identifier, name, price, and quantity in stock. Implement an array of structures to store the product records. Create functions to add new products, update product details, display all products, and search for products based on their identifier or name.
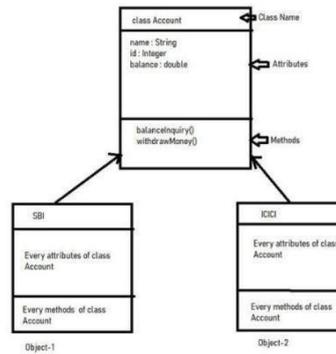
1. Create a class and the object code for the above scenario.
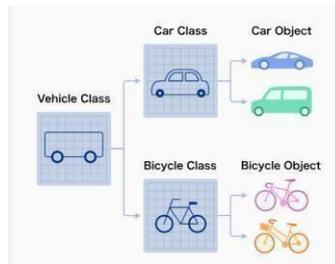
2. Develop code for Class and Object.

Week12: Data Abstraction

Developing a banking application that handles various types of accounts such as savings, checking, and loans.

- **Abstraction Use:** Create abstract classes or interfaces like Account with common methods (e.g., deposit(), withdraw(), get Balance()). Concrete classes (e.g., Savings Account, Checking Account) implement these methods. The user interacts with Account objects without needing to know the specific type of account or its internal workings.

Inheritance

Developing a graphical user interface (GUI)library with various types of buttons.

- **Inheritance Use:** Create a base class Button with common properties like label, size, and methods like click(). Derive subclasses like Image Button, Toggle Button,and Radio Button that inherit from Button and add specific properties or methods unique to each type of button.

Building a ne-commerce plat form with different types of products.

- **Inheritance Use:** Define a base class Product with common attributes like name, price, and methods like apply Discount(). Create subclasses like Electronics, Clothing, and Books, each adding specific attributes (e.g., Electronics might have

  warrantyPeriod, Clothing might have size and color).

Building educational software that manages different types of learning resources.
- **Inheritance Use:** Establish a base class Learning Resource with common properties like title, subject, and methods like display(). Derive subclasses such as Book, Video Lecture, and Quiz, each adding specific attributes and methods (e.g., Quizmight have questions and a method evaluate()).

Designing a system to classify and manage information about different animals.
- **Inheritance Use:** Define a base class Animal with common attributes like name, habitat, and methods like eat(), sleep(). Create subclasses such as Mammal, Bird, and Reptile, each with specific characteristics and methods(e.g., Bird might have methods fly()).

Week13: Polymorphism

An application that can draw various shapes such as circles, rectangles, and triangles.
- **Polymorphism Use:** Define an abstract class Shape with a method draw(). Implement subclasses Circle, Rectangle, and Triangle, each providing its specific draw() implementation. The application can then handle any shape object through the Shape interface

A program that simulates sounds of different animals.
- **Polymorphism Use:** Create a base class Animal with an abstract method make Sound(). Implement subclasses Dog, Cat, and Cow that override make Sound(). The simulator can then invoke make Sound() on any animal object

Managing different types of transportation such as cars, buses, and bicycles.

Skill Oriented Exercise

- **Polymorphism Use:** Define a base class Vehicle with an abstract method move(). Implement subclasses Car, Bus, and Bicycle, each with its own implementation of move(). The system can then manage different vehicles uniformly

A system sending notifications via email, SMS, and push notifications.
- **Polymorphism Use:** Define an abstract class Notification with a method send(). Implement subclasses Email Notification, SMS Notification, and Push Notification, each with its own send() method. The system can send notifications through any medium using the same interface

Week14: Virtual functions

A document edit or that supports different types of documents such as text documents, spreadsheets, and presentations.
- **Virtual Function Use:** Define a base class Document with a virtual function save(). Subclasses Text Document, Spreadsheet, and Presentation override save() to handle specific saving mechanisms.

An audio processing library that handles various audio effects such as reverb, echo, and distortion.

- **Virtual Function Use:** Define a base class Audio Effect with a virtual function apply().Sub classes Reverb Effect, Echo Effect, and Distortion Effect override apply() to implement specific effects.
  An AI strategy game that involves different types of game characters such as warriors, mages, and archers.
- **Virtual Function Use:** Define a base class Character with a virtual function attack(). Subclasses Warrior, Mage, and Archer override attack() to provide specific attack behaviors.

Week15: Exception handling

1)   File Operations Scenario: An application needs to read data from a file. Exception Handling Use: Implement code to handle scenarios where the file might not exist, the application lacks permissions, or the file is corrupted. Use try-catch blocks to manage these exceptions:
2)   E-Commerce Checkout Process
Scenario: An e-commerceapplicationprocessesuserordersduringcheckout.
- Exception Handling Use: Handle errors such as invalid payment details, out-of-stock items, or delivery address issues.

Skill Oriented Exercise

3) An application processes images for various operations like resizing, filtering, and saving. Exception Handling Use: Handle errors such as unsupported file formats, corrupted files, or out-of-memory issues.

TEXT BOOKS:

1. ForouzanB.A&RichardF.Gilberg,A Structured ProgrammingApproachusingC,3rd Edition(2013), Cengage Learning.
2. JeriR.HanlyandElliotB.Koffman,ProblemsolvingandProgramDesigninC7th Edition, Pearson
3. ANSI and Turbo C++by Ashoke N.Kamthane, Pearson Education

REFERENCE BOOKS:

1. BrianW.KernighanandDennisM.Ritchie,TheCProgrammingLanguage,PrenticeHall of India
2. E.Balagurusamy,ComputerfundamentalsandC,2ndEdition,McGraw-Hill
3. ashavantKanetkar,LetUsC,18thEdition, BPB
4. E.Balagurusamy,ObjectOrientedProgrammingusingC++,2ndEdition,McGraw-Hill

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(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
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2410073: ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY

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

Prerequisites: There are no prerequisites to take this course.

Course Objectives:

1. To enable students, develop their active listening skills
2. To equip students with necessary training in listening, so that they can comprehend the speech of people from different linguistic backgrounds
3. To improve their pronunciation and neutralize accent
4. To enable students express themselves fluently and appropriately
5. To practice speaking in social and professional contexts

Course Outcomes:

After successful completion of the course, student will be able to:

1. **Identify** key information while listening to spoken texts.
2. **Interpret** the speaker's intention from the speech.
3. **Apply** pronunciation techniques to improve intelligibility.
4. **Demonstrate** fluency, clarity, and confidence while speaking.
5. **Use** English effectively in real-life situations.

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

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

Exercise – I Listening and Speaking Skills

CALL Lab:
Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.
Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs- Consonant Clusters-Past Tense Marker and Plural Marker- Testing Exercises
   ICS Lab:

Understand: Spoken vs. Written language- Formal and Informal English.
Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Exercise – II Speaking Skills CALL

Lab:
Understand: Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Stress pattern in sentences – Intonation.
Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Stress pattern in sentences – Intonation - Testing Exercises

ICS Lab
Understand: Features of Good Conversation – Strategies for Effective Communication.
Practice: Situational Dialogues – Role Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise – III Speaking Skills CALL

Lab
Understand: Errors in Pronunciation-Neutralising Mother Tongue Interference (MTI).
Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation - Testing Exercises

ICS Lab
Understand: Descriptions- Narrations- Giving Directions and Guidelines – Blog Writing
Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

Exercise – IV Speaking Skills and Writing Skills CALL

Lab
Understand: Listening for General Details.
Practice: Listening Comprehension Tests - Testing Exercises

ICS Lab
Understand: Public Speaking – Exposure to Structured Talks - Non-verbal Communication- Presentation Skills. Practice: Making a Short Speech – Extempore- Making a Presentation.

Exercise – V Group Discussion and Listening Skills

CALL Lab
Understand: Listening for Specific Details.
Practice: Listening Comprehension Tests -Testing Exercises

ICS Lab
Understand: Group Discussion
Practice: Group Discussion

Minimum Requirement of infrastructural facilities for ELCS Lab:

1.   Computer Assisted Language Learning (CALL) Lab:

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

i) Computers with Suitable Configuration

ii)   High Fidelity Headphones

2.   Interactive Communication Skills (ICS) Lab:

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

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

Suggested Software:

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

References:

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

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2410596: WEB APPLICATION DEVELOPMENT

B.Tech. I Year. I Sem   **L T P C**

0 0 2 1

Prerequisites: **There are no prerequisites to take this course.**

Course Objectives:
1. HTML tags
2. CSS
3. Development of static web site
4. Concepts of Java script
5. Development of dynamic web site

Course Outcomes: After Completion of the Course, Students should be able to

CO1: Learn HTML tags and CSS
CO2: Develop static web pages using HTML
CO3: Use CSS in web pages
CO4: Understand basic concepts of JavaScript
CO5: Develop dynamic web pages

PART-A

1. Write a HTML program to create a webpage about the different art forms of India, with appropriate title on the title bar. Use different heading tags for the headings, and list them using ordered list.
2. Write a HTML program to create sections in the document using appropriate tags and apply different color as background to them. Use internal hyperlinks to move to different points within the page.
3. Write a HTML program to insert a picture on the webpage, giving description for the picture in a paragraph. Use properties of height, width, space, space and align, with different values.
4. Write a HTML Program, to create a profile of 2 pages, the First page containing the applicant's picture with personal details using unordered lists, and the second containing Educational details using tables. Use hyperlinks to move to the next page.
5. Using Frames create an Indian Flag and insert the image of chakra in the center.
6. Create a frame like structure based on the given diagram, such that When the first link is clicked, the contents of the first frame is filled with the corresponding information and when the second link is clicked the second frame is filled.

	Networks……..
● Networks ● Simulation	Simulation

7. Write a program in HTML to demonstrate the concept of Image map, for India map. Map for areas rectangle, Circle and polygon.

PART-B

1. Write a program using JavaScript to do the multiplication table for a number

entered by the user in the textbox.

2. Create a sparse array using the values entered by the user in the five textboxes, and use Array methods such as sort (), pop (), push (), reverse () and join ().

3. Create a math object and use methods ceil (), floor (), round () for rounding off the number, also use methods such as cos (), sin (), sqrt ().

4. Write a Program using JavaScript to print a bill for 5 items purchased by the user.

5. Write a program Using Date object, to display appropriate greeting message "Good Morning" or "Good Afternoon" or "Good Night", in an alert box with the user's name, after receiving the same in the prompt box.

6. To demonstrate the concept of styles, write a program applying internal style for paragraph tag, and override the same by applying inline style. Also create an external CSS file applying styles for the headings.

7. Create a registration form for creating an email account, having the input type elements like checkbox, radio button, select option, text area and submit button, and validate the textboxes for verifying the password.

8. Create a web page using two image files, which switch between one another as the mouse pointer moves over the image. Use on Mouse Out and on Mouse Over event handlers.

9. Using filters apply opacity feature to blur the image and using Transition apply hover feature, so the image will be transparent again when the mouse pointer is placed on the image.

TEXT BOOKS:

1. HTML & CSS: The Complete Reference – *Thomas A. Powell*, McGraw-Hill
2. Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML and AJAX – *Uttam K. Roy*, Oxford University Press
3. Internet & World Wide Web: How to Program – *Paul Deitel & Harvey Deitel*, Pearson
4. Learning Web Design – *Jennifer Niederst Robbins*, O'Reilly Media
5. JavaScript: The Definitive Guide – *David Flanagan*, O'Reilly Media
6. Beginning HTML, XHTML, CSS and JavaScript – *Jon Duckett*, Wiley
7. Web Programming with HTML5, CSS, and JavaScript – *John Dean*, Jones & Bartlett

REFERENCE BOOKS:

□ **Internet & World Wide Web – How to Program**
Paul Deitel & Harvey Deitel, Pearson Education

□ **Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML and AJAX**
Uttam K. Roy, Oxford University Press

□ **HTML, XHTML & CSS: The Complete Reference**
Thomas A. Powell, McGraw-Hill Education

□ **JavaScript: The Definitive Guide**
David Flanagan, O'Reilly Media

□ **Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics**
Jennifer Niederst Robbins, O'Reilly Media

□ **Beginning HTML, XHTML, CSS and JavaScript**
Jon Duckett, Wiley

□ **Web Programming with HTML5, CSS, and JavaScript**
John Dean, Jones & Bartlett Learning

□ **Professional JavaScript for Web Developers**
Nicholas C. Zakas, Wrox

I-II

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2420002: DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(CSE,CSD,CSM, ECE,EEE,MECH, CIVIL)

B.Tech. I Year II Sem.   **L T P C**

                                                                 3 1 0 4

Prerequisites: Mathematics courses of 10+2 year of study.

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

Course Outcomes: After Completion of the Course, Students should be able to
1. Utilize the methods of differential equations for solving Newton's law of cooling and   Law of Natural growth and decay.
2. Understand the solutions of linear differential equations with constant coefficients.
3. Explain the concept of the Laplace transforms and its significance in solving differential equations and evaluating integrals.
4. Interpret the vector differential operators and their relationships for solving engineering problems.
5. Apply the integral transformations to line, surface and volume of different geometrical models.

UNIT-I: First Order ODE

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

UNIT-II: Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax}, sin ax, cos ax, polynomials in x, e^{ax} V(x) and x V(x), method of variation of parameters, Equations reducible to linear ODE with constant coefficients: Cauchy-Euler equation, Legendre's equation.

UNIT-III: Laplace transforms

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function (All without proof), Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

UNIT-IV: Vector Differentiation

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

UNIT-V: Vector Integration

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

TEXTBOOKS:

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

REFERENCEBOOKS:

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

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2420009: **ENGINEERING CHEMISTRY**

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

Prerequisites: **There are no prerequisites to take this course.**

Course Objectives:

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

Course Outcomes: After Completion of the Course, Students should be able to

CO1: Understand the fundamental properties of water and its applications in both domestic and industrial purposes.

CO2: Acquire the knowledge of electro chemical processes and their relevance to corrosion and its control methods.

CO3: Determine the significance and practical applications of batteries and various energy sources, enhancing their potential as future engineers and entrepreneurs.

CO4: Understand the basic concepts and properties of polymers and other engineering materials.

CO5: Apply the medicinal values in daily life

UNIT - I: Water and its treatment: [8]

Introduction to hardness of water – Estimation of hardness of water by complexometric method and related numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water-Disinfection of potable water by chlorination and break-point chlorination. Boiler troubles: Sludges, Scales and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning, External treatment methods - Softening of water by ion- exchange processes. Desalination of Brackish water – Reverse osmosis.

UNIT – II Battery Chemistry & Corrosion [8]

Introduction-Classification of batteries-primary, secondary and reserve batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of: Lithium ion battery, Applications of Li-ion battery to electrical vehicles. Fuel Cells- Differences between battery and a fuel cell. Construction and applications of Hydrogen Oxygen fuel cell. Solar cells - Introduction and applications of Solar cells. Corrosion: Causes and effects of corrosion – theories of chemical and electrochemical corrosion mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current methods. Surface coatings-Metallic Coatings-Hot Dipping-Galvanization, Tinning

UNIT - III: Polymeric materials: [8]

Definition – Classification of polymers with examples – Types of polymerizations–addition (Mechanism of free radical addition) and condensation polymerization with examples – Nylon 6:6. Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, Preparation, Properties and engineering applications of PVC, Teflon, Fiber reinforced plastics (FRP). Rubbers: Natural rubber and its vulcanization. Elastomers: Characteristics –preparation – properties and applications of Buna-S Thiokol rubber. Conducting polymers: Characteristic, Classification and applications of conducting polymers. Biodegradable polymers: Concept and advantages - Poly vinyl alcohol and their applications.

UNIT - IV: Energy Sources: [8]

Introduction, Calorific value of fuel – HCV, LCV- Dulong's formula. Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, Knocking – octane and cetane rating, synthetic petrol - Fischer Tropsch"s process; Gaseous fuels – composition and uses of natural gas, LPG and CNG.Bio Diesel-Transesterification-advantages.

UNIT - V: Engineering Materials: [8]

Cement: Portland cement, its composition, setting and hardening, special cements-white cement, waterproof cement, high alumina cement.
Smart materials and their applications: - Classification-(piezoelectric materials-quartz, Shape memory material (SMA-Nitinol), Thermo responsive materials, magneto rheological materials-Examples.
Lubricants: Classification of lubricants with examples-characteristics of a good lubricants mechanism of lubrication (thick film, thin film and extreme pressure)- properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

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

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

2420502: Essentials of Problem Solving Using Python

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

Prerequisites: A course on "Problem solving using C and C++"

Course Objectives:

1. Basic building blocks of python.
2. Using of Functions and Modules.
3. Importance of Multithreading in problem solving.
4. The fundamental concepts of graph theory.
5. Graph coloring and traversal algorithms for solving real-world problems.

Course Outcomes: After Completion of the Course, Students should be able to

1. Construct Python data structures programs using tuples sets and dictionaries
2. Design Programs using Functions and Modules
3. Implement Multithread concept in solving problems
4. Understand graph terminology
5. Build efficient graph routing algorithms for various optimization problems on graphs.

UNIT - I: Python Basics: Python Objects, Operators, Python Numbers, Operators, Built-in Functions. Conditionals and Loops-if, else, elif, for, while, break, continue, pass.
Sequences: Strings, Lists, and Tuples- Built-in Functions, Special features. Mapping and Set Types: Dictionaries, Sets.

UNIT - II: Functions and Functional Programming –Calling Functions, Creating Functions, Passing Functions, Formal Arguments, Variable-Length Arguments, Functional Programming.
Modules–Modules and Files, Namespaces, Importing Modules, Module Built-in Functions, Packages, Related modules.

UNIT - III: Files and Input / Output: File Objects, File Built-in Functions, File Built-in Methods, File Built-in Attributes, Standard Files, Command-line Arguments.

Multithreaded Programming: Introduction, Threads and Processes, Python Threads, the Global Interpreter Lock, Thread Module, Threading Module.

UNIT - IV: Graph terminology, Digraphs, Weighted graphs, Complete graphs, Graph complements, Bipartite graphs, Graph combinations, Isomorphism's, Matrix representations of graphs, incidence and adjacency matrices, Degree Sequence, Eulerian circuit: Konigsberg bridge problem, Touring a graph; Eulerian graphs, Hamiltonian cycles

UNIT - V: Shortest paths: Dijkstra's algorithm, Walks using matrices.
Graph Coloring and Graph Algorithms: Four color theorem, Vertex Coloring, Edge Coloring, Coloring Variations.
Graph traversal: Depth-First Search, Breadth-First Search and its applications; The traveling salesman problem, Minimum Spanning Trees: Kruskal's and Prim's algorithm

TEXT BOOKS:

1. Core Python Programming, Wesley J. Chun, Third Edition, Prentice Hall PTR

2. Karin R Saoub, Graph Theory: An Introduction to Proofs, Algorithms, and Applications, 1st edition, Chapman and Hall, 2021.

REFERENCE BOOKS:

1. Think Python, Allen Downey, Green Tea Press
2. Introduction to Python, Kenneth A. Lambert, Cengage
3. Python Programming: A Modern Approach, VamsiKurama, Pearson
4. Learning Python, Mark Lutz, O'Reilly
5. R Balakrishnan, K Ranganathan, A Textbook of Graph Theory, Springer Exclusive, 2nd edition, 2019.

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2420221: ELECTRICAL ENGINEERING
(Common for EEE and ECE)

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

Prerequisites: **Mathematics**

Course Objectives: The students will try to learn
1. The network reduction techniques such as source transformation, mesh analysis, nodal analysis to solve different networks.
2. The basic concept of AC circuits for optimization of household and industrial circuitry.
3. The basic concepts of theorems to solve complicated circuits
4. The characteristics of two-port networks and network topologies suitable in power system.

Course Outcomes: After successful completion of the course, students should be able to
1. Apply the techniques like nodal analysis and mesh analysis to solve the complicated circuits.
2. Understand the behavior of sinusoidal AC supply compared to the DC supply.
3. Summarize the procedure for several theorems to reduce complex network into simple equivalent network with DC and AC excitation.
4. Understand the concept of initial conditions of RLC elements to determine the transient response of first and second order electrical circuits
5. Recognize the two port parameters, correlate their interrelations and importance of graph theory and duality of various circuits

UNIT-I
NETWORK ELEMENTS & LAWS
Basic Concepts of Circuits: Basic definitions, Ohm's Law, Kirchhoff's laws, dependent and Independent sources. Passive elements — R, L and C, Energy stored in inductance and capacitance.
Circuit Analysis: Source transformations, Star-delta transformations, Node voltage method, Mesh current method including super node and super mesh analysis.

UNIT-II
ANNLYSIS OF AC CIRCUITS
Single Phase AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power and power factor. Analysis of single-phase ac circuits consisting of R, L, C, and RL, RC, RLC combinations (series only).

UNIT-III
NETWORK THEOREMS
Network Theorems-I: Superposition theorem, Thevinin's theorem, Norton's theorems, and Maximum power transfer theorems for DC and AC excitations, numerical problems.
Network Theorems-II: Tellegen's theorem, Compensation theorem, Milliman's theorem and Reciprocity theorems for DC and AC excitations, numerical problems.

UNIT-IV
TRANSIENT ANALYSIS
Initial conditions, Transient Response of RL, RC and RLC series and parallel circuits with DC and AC excitations, differential equation and Laplace transform approach.

UNIT-V
TWO PORT NETWORK AND GRAPH THEORY
Two Port Network: Two port parameters, interrelations, Two port Interconnections.
Network topology: Definitions, incidence matrix, basic tie set and basic cut set matrices for planar networks duality and dual networks.

TEXT BOOKS:
1. A Sudhakar, Shyammohan S Palli."Circuits and Networks: Analysis and Synthesis",McGraw Hill", 5th Edition,2017.
2. Van Valkenburg M.E,"Network Analysis"Prentice Hall of India,3rd edition, 2000.
3. M Nahvi, Joseph A. Edminister, Schaum's " Outline of Electric Circuits", 7th Edition, 2018.

REFERENCE BOOKS:
1. B. Subramanyam," Electric Circuit Analysis", Dreamtech Press & Wiley, 2021.
2. James W.Nilsson, Susan A.Riedel" Electric Circuits", Pearson, 11th Edition, 2020.
3. Jagan N.C, Lakshrninarayana C," Network Analysis", B.S. Publications, 3 rd Edition, 2014.
4. Ravish R Singh," Network Analysis and Synthesis", McGrawHill, 2nd Edition, 2019.

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2420371: COMPUTER AIDED ENGINEERING GRAPHICS
(Common to All Branches)

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

                                                                 1 0 4 3

Prerequisites: Nil

Course Objective: The students will be able

1. To understand the importance of engineering graphics in the engineering design process.
2. To apply principles of dimensioning and lettering in engineering drawings
3. To develop the ability to create and interpret technical drawings.
4. To master geometric constructions and projections.
5. To gain proficiency in computer-aided design (CAD) software.

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

1. Explain the role of engineering graphics in the engineering design and manufacturing process.
2. Understand the fundamental concepts of AutoCAD.
3. Perform basic geometric constructions and create accurate technical drawings.
4. Develop skills to create 2D and 3D drawings.
5. Use CAD software to create, modify, and manage engineering drawings.

Module-I: Introduction to Engineering Graphics:

The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line, The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.

Module-II: Conic Sections and Engineering Curves

Construction of Ellipse, Parabola, Hyperbola (General Method Only)
Engineering Curves: Cycloids, Epicycloid and Hypocycloid

Module -III: Orthographic Projections

Introduction to Projections: Assumptions, Principles and Different angles of projections.
Projections of Points: Located in all Quadrants
Projections of Lines: Parallel, Perpendicular, Inclined to one plane.

Module -IV: Projections of Planes and Projection of Solids

Projections of Planes: Introduction to planes, Regular lamina- Orientations- Surface parallel to HP, Surface parallel to VP, Inclined to HP, Inclined to VP.
Projections of Solids: Introduction to solids, Right Regular Solids- Orientations- Axis perpendicular to HP, Axis perpendicular to VP, Axis inclined to HP, Axis inclined to VP.

Module –V: Isometric Drawing and Conversions

Principles of Isometric projections, Isometric View and Isometric Scale, Isometric view of: Planes and Solids, Conversion: Isometric to Orthographic and Vice Versa

Text Books:

1. **"Engineering Drawing",** N.D. Bhatt,Charotar Publishing House Pvt. Ltd, 53rd Edition, 2014, ISBN: 978-9380358173
2. **"Textbook of Engineering Drawing",** K. Venkata Reddy, BS Publications, Revised Edition, 2013, ISBN: 978-9381075994
3. **"Engineering Graphics**", K.R. Gopalakrishna, Subhas Stores, 32nd Edition, 2014, ISBN: 978-9353460206
4. "**Engineering Drawing and Computer Graphics",** M B Shah & C. Rana, Pearson Edition 2010.

Reference Books:

1. "**A Textbook of Engineering Drawing**", R.K. Dhawan, S. Chand Publishing, Revised Edition, 2012, ISBN: 978-8121914311
2. "**AutoCAD 2024: A Problem-Solving Approach, Basic and Intermediate**", Sham Tickoo, CADCIM Technologies, 1st Edition, 2023, ISBN: 978-1640571577
3. "**Engineering Drawing and Graphics Using AutoCAD**", T. Jeyapoovan, Vikas Publishing House 2nd Edition, 2015, ISBN: 978-9325982417

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EMPOWERING THROUGH INNOVATIONS
MLRS

2420072: ENGINEERING CHEMISTRYLAB

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

Prerequisites: Intermediate

Course Objectives: The students will try to learn:

The course consists of experiments related to the principles of chemistry required for engineering student. The student will learn:

- Estimation of hardness of water to check its suitability for drinking purpose.
- Students are able to perform estimations of acids and bases using conductometry, potentiometry methods.
- Students will learn to prepare polymers such as Bakelite and Thiokol rubber in the laboratory.
- Students will learn skills related to the lubricant properties such as saponification value, surface tension and viscosity of oils.

Course Outcomes: After Completion of the Course, Students should be able to

CO1	**Recall** the steps involved in estimating the amount of iron (Fe) in a sample using volumetric analysis and **list** the reagents and equipment used to determine water hardness by the complexometric method. (BL1)
CO2	**Contrast** the fundamental concepts related to conductometry and potentiometry for acid-base concentration analysis. (BL2)
CO3	**Explain** the chemical reactions involved in forming Bakelite (phenol-formaldehyde) and Thiokol (sulfur-based polymerization) rubbers. (BL2)
CO4	**Demonstrate** the procedure to measure viscosity of lubricating oils using a viscometer (e.g., capillary, rotational), and **compare** the viscosity profiles of different grades of lubricating oils. (BL3)
CO5	**Describe** how virtual labs simulate real-world conditions through the working principles of: photovoltaic effect in solar cells, lithium-ion movement in EV batteries, redox reactions in fuel cells, and stimuli-responsive behavior of smart materials. (BL2)

List of Experiments:

I. Volumetric Analysis: Estimation of Hardness of water by EDTA Complexometric method.

II.   Conductometry: Estimation of the concentration of an strong acid by Conductometry.

III.   Potentiometry: Estimation of the amount of Fe^{+2} by Potentiometry.

IV.   Dichrometry: Determination of Ferrous ion by Dichrometry

V. Preparations:

   1. Preparation of Thiokol rubber

VI.   Lubricants:

   1. Estimation of acid value of given lubricant oil.

   2. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer.

VII.   Preparation of Hand sanitizer (Isopropyl alcohol)

VIII. Virtual lab experiments

   1.   Construction of Fuel cell and its working.

   2.   Smart materials for Biomedical applications

   3.   Batteries for electrical vehicles.

   4.   Functioning of solar cell and its applications

List of Experiments: (Any 2 experiments are to be performed)

   1.   Preparation of Aspirin
   2.   Preparation of Paracetamol.

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EMPOWERING THROUGH INNOVATIONS
MLRS

2420270: ELECTRICAL ENGINEERING LAB
B.Tech. I Year. II Sem   **L T P C**
                                                          0 0 2 1

Co requisites: **Electrical Engineering**

Course Objectives: The students will try to learn
1. The gap between theoretical knowledge and practical applications by exposing students to a wide range of electrical components and circuit configurations.
2. The essential skills in circuit design, measurement, testing, and analysis using laboratory equipment such as millimeters and power supplies.
3. The basic laws, network reduction techniques and theorems for different circuits.

Course Outcomes: After successful completion of the course, students should be able to
1. Solve the source resistance, currents, voltage and power using various laws associated with electrical circuits.
2. Perform the superposition principle, reciprocity and maximum power transfer condition for the Electrical network with DC excitation.
3. Demonstrate Thevenin's and Norton's theorem to reduce complex networks into simple equivalent networks with DC excitation.
4. Apply Faraday's laws of electromagnetic induction for calculating the various performance parameters in magnetic circuits.
5. Understand the waveforms of different inputs and determine the form factor of electrical circuits.

COURSE CONTENT:
EXERCISES FOR ELECTRICAL ENGINEERING LABORATORY
Perform Any Ten Experiments From Below
1. Verification of Ohm's Law
2. Verification of Kirchhoff's laws
3. Calculations and verification of Impedance and current of series RL & RC
4. Determination of Resonant frequency and band width of Series Resonance circuit
5. Calculations and verification of Impedance and current of series RLC
6. Verification of Thevenin's and Norton's Theorem
7. Verification of Superposition Theorem
8. Verification of Reciprocity Theorem
9. Verification of Maximum Power Transfer Theorem
10. Determination of self and mutual inductance of two inductive coils
11. Determination of form factor for non-sinusoidal waveform

TEXT BOOKS:
1. A Chakrabarti, "Circuit Theory", Dhanpat Rai Publications, 8th Edition, 2021.
2. William Hayt, Jack E Kemmerly S.M. Durbin, "Engineering Circuit Analsysis", Tata McGraw Hill, 9th Edition, 2020.

REFERENCE BOOKS:
1. CL Wadhwa, Electrical Circuit Analysis including passive network synthesis, International, 2nd Edition, 2009.
2. David A Bell, Electrical Circuits, Oxford University Press, 7th Edition, 2009.

2420572: ESSENTIALS OF PROBLEM-SOLVING USING PYTHON LAB

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

Prerequisites: **A course on "Problem solving using C and C++"**

Course Objectives:
1. Basic building blocks of python.
2. Using of Functions and Modules.
3. Importance of Multithreading in problem solving.
4. The fundamental concepts of graph theory.
5. Graph coloring and traversal algorithms for solving real-world problems.

Course Outcomes: After Completion of the Course, Students should be able to
1. Apply fundamental Python programming concepts including data types, operators, built-in functions, control flow statements, sequences, dictionaries, and sets to develop structured and efficient code for solving basic computational problems.
2. Write modular Python programs using user defined and built in functions, functional programming concepts, and modules/packages to promote code reuse, organization, and maintainability.
3. Develop Python applications that perform file handling and input/output operations, and implement multithreaded programs using Python's threading modules while understanding concepts like processes and the Global Interpreter Lock (GIL).
4. Analyze and apply fundamental graph theory concepts including various types of graphs, graph representations, isomorphisms, and classical problems such as Eulerian circuits and Hamiltonian cycles to model and solve real world problems.
5. Implement and evaluate graph algorithms including shortest path algorithms, graph coloring, traversal techniques, and minimum spanning tree algorithms to solve

LIST OF EXPERIMENTS:

Exercise 1: Python Numbers

a. You are developing a program to determine whether a given year is a leap year, using the following formula: a leap year is one that is divisible by four, but not by one hundred, unless it is also divisible by four hundred. For example, 1992, 1996, and 2000 are leap years, but 1967 and 1900 are not. The next leap year falling on a century is

2400.

b. You are developing a program to determine the greatest common divisor and least common multiple of a pair of integers.

c. You are developing a program to create a calculator application. Write code that will take

Exercise 2: Control Flow

a) Write a Program for checking whether the given number is a prime number or not.

b) Write a program to print Fibonacci series up to given n value.

c) Write a program to calculate factorial of given integer number.

d) Write a program to calculate value of the following series $1+x-x^2+ -x.t..x$.

e) Write a program to print Pascal triangle.

Exercise 3: Python Sequences

a) Write a program to sort the numbers in ascending order and strings in reverse alphabetical order.

b) Given an integer value, return a string with the equivalent English text of each digit. For example, an input of 89 results in "eight-nine" being returned. Write a program to implement it.

c) Write a program to create a function that will return another string similar to the input string, but with its case inverted. For example, input of "Mr. Ed" will result in "mR.eD" as the output string.

d) Write a program to take a string and append a backward copy of that string, making a palindrome.

Exercise 4: Python Dictionaries

a) Write a program to create a dictionary and display its keys alphabetically.

b) Write a program to take a dictionary as input and return one as output, but the values are now the keys and vice versa.

c) Given a List, extract all elements whose frequency is greater than K. Ex: Input test list= (4,6,4,3,3,4,3,4,3,8], k=3 Output - [4,3]

Exercise 5: Files

a) write program to compare two text files. If thev are different, give the line and column numbers in the files where the first difference occurs.

b) write a program to compute the number of characters, words and lines in a file.

Exercise 6: Functions

a. Write a function ball collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding. Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius If (distance

between two balls centers) <= (sum of their radi) then (they are colliding)

b. Find mean, median, mode for the given set of numbers in a list.

c. Write simple functions max2() and min2() that take two items and return the larger and smaller item, respectively. They should work on arbitrary Python objects. For example, max2(4, 8) and min2(4, 8) would each return 8 and 4, respectively.

d. Write a function nearly equal to test whether two strings are nearly equal. Two strings a and bare nearly equal when a can be generated by a single mutation on b.

e. Write a function dups to find all duplicates in the list.

f. Write a function unique to find all the unique elements of a list.

g. Write a function cumulative_ product to compute cumulative product of a list of numbers.

h. Write a function reverse to reverse a list. Without using the reverse function

i. Write function to compute GCD, LCM of two numbers. Each function shouldn't exceed one line.

Exercise 7: Files

a) Write a program to compare two text files. If they are different, give the line and column numbers in the files where the first difference occurs.

b) Write a program to compute the number of characters, words and lines in a file.

Exercise 8: Multithreading

a. Write a program to create thread using thread module.

b. Write a program to create thread using threading module.

c. Write a Program to use Python's threading module to calculate the square and cube of a number concurrently.

Exercise 9:

a. Write a Python program to implement Euler Circuit.

b. Write a Python program to implement Dijkstra's algorithm.

c. Given a connected graph G with N nodes and M edges (edges are bi-directional). Every node is assigned a value A[i]. We define a value of a simple path as: Value of path = Maximum of (absolute difference between values of adjacent nodes in a path). A path consists of a sequence of nodes starting with start node S and end node E. S-ul-u2-.-E is a simple path if all nodes on the path are distinct and S,ut,u2,..E are nodes in G. Given start node S and end node E, find the minimum possible "value of path" which starts with node S and ends with node E

d. Yatin created an interesting problem for his college juniors. Can you solve it? ven N rooms, where each room has a one-way door to a room denoted by room<=i<=N) a positive integer K such that, if a person Starts Trom and continuously moves to the room it is connected to (:e. room[i]), the person should end up in room i after K Steps, Note: The condition should hold for each room .If there are multiple possible values .

Exercise 10: Implement the following using python

a. M-coloring

b. Vertex coloring

c. Edge coloring

Exercise 11: Implement the following graph traversal methods.

a. Depth-First Search

b. Breadth-First Search

c. 1 You are presented with a network comprising N computers and M wired connections between them. Your objective is to precisely K wires from your inventory. computers that can be linked together determine and report the size of the establishing these connections. optimize the network's connectivity using The aim is to maximize the number of within the given constraints. Your task is to largest network that can be formed by In the context of this problem, computers are considered connected if they share either a direct or indirect wired connection. It is worth noting that the value of K will always be less than the number of isolated (standalone) networks in the given configuration, and it may even be zero.

d. A country consists of N cities. These cities are connected with each other using N-1 bidirectional roads that are in the form of a tree. Each city is numbered from 1 to N. You want to safeguard all the roads in the country from any danger, and therefore, you decide to place cameras in certain cities. A camera in a city can safeguard all the roads directly connected to it. Your task is to determine the minimum number of cameras that are required to safeguard the entire country.

Exercise 12: Travelling Salesman problem.

a) You are working in a salesmen company as a programmer. There are n towns in your country and m directed roads between them. Each road has a cost person should spend on fuel. The company wants to sell goods in all n towns. There are infinitely many salesmen in the company. We can choose some positive number of salesmen and give a non-empty list of towns to each of them. Towns from the list are the towns to sell goods in. Each salesman will visit all the towns in his list in this particular order in cycle (after the last town he will return to the first town and so on). Salesman can visit other towns on his way but he will not sell goods in these towns. Two Salesmen cannot sell goods in one town because it will attract unnecessary attention to your company. But for every town there must be a salesman who sell goods in this town. spend money on fuel. If salesman's list of towns consists of exactly one town then he should pay fee to stay in this town each month (each town has its own fee) or he should go for a round trip and cycle. Your task is to calculate the minimal amount of money company must spend monthly to achieve its goals. We will assume that every salesman will spend a month to make one

b) It is the final leg of the most famous amazing race. The top 'n' competitors have made it to the final. The final race has just begun. The race has 'm' checkpoints. Each team can reach any of the 'm' checkpoint but after a team reaches a particular checkpoint that checkpoint gets closed and is not open to any other team. The race ends when 'k' teams finish the race. Each team travel at a constant speed throughout the race which end the race. might be different for different teams. Given the coordinates of n teams and m

checkpoints and speed of individual team return the value of minimum time needed to

c) Little Jhool is a very lenient teaching assistant in his college. He doesn't like cutting the marks of students, so obviously, every student in his tutorial loves him. But anyway, the teacher has got to know about the leniency of Jhool while giving marks, so this time in exam, he decides to give a different exam paper to every single student to check how well have the students been taught by Jhool. Now, Little Jhool knows the strong and weak topics of every single student, so he wants to maximize the total marks obtained by students in his tutorial .You are given the number of

students in Jhool's tutorial, denoted by n -n also being the number of different exam papers - that is, one for every student. Every student will get only one exam paper to solve. You are further given a matrix, (n x n) denoting the marks every student will get if he attempts a particular exam obtained by his entire class.

Exercise 13: Construct minimal spanning tree using the following
a) Prim's Algorithm
b) Kruskal's Algorithm
c) There are total N Hacker-cities in plane. Each city on coordinates (X*t),Y*E)) and there can be any number of cities on the same coordinates. is located You have to make these cities connected by constructing some roads in such a way that it is possible to travel between every pair of cities by traversing the roads. The cost of constructing one road between any two cities is the minimum of the absolute difference between their X and Y coordinates. has you want to earn more and more. you decided to do this in the most optimal way possible, such that the total cost of constructing these roads is minimal. You have to return the minimum money you need to spend on connecting all the cities.

TEXT BOOKS:

1. Core Python Programming, Wesley J. Chun, Third Edition, Pearson.

2. Karin R Saoub, Graph Theory: An Introduction to Proofs, Algorithms, and Applications, 1st edition, Chapman and Hall, 2021.

REFERENCE BOOKS:

1. Think Python, Allen Downey, Green Tea Press
2. Introduction to Python, Kenneth A. Lambert, Cengage
3. Python Programming: A Modern Approach, VamsiKurama, Pearson
4. Learning Python, Mark Lutz, O'Reilly

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2430224: ELECTRO MAGNETIC FIELDS

B.TECH II Year I SEM

L T P C
2 0 0 2

Prerequisites: **Circuit Theory, Engineering Mathematics**

COURSE OBJECTIVE:

1. The behavior of a charge in a static electric field with regard to the intensity, electric displacement, and electric potential.
2. Charge distribution in conductors, dielectrics, and condensers.
3. The effects of magnetic fields in terms of magnetic potential, magnetic displacement, and magnetic field intensity by using resources that can be used to create both steady and fluctuating magnetic fields.
4. The properties of electromagnetic wave transmission through conductors, dielectric materials, and open spaces.
5. Faraday's laws, Maxwell's equations, wave propagation, and Poynting's theorem for analyzing and predicting electromagnetic phenomena in various media

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

1. Determine the potential, electrostatic field behavior and electric field intensity; utilize the vector calculus, Coulomb's law, and Gauss law.
2. Determine the capacitance of various physical configurations by analyzing the conductor and dielectric material behaviors.
3. Showcase the Ampere circuital law and the Biot-Savart law to calculate the magnetic field intensity caused by various current-carrying conductors.
4. Estimate the force caused by moving charge or current in a static magnetic field to determine the inductance for various wire designs and the coil's stored energy.
5. Create the wave equation for the free space, insulators, and conductors for the propagation of electromagnetic waves, apply Maxwell's equation and the Faraday rules of electromagnetic induction.

UNIT-I: ELECTROSTATICS

Introduction to Cartesian, Cylindrical and Spherical Co-ordinates. Conversion of one type of co-ordinates to another; Electrostatic fields: Coulomb's law, electric field intensity due to surface charges, work-done in moving point charge in an electrostatic field, electric potential, properties of potential function, potential gradient, Gauss law, application of Gauss law, Maxwell's first law, Laplace's and Poisson's equations, solution of Laplace's equation in One variable.

UNIT-II: CONDUCTORS AND DIELECTRICS

Dipole moment, potential and electric field intensity due to an electric dipole, torque on an electric dipole in an electricfield, behavior of conductors in an electric field, electric field inside a dielectric material, polarization, conductor and dielectric, dielectric boundary conditions, capacitance of parallel plate and spherical and coaxial capacitors with composite dielectrics, energy stored and

energy density in a static electric field, current density, conduction and convection current densities. Ohm's law in point form and equation of continuity.

UNIT-III: MAGNETOSTATICS

Biot- Savart's law, magnetic field intensity, magnetic field intensity due to a straight current carrying filament magnetic field intensity due to circular, square and solenoid current carrying wire, relation between magnetic flux, magnetic flux density and magnetic field intensity. Maxwell's second equation, Magnetic intensity due to an infinite sheet of current and along current carrying filament, point form of Ampere's circuital law, Maxwell's third equation, field due to a circular loop, rectangular and square loops.

UNIT-IV: FORCE IN MAGNETIC FIELD AND MAGNETIC POTENTIAL

Moving charges in a magnetic field, Lorentz force equation, force on a current element in a magnetic field, force on astraight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors, magnetic dipole and dipole moment, a differential current loop as a magnetic dipole, torque on a current loop placed in a magnetic field; Vector magnetic potential and its properties, vector potential due to s imple configurations, Poisson's equation, Self and mutual inductance, Neu mann's for mula, determination of self-inductance of a solenoid, toroid and determination of mutual inductance between a straight longwire and a square loop of wire in the same plane, energy stored and density in a magnetic field, characteristics and applications of permanent magnets.

UNIT-V: TIME VARYING FIELDS AND FINITE ELEMENT METHOD

Faraday's laws of electromagnetic induction, integral and point forms, Maxwell's fourth equation, curl (E) $= \frac{\partial B}{\partial t}$, statically and dynamically induced EMFs, modification of Maxwell's equations for time varying fields, displacement current equation. Uniform plane waves, Maxwell's equation in phasor form, wave equation in Phasor form, Derivation of Wave equation, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in loss dielectrics, Propagation in good conductors, Skin effect. Poynting's theorem

Text Books:

1. K.B. Madhu Sahu."Electromagnetic Fields", Scitech Ltd. 2nd Edition,2014.
2. David J Griffiths, "Introduction to Electrodynamics", Pearson Education Ltd. 4th edition, 2014.
3. Sunil Bhooshan, "Fundamentals of Engineering Electromagnetics", Oxford University Press, 1st edition, 2012.
4. E.Kuffel, W S Zaengl. J Kuffel, "High Voltage Engineering Fundamental", Newnes, 2nd edition, 2000.

Reference Books:

1. Matthew N O Sadiku. S V Kulkarni," Principles of Electromagnetics", Oxford University Press, 6th edition, 2015.
2. AS Mahajan, AA Rangwala" Electricity and Magnetism", McGraw Hill Publications, 1st edition, 2000.
3. MS Naidu, V. Kamaraju," High Voltage Engineering", McGraw Hill Publications, 3rd edition, 2013.

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2430222: NETWORK ANALYSIS

B.TECH II Year I SEM   L T P C

                                                                      3 0 0 3

Prerequisites: Circuit Theory, Engineering Mathematics

COURSE OBJECTIVE:

1. The concept of locus diagram for series and parallel circuits and discuss series and parallel resonance.

2. Understand the three phase systems for star and delta connected systems and perform three phase power calculations for balanced and unbalanced loads.

3. The various configurations of electromagnetic induction used in magnetic circuits helps in the winding of electrical machines.

4. Classify and design different types of filters and study their characteristics.

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

1. Illustrate the locus diagram for series and parallel circuits and describe series and parallel resonance circuits.

2. Understand the concept of network functions and describe the network functions in time domain and frequency domain approach.

3. Solve the relation between line and phase quantities of three phase star and delta connected systems to analyze balanced and unbalanced circuits.

4. Describe the electromagnetic induction, magnetic flux, self and mutual inductance in single coil and coupled coils magnetic circuits to know total magneto motive force and total ampere turns values. Illustrate the locus diagram for series and parallel circuits and describe the network functions in time domain and frequency domain approach.

5. Classify and design different types of filters and study their characteristics.

UNIT-I: LOCUS DIAGRAMS AND RESONANCE

Locus Diagrams: Series R-L, R-C, R-L-C and Parallel Combination with Variation of Various Parameters.

Resonance: Series, Parallel Circuits, Frequency Response, Concept of Bandwidth and Q Factor.

UNIT-II: NETWORK FUNCTIONS

Network Functions: The concept of complex frequency, physical interpretation, transform impedance, series and parallel combination of elements, terminal ports, network functions for

one port and two port networks, poles and zeros of network functions, significance of poles and zeros, properties of driving point functions and transfer functions, necessary conditions for driving point functions and transfer functions, time domain response from pole-zero plot.

UNIT-III: THREE PHASE CIRCUITS

Three phase circuits: Star and delta connections, phase sequence, relation between line and phase voltages and currents in balanced systems (both star and delta) three phase three wire and three phase four wire system, analysis of balanced and unbalanced three phase circuits, measurement of active and reactive power.

UNIT-IV: MAGNETIC CIRCUITS

Magnetic circuits: Faraday's laws of electromagnetic induction, Concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit analysis of series and parallel magnetic circuits.

UNIT-V: FILTERS

Filters: Classification of filters, filter networks, classification of pass band and stop band, characteristic impedance in the pass and stop bands, constant-k low pass filter, high pass filter, m-derived T-section, band pass filter and band elimination filter.

TEXT BOOKS:

1. William Hayt H, Kimmerly Jack E. and Steven Durbin M, ―Engineering Circuit Analysis‖, McGraw Hill, 6 th Edition, 2002.
2. Van Valkenburg M.E, ―Network Analysis‖, Prentice Hall of India, 3 rd Edition, 2000.

REFERENCE BOOKS:

1. B. Subramanyam, ―Electric Circuit Analysis‖, Dreamtech Press & Wiley, 2021.
2. James W. Nilsson, Susan A.Riedel, ―Electric Circuits‖, Pearson, 11th Edition, 2020
3. A Sudhakar, Shyammohan S Palli, ―Circuits and Networks: Analysis and Synthesis‖, McGraw Hill, 5 th Edition, 2017
4. Jagan N.C, Lakshrninarayana C., ―Network Analysis‖, B.S. Publications, 3 rd Edition, 2014.
5. Ravish R Singh, ―Network Analysis and Synthesis‖, McGrawHill, 2 nd Edition, 2019.

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EMPOWERING THROUGH INNOVATIONS
MLRS

2430460: ANALOG ELECTRONICS

B.TECH II Year I SEM   L T P C

                                                                              3 0 0 3

Prerequisites: Nil

Couse Overview:

This course is intended to introduce students to the fascinating world of analog electronics. The emphasis of the course is to build intuition behind the operation of circuits. This course can be applied in speedometers, position sensors (laser, radar), Microphones, Thermometers, Amplifiers. RF devices, Heart rate monitors, Pressure gauges.

Course Objectives:

The students will try to learn

- Components such as diodes, BJTs and FETs their switching characteristics, applications
- Concepts of high frequency analysis of transistors
- Various types of basic and feedback amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers
- Basic linear integrated circuits
- Concepts of waveform generation and introduce some special function ICs

Course Outcomes:

After successful completion of the course, students shall be able to

- Know the characteristics, utilization of various components.
- Understand the biasing techniques
- Design and analyze various rectifiers, small signal amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- Understand the functioning of OP-AMP, designs OP-AMP based circuits with linear integrated circuits.

MODULE - I: Diode Circuits   **9L**

P-N junction diode, I-V characteristics of a diode; Half-wave and Full-wave rectifiers, Clamping and Clipping circuits. Input output characteristics of BJT in CB, CE, CC configurations, biasing circuits, Load line analysis, Common-emitter, Common-base and Common collector amplifiers; Small signal equivalent circuits.

MODULE - II: MOSFET Circuits   **9L**

MOSFET structure and V-I characteristics. MOSFET as a switch. small signal equivalent circuits - gain, input and output impedances, small-signal model and common-source, common-gate and common-drain amplifiers, trans conductance, high frequency equivalent circuit.

MODULE - III: Multi-Stage and Power Amplifiers   **9L**

Direct coupled and RC Coupled multi-stage amplifiers; Differential Amplifiers, Power amplifiers - Class A, Class B, Class C.

MODULE – IV: Feedback Amplifiers   **12L**

Concepts of feedback – Classification of feedback amplifiers – General characteristics of Negative feedback amplifiers – Effect of Feedback on Amplifier characteristics – Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations – Simple problems.

Oscillators: Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators - Applications.

MODULE – V: Operational Amplifiers   **10L**

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

TEXT BOOKS:

1. Jacob Millman, Christos C Halkias, "Integrated Electronics," McGraw Hill Education, 2nd Edition 2010.
2. Ramakanth A. Gayakwad, "Op-Amps & Linear ICs," 3rd Edition, PHI, 2003.

REFERENCE BOOKS:

1. Thomas L. Floyd, "Electronic Devices," 1st Edition, 2015, Pearson.
2. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 4th Edition, 1988.
3. P. Horowitz and W. Hill, "The Art of Electronics," Cambridge University Press, 3rd Edition, 1989.

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<div align="center">**2430223: DC MACHINES AND TRANSFORMERS**</div>

B.TECH II Year I SEM   L T P C

3 0 0 3

Prerequisites: Engineering Mathematics

COURSE OBJECTIVE:

1. The principles of single excited and multiple excited systems leading to the energy balance equations.

2. The construction, working and operation of self and separately excited DC machines.

3. The performance characteristics of different DC machines when they are under no load and load conditions.

4. The energy transformation using single phase transformers under no load and load conditions.

5. The Different type of connections of poly phase transformers and working principle of Auto Transformer.

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

1. Describe the load sharing capabilities and reliability of electrical machines using parallel operation under various loading conditions.

2. Use the concepts of complex algebra, phasor operations, principles of electromagnetism and circuit theory for analyzing the performance related issues in electrical machines.

3. Demonstrate the working of linear machine as generator and motor by applying electromagnetic laws and its mathematical models under different loading conditions.

4. Identify various control strategies for calculating the performance parameters and voltage regulation of electrical machines.

5. Illustrate the equivalent circuits and connections of single and three phase transformers and auto transformers for power system analysis.

UNIT-I: DC GENERATORS

Introduction to single excited and Multi excited coils, Principle of operation, construction, lap and wave windings, simplex and multiplex windings, commutator, EMF equation, types of DC generators, Armature reaction: Cross magnetization and demagnetization, ampere turns per pole, compensating winding; Commutation: Methods of improving commutation; Open circuit characteristics, voltage buildup, critical field resistance and critical speed, causes for failure to self-excite and remedial measures, load characteristics of shunt, series and compound generators; Conditions and necessity for parallel operation, load sharing, equalizer bars, cross connection of field windings, numerical problems.

UNIT -II: DC MOTORS

Principle of operation, back EMF, torque equation, types of DC motors, condition for maximum power developed, armature reaction and commutation, characteristics, types of starters, numerical problems.

UNIT III: PERFORMANCE OF DC MACHINES

Losses and efficiency: Types of losses, efficiency, condition for maximum efficiency Speed Control

Methods: Speed control of DC machines;

Testing methods: test, brake test, retardation test, separation of stray losses, Hopkinsons test, and test, numerical problems.

UNIT -IV: SINGLE PHASE TRANSFORMERS

Principle of operation, construction, types of transformers, EMF equation, concept of leakage flux and leakage reactance, operation of transformer under no-load and on-load, phasor diagrams, equivalent circuit, efficiency, regulation and all day efficiency; Cooling methods;
Testing of transformers: objectives, polarity test, measurement of resistance, OC and SC tests, back to back test, heat run test, parallel operation, numerical problems.

UNIT V: POLY PHASE TRANSFORMERS

Principle of operation, star to star, delta to delta, star to delta, delta to star, three phase to six phase, open delta connection, Scott connection; Auto transformers: Principles of operation, equivalent circuit, merits and demerits, no load and on load tap changers, harmonic reduction in phase voltages, numerical problems.

TEXT BOOKS:
1. P S Bhimbhra, Khanna Publishers, 1st edition, 2011.

2. I J Nagrath and D P Kothari, McGraw Hill Education, 1st edition, 2010.

3. J B Guptha and performance of Electrical S.K.Kataria & Sons Publishers 14th edition, 2009.

REFERENCE BOOKS:
1. M G Say, E O Taylor, Current Higher Education, 1st edition, 1985.

2. M G and design of AC CBS Publishers, 1st edition, 2002.

3. A E Fitzgerald and C Kingsley, "Electric New York, McGraw Hill Education, 1st edition, 2013.

4. M V Deshpande, PHI Learning Private Limited, 3rd edition, 2011.

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2430507: DATA STRUCTURES

B.TECH II Year I SEM

L T P C

3 0 0 **3**

Prerequisites: "Essentials of Problem Solving using python".

Course Objectives:

The students will try to learn
- Various linear and non-linear data structures.
- How to perform operations on data structures.
- Priority Queues and Heaps
- Various searching and sorting techniques.
- Different hashing techniques

Course Outcomes:

After Completion of the Course, Students should be able to develop solutions by

- Using different types of linked lists
- Solve problems using stack and queue
- Learn different types of trees and their applications
- Implement and know the application of algorithms for searching and sorting.
- Design programs using hashing

Module -I: Linked Lists   [9]
Introduction to Data Structures, Linear list – singly linked list, Doubly linked list, Circular linked list - operations and its applications.

Module-II: Stack and Queue   [8]
Stacks- Introduction, Operations, array and linked representations of stacks, stack applications (Infix to postfix conversion and postfix evaluation),
Queues- Introduction, operations, array and linked representations of queues and its applications.

Module-III: Trees   [10]
Trees: General Trees, Binary Trees, Implementing Trees, Tree traversals
Search Trees: Binary Search Trees, Balanced search trees- AVL trees, B- trees
Priority Queue and Heaps: Priority queue ADT, Priority queue, Applications, Heap Trees, implementing a priority queue with a Heap, Heap Sort.

Module–IV: Searching and Sorting   [9]
Searching: Linear Search and Binary Search and its applications.
Sorting: Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort and its applications.

Module – V: Hashing   [8]
Introduction, Hash Functions-Modulo, Middle of Square, Folding, Collision Resolution Techniques-Separate Chaining, Open addressing,- Linear Probing, Quadratic Probing, Double Hashing.

TEXTBOOKS:

1. Fundamentals of data structures in C, E.Horowitz, S.Sahni and Susan Anderson Freed, 2nd Edition, Universities Press.

2. Data structures using C, A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/pearson education.

REFERENCES:

1. Data structures: A Pseudocode Approach with C, R.F.Gilberg And B.A.Forouzan, 2nd Edition, Cengage Learning.

2. Introduction to data structures in C, Ashok Kamthane, 1st Edition, PEARSON.

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<div align="center">

243EXL1: DESIGN AND INNOVATION

</div>

B.TECH II Year I SEM   L T P C
                                                                                            0 0 2 1

Prerequisites: Nil

Course Objectives: The students will try to learn

- Introduce the principles, stages, and tools of Design Thinking for organizational problem- solving.
- Enable empathy-driven research and ideation to address stakeholder needs.
- Develop skills to build and prototype user-centric solutions collaboratively.
- Train students to test and refine solutions through iterative feedback.
- Guide students in business modeling, effective presentation, and basics of IP filing.

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

- Understand the principles and process of Design Thinking and its relevance in organizational and educational contexts.
- Apply empathy-driven research methods to understand stakeholder needs and create user personas
- Define problem statements and ideate innovative solutions using appropriate tools and frameworks
- Develop and test prototypes iteratively, using feedback and testing tools to refine user- centric solutions
- Design, present, and document a viable business model with potential for publication or IP filing

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Week 1: Course Introduction and Project Kickoff
- Course Overview: Objectives, structure, and expectations
- Capstone Project Introduction: SDG Goals, Themes or challenges
- Team Formation: Assign roles and responsibilities
- Initial Brainstorming: Discuss project ideas and start preliminary research
- Task : Team Formation

Week 2: What Is Design Thinking, Really?
- Define the term "design thinking."
- Design thinking in problem-solving.
- Importance of design thinking for organizations.
- Perspectives of design thinking.
- Case Study: DT at Asian Paints Ltd.
- Case Study: Waste for Warmth
- Task : SDG/Theme Proforma

Week 3: Setting the Stage for Design Thinking in Management Education
- Establishing the Context for Design Thinking Project
- Traditional Problem-Solving and Design Thinking
- Research and Planning for a DT Project

- Principles of Design Thinking Relevant for Business Management
- Case Study: DT at Flipkart
- Case Study: Uber
- Task : Literature Survey

Week 4: Establishing the Design Thinking Essentials
- Ensuring the DT Mindset
- Role of Teams in Design Thinking
- Effects of Design Thinking on Teams
- DT Warm-up (Ice-breaking) Exercises
- Case Study: DT at Apple
- Case Study: Solar energy Supply in Rural Africa
- Task : Abstract Submission and 9 Whys's

Week 5: The DT Process—Understanding the Environment
- DT Process
- First step of the design thinking process—exploration.
- why exploration is an important step to begin with.
- "tools" for conducting exploration.
- Frameworks for analyzing the information collected through exploration.
- Case Study: DT at HCL Technologies
- Case Study: Siemens CT, China
- Task : STEEP Analysis

Week 6: Understanding the Stakeholders' Perspective—Empathy
- Need for "understanding the stakeholders" in design thinking process.
- Role of empathy in design thinking.
- Approaches to "empathizing" with stakeholders.
- How to create customer profiles based on empathy mapping.
- Case Study: DT at Hero MotoCorp Ltd.
- Case Study: PillPack
- Task : Empathy map, Persona of a user, Finalize the Stakeholders/ Customer Segments

Week 7: Defining the Point of View—Problem Articulation
- "How Might we" statements
- Art of Storytelling
- Context Mapping
- Creating a critical item diagram
- Case Study: DT at Infosys
- Case Study: OPT Bank Romania
- Task: Template for Context Mapping

Week 8: Ideation
- Ideation Techniques
- Importance of the ideation phase in the design thinking project.
- Build a buyer utility map.
- Create the lean canvas for the proposed-solution.
- Case Study: DT at Mahindra and Mahindra Group
- Case Study: In-Flight Meal Experience at L Airlines
- Task : Evaluating the Idea: SWOT Analysis, 2*2 Matrix, Dot Voting,

NABC Method

Week 9: Creating the Prototype
- Importance of prototyping stage.
- Types of prototypes.
- Stages of prototyping and the uniqueness of each stage.
- Case Study: DT at Godrej
- Case Study: Making Sydney's King Cross Crime Free
- Task : Any Prototyping Method, POC, 3D Model

Week 10: Testing
- Testing Phases
- Need of testing phases
- Tools for testing phase
- Techniques used in testing the prototypes.
- Case Study: DT at Paytm
- Case Study: Employment Pass Service at Singapore
- Task : Tools for   Testing Phase- Create a Template for Testing (Testing sheet, Feedback Capture Grid, A/B Testing)

Week 11: Execution
- Creating a Pitch
- Business Model Canvas and Lean Canvas
- Task : Business Model Canvas (BMC)

Week 12: Assessment, Showcase and Publication/Patenting
- Presentation: Teams present their projects to faculty, industry professionals, and peers
- Demonstration: Showcase prototypes and explain the design process
- Publication/Patenting: selecting appropriate journals for publication
- patent application process, including patent searches, drafting patent claims, and filing procedures

Text Books:		
	1.	**Design Thinking: A Comprehensive Textbook** by Shalini Rahul Tiwari, Rohit Rajendra Swarup, Wiley, 2024
	2.	**Design Thinking: A Beginners perspective**, E Balagurusamy, Bindu Vijaykumar, Mc Graw Hill, 2024
References:		
	1.	**Design Thinking in the Classroom**, David Lee, Ulysses Press, Korea, 2018

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2430277: NETWORK ANALYSIS AND SIMULATION LABORATORY

B.TECH II Year I SEM   L T P C
                                                                                      0 0 2 1

Prerequisites: Electrical Circuits, Linear Algebra and Calculus

COURSE OBJECTIVE:

1. Time varying characteristics of series and parallel circuits using MATLAB

2. Transfer function of electrical circuits using MATLAB

3. Relations between electrical quantities in complex electrical networks using MATLAB

4. The generation of three phase waveforms using MATLAB

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

1. Draw the locus diagrams of electrical networks

2. Make use of two port network parameters for enumerating the symmetry, reciprocity, internal voltages and currents in the various electrical circuits

3. Develop the various types of active filters and understand their characteristics

4. Examine the transfer function for studying transient response of RL, RC and RLC circuits

5. Determine various alternating quantities of three phase signals generated in MATLAB

COURSE CONTENT:

1. Locus Diagrams of RL and RC Series Circuits

2. Time response of first order RC / RL network for periodic non – sinusoidal inputs – Time constant

3. Two port network parameters – Z – Y parameters, Analytical verification

4. Two port network parameters – A, B, C, D & Hybrid parameters, Analytical verification

5. Determination of Two port network parameters -Hybrid parameters

6. Frequency domain analysis of Low-pass filter

7. Frequency domain analysis of Band-pass filter

8. Simulate Transient Response of Series RL, RC and RLC Circuits

9. Simulate Transient Response Of Parallel RL , RC And RLC Circuits

10. Simulate Transfer Function of Electrical Circuit

11. Simulate Generation of Three Phase Wave Forms

TEXT BOOKS:

1. Van Valkenburg M.E, ―Network Analysis‖, Prentice Hall of India, 3 rd Edition, 2000.

2. Ravish R Singh, ―Network Analysis and Synthesis‖, McGrawHill, 2 nd Edition, 2019.

REFERENCE BOOKS:

1. A Chakrabari, "Circuit Theory", Dhanpat Rai Publications, 6th edition, 2006.

2. William Hayt, Jack E Kemmerly S.M. Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 7th edition, 2010.

3. K S Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1st edition, 2013

2430278: DC MACHINES LABORATORY

B.TECH II Year I SEM   L T P C
                                                                            0 0 2 1

Prerequisites Electrical Machines - 1

COURSE OBJECTIVES:

1. To expose the students to the operation of D.C Generator.

2. To expose the students to the operation of D.C Motor.

3. To examine the self-excitation in DC Generators.

4. To understand the generation of D.C. voltages by using different type of generators and study their performance.

5. It also enables the students to understand the working principles of D.C. motors and their load characteristics, starting and methods of speed control.

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

1. Be able to systematically obtain the equations that characterize the performance of an electric Motor as well as Generator.

2. Acknowledge the principles of operation and the main features of electric machines and their applications.

3. Acquire skills in using electrical measuring devices

4. Know the basic operation of DC machines and to know the testing method of DC machines

5. Applications of DC machines through the characteristics.

List of experiments / demonstrations:

PART A: The following experiments are required to be conducted compulsory experiments:

1. Magnetization characteristics of DC shunt generator (Determination of critical field resistance and critical speed)

2. Load test on DC shunt generator (Determination of characteristics)

3. Load test on DC series generator (Determination of characteristics)

4. Load test on DC compound generator (Determination of characteristics.

5. Hopkinson's test on DC shunt machines (Predetermination of efficiency)

6. Fields test on DC series machines (Determination of efficiency)

7. Swinburne's test and speed control of DC shunt motor (Predetermination of efficiencies)

8. Brake test on DC compound motor (Determination of performance curves)

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

9. Brake test on DC shunt motor (Determination of performance curves)

10. Retardation test on DC shunt motor (Determination of losses at rated speed)

11. Separation of losses in DC shunt motor.

TEXT BOOKS

1. A.E.Fritgerald, C.Kingsley & S.Umans "Electric Machinary", Mc Graw-Hill Companies, 5thEdition.
2. P.S.Bhimbra "Electric Machines " Khanna Publications

REFERENCE BOOKS

1. Clayton & Hancock , "Performance & Design of DC Machines", B.P.B.Publications
2. S.K.Bhattacharya "Electrical Machines" Tata Mc Graw-Hill Publishers
3. I.J.Nagrath & D.P.Kothari "Electric Machines" Tata Mc Graw-Hill Publishers , 3rd Edition
4. S. Kamakshiah "Electromechanics" Hi-Tech Publishers
5. J.B.Gupta, " Theory & Performance of Electrical Machines" S.K.Kataria

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MLRS
EMPOWERING THROUGH INNOVATIONS

2430575: DATA STRUCTURES LAB USING PYTHON

B.TECH II Year I SEM   L T P C
0 0 2 1

Prerequisites: "Essentials of Problem Solving".

Course Objectives:

The students will try to learn

- Various linear and non-linear data structures.
- How to perform operations on data structures.
- Priority Queues and Heaps
- Various searching and sorting techniques.
- Different hashing techniques

Course Outcomes: After Completion of the Course, Students should be able to

CO1:Develop solutions by using different types of linked lists

CO2:Solve problems using stack and queue

CO3:Learn different types of trees and their applications

CO4:Implement and know the application of algorithms for searching and sorting.

CO5:Design Programs using Hashing

List of Experiments

1. Write a program that uses functions to perform the following operations on singly linked list.: i) Creation ii) Insertion iii) Deletion iv) Traversal

2. Write a program that uses functions to perform the following operations on doubly linked list.: i) Creation ii) Insertion iii) Deletion

3. Write a program that uses functions to perform the following operations on circular linked list: i) Creation ii) Insertion iii) Deletion

4. Write a program that implement stack operations using i) Arrays ii) Pointers

5. Write a c program to implement infix to postfix conversion using stack.

6. Write a c program to implement postfix evaluation.

7. Write a program that implement Queue operations using i) Arrays ii) Pointers

8. Write a program to implement the tree traversal methods using both recursive and non-recursive.

9. Write a program to implement tree operations on i) AVL Trees ii) B Trees iii) Heap

10. Write a program that implements the following sorting methods to sort a given list of integers in ascending order i) Bubble sort ii) Selection sort iii) Insertion sort

11. Write a program that implements the following sorting methods to sort a given list of integers in ascending order i) Merge sort ii) Quick sort iii) Heap Sort

12. Write a program that use both recursive and non-recursive functions to perform the following searching

operations for a Key value in a given list of integers: i) Linear search ii) Binary search

13. Write a program to implement hashing**.**

CASE STUDY-1 Balanced Brackets

A bracket is considered to be any one of the following characters: (,), {, }, [, or].

Two brackets are considered to be a *matched pair* if the an opening bracket (i.e., (, [, or {) occurs to the left of a closing bracket (i.e.,),], or }) *of the exact same type*. There are three types of matched pairs of brackets: [], {}, and ().

A matching pair of brackets is *not balanced* if the set of brackets it encloses are not matched. For example, {[(])} is not balanced because the contents in between { and } are not balanced. The pair of square brackets encloses a single, unbalanced opening bracket, (, and the pair of parentheses encloses a single, unbalanced closing square bracket,].

By this logic, we say a sequence of brackets is *balanced* if the following conditions are met:

- It contains no unmatched brackets.

- The subset of brackets enclosed within the confines of a matched pair of brackets is also a matched pair of brackets.

Given strings of brackets, determine whether each sequence of brackets is balanced. If a string is balanced, return YES. Otherwise, return NO.

CASE STUDY-2 Minimum Average Waiting Time

Mr. Raju owns a pizza restaurant and he manages it in his own way. While in a normal restaurant, a customer is served by following the first-come, first-served rule, Raju simply minimizes the average waiting time of his customers. So he gets to decide who is served first, regardless of how sooner or later a person comes.

Different kinds of pizzas take different amounts of time to cook. Also, once he starts cooking a pizza, he cannot cook another pizza until the first pizza is completely cooked. Let's say we have three customers who come at time t=0, t=1, & t=2 respectively, and the time needed to cook their pizzas is 3, 9, & 6 respectively. If Raju applies first-come, first-served rule, then the waiting time of three customers is 3, 11, & 16 respectively. The average waiting time in this case is (3 + 11 + 16) / 3 = 10. This is not an optimized solution. After serving the first customer at time t=3, Raju can choose to serve the third customer. In that case, the waiting time will be 3, 7, & 17 respectively. Hence the average waiting time is (3 + 7 + 17) / 3 = 9.

Help Raju achieve the minimum average waiting time. For the sake of simplicity, just find the integer part of the minimum average waiting time.

Note:

- The waiting time is calculated as the difference between the time a customer orders pizza (the time at which they enter the shop) and the time she is served.

- Cook does not know about the future orders.

TEXTBOOKS:

1. Fundamentals of data structures in C, E.Horowitz, S.Sahni and Susan Anderson Freed, 2nd Edition, Universities Press.

2. Data structures using C, A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/pearson education.

REFERENCES:

1. Data structures: A Pseudocode Approach with C, R.F.Gilberg And B.A.Forouzan, 2nd Edition, Cengage Learning.

2. Introduction to data structures in C, Ashok Kamthane, 1st Edition, PEARSON

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EMPOWERING THROUGH INNOVATIONS
MLRS

2430455: PCB FABRICATION

B.TECH II Year I SEM   L T P C
                                                                           0 0 2 1

Prerequisites: Basic electronics concepts
Course Objectives:

The students will try to
- Understand components and materials simulation tools
- Understand PCB simulation tools
- Develop PCB Designing Flow Chart and description
- Single layer and multilayer PCB
- Design of different circuits on PCB

Course Outcomes:

After successful completion of the course, students shall be able to
- Understand components and their categories
- Understand PCB simulation tools
- Develop PCB Designing Flow Chart and description
- Single layer and multilayer PCB
- Design of different circuits on PCB

List of Experiments:

1. Introduction to circuit creation and simulation using Easy EDA.
2. Introduction to Layout Tool, and creating Layout board using Proteus
3. Design a RLC circuit & verify it for different values of R, L &C.
4. Design a half wave rectifier using Proteus.
5. Design a full wave center tapped rectifier using Proteus.
6. Design a clipper circuit using Proteus.
7. Design a clamper circuit using Proteus.
8. Convert the power supply circuit into PCB.
9. Introduction of the following materials required for the fabrication of simple PCB's
   - PCB copper clad boards
   - Ferrous chloride' for PCB etching
   - Hand drills with needles
   - Glossy photo paper (130gsm) hands on schematic implantation on board
   - Hand grouses, Soldering iron, Soldering paste flux, Soldering lead
   - Iron boxes as a heat sink
10. Development of different mini projects on PCB.

||-||

B.TECH II Year II SEM   L T P C

                                                        3 1 0 4

Prerequisites: Mathematics courses of first year of study**.**

Course Objectives:

1. Various numerical methods to find roots of polynomial and transcendental equations and to estimate the value for the given data using interpolation.
2. Evaluation of derivatives and integrals using numerical techniques and solving ordinary differential equations of first order using numerical techniques.
3. The Fourier series Expansion and Fourier Transforms.
4. Differentiation and integration of complex valued functions.
5. Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem and Expansion of complex functions using Taylor's and Laurent's series.

Course Outcomes: After Completion of the Course, Students should be able to

1. Find the root of a given Algebraic and transcendental equations and estimate the value for given data using interpolation.
2. Apply the concept of numerical integration and differentiation to the real-world problems and find the solutions for a given first order ODE's.
3. Understand the various Properties of curves through Fourier series expansions.
4. The complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems.
5. Apply the Cauchy's residue theorem for various integrals and write the Taylor's and Laurent's series expansions for complex function.

UNIT-I: Numerical Methods-I

Solution of polynomial and transcendental equations: Bisection method, Iteration Method, Newton-Raphson method and Regula-Falsi method. Methods for solving linear systems of equations: Gauss Jacobi method and Gauss Seidel Iteration Method. Interpolation using Newton's forward and backward difference formulae. Central difference interpolation: Gauss's forward and backward formulae, Lagrange's method of interpolation.

UNIT-II: Numerical Methods-II

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

Ordinary differential equations: Taylor's series, Picard's method, Euler and modified Euler's methods, Runge-Kutta method of fourth order for first order ODE

UNIT-III: Fourier series and Bessel's functions

Fourier series - Dirichlet's Conditions - Half-range Fourier series.

Bessel function- properties of Bessel function, Recurrence relations, Generating function and Orthogonality of Bessel function (without proof) Trigonometric expansions involving Bessel function.

UNIT-IV: Complex Differentiation

Limit, Continuity and Differentiation of Complex functions. Cauchy-Riemann equations (with out proof), Milne Thomson methods, analytic functions, harmonic functions, finding harmonic conjugate, Conformal mappings, Mobius transformations.

UNIT-V: Complex Integration

Line integrals, Cauchy's theorem, Cauchy's Integral formula, zeros of analytic functions, singularities, Taylor's series, Laurent's series, Residues, Cauchy Residue theorem and their properties (all theorems without proof).

TEXTBOOKS:
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI, 4th Edition, 2005.

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

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2440225: **AC MACHINES**

B.TECH II Year II SEM   L T P C

3 0 0 3

Prerequisites: BEE & DC MACHINES
Course Objectives:

1. To provide a clear understanding of the principles and magnetic field concepts involved in AC machines.
2. To familiarize students with the construction, operation, and performance of induction motors and induction generators.
3. To introduce the testing, starting, and speed control methods of induction motors.
4. To impart knowledge on the construction, operation, and voltage regulation of alternators and synchronous motors.
5. To develop understanding of the working principles and applications of single-phase induction motors.

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

1. Describe magnetic fields and basic principles of electrical machines.
2. Explain construction, operation, and equivalent circuits of induction and synchronous machines.
3. Apply testing methods and mathematical relations to solve numerical problems.
4. Analyze performance characteristics of machines under different operating conditions.
5. Evaluate suitable machines and control methods for practical applications.

UNIT–I: THREE PHASE INDUCTION MACHINES

Magnetic fields: Constant magnetic field, pulsating magnetic field, rotating magnetic field; Three phase induction motors: Construction, types of induction motors, slip and frequency of rotor currents, rotor MMF and production of torque, equivalent circuit, power across air gap, torque and power output, torque slip characteristics, generating and braking modes, maximum (breakdown) torque, starting torque, maximum power output. Equivalent circuit; Induction generator: Operation, approximate equivalent circuit, doubly fed induction generator, numerical problems.

UNIT –II: TESTING AND SPEED CONTROL OF INDUCTION MOTORS

Testing: Brake test, no load and blocked rotor test, determination of induction motor parameters from circle diagram, numerical problems. Starting methods of Slip ring and squirrel cage induction motors; Speed control of induction motors, numerical problems.

UNIT –III: ALTERNATORS

Synchronous generators: Introduction, principle of operation, types, constructional features, integral slot and fractional slot windings, distributed and concentrated windings, winding factors, basic synchronous machine model, circuit model of a synchronous machine, armature reaction, phasor diagrams.
Voltage regulation: Determination of synchronous impedance, short circuit ratio, leakage reactance, calculation of regulation by synchronous impedance method, MMF, ZPF and ASA methods; Parallel operation, synchronization of alternators; Slip test, numerical problems.

UNIT –IV: SYNCHRONOUS MOTORS

Synchronous motors: Principle of operation, phasor diagrams, power developed, synchronous motor with different excitations, effect of increased load with constant excitation, effect of change in excitation with constant load, effect of excitation on armature current and power factor, construction of "V" and inverted "V" curves, power and excitation circles, starting methods, and analysis, synchronous condenser

UNIT –V: SINGLE-PHASE INDUCTION MOTORS

Single phase induction motors: Principle of operation, two reaction theory, equivalent circuit analysis, split phase motor, construction, principle of operation, capacitor start, capacitor run, capacitor start capacitor run motor,shaded pole motor, torque speed characteristics of single phase induction motors.

TEXTBOOKS:

1. P S Bhimbhra."Electrical Machinery",Khanna Publishers", 7th Edition,2011.

2. I J Nagrath and D P Kothari. " Electrical machines" McGraw Hill Education,3rd Edition, 2004.

3. J B Guptha A. "Theory and performance of Electrical machines" S.K.Kataria & Sons Publishers, 14th Edition, 2009

REFERENCES:

1. M G Say and E O Taylor," Direct Current Machines", Longman Higher Education, 1st Edition, 1985.

2. A E Fitzgerald, Charles Kingsley, JR., Stephen D Umans" Electric Machinery", McGraw Hill, 6th Edition, 1985.

3. M V Deshpande," Electrical Machines", PHI Learning Private Limited, 3 rd Edition, 2011.

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2440461: **DIGITAL ELECTRONICS**

B.TECH II Year II SEM   L T P C
                                                                                                3 0 0 3

Prerequisites: Nil
Course Objectives:

The students will try to learn

- About Number System and Boolean Algebra and Switching Functions
- Concepts of Design of Combinational Circuits
- Various types of Registers and Counters
- Concepts of ADC and DAC converters
- Filters & IC-555 and its applications

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

- Understand of Number System and Boolean algebra
- Design of Combinational Circuits
- Acquire the knowledge about the Data converters
- Design the Sequential Logic Circuits
- Know the Filters & IC-555 Applications

MODULE – I: Number Systems and Boolean Algebra: **10L**

Number Systems: Number systems, complements of numbers, Codes: weighted and non-weighted codes and its properties, Parity check code and Hamming code.

Boolean Algebra: Basic theorems and properties, Switching functions- Canonical and standard form, Algebraic simplification, Digital logic gates, EX-OR gates, Universal gates, Multilevel NAND/NOR realizations, and their applications.

MODULE – II: Minimization of Boolean Functions and Combinational Logic Circuits   **10L**

Minimization of Boolean Functions: Karnaugh Map method - Up to five variables, Don't Care map entries, Quine Mc Cluskey, and Tabular method.

Combinational Logic Circuits: Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free relations.

MODULE – III: Sequential Circuits Fundamentals and Registers and Counters   **10L**

Sequential Circuits Fundamentals: Basic architectural distinctions between combinational and sequential circuits, SR latch, flip flops: SR, JK, JK master slave, D and T type flip flops, Excitation table of all flip flops, Timing and triggering consideration, Conversion from one type of flip-flop to another.

Registers and Counters: Shift registers – left, right and bidirectional Shift Registers, Applications of shift registers - Design and operation of ring and twisted ring counter, Operation of asynchronous and synchronous counters.

MODULE – IV: Sequential Machines   **9L**

Sequential Machines: Finite state machines, Synthesis of synchronous sequential circuits- Serial binary adder, Sequence detector, Parity-bit generator, Synchronous modulo N –counters. Finite state machine-Capabilities and limitations, Mealy and Moore models.

MODULE – V: Programmable Logic Devices, **Threshold Logic**   **9L**

Programmable Logic Devices, **Threshold Logic**: Basic PLD's-ROM, PROM, PLA, and PLD

Realization of Switching functions using PLD's. Capabilities and limitations of threshold gate, Synthesis of threshold functions, Multigate Synthesis.

TEXT BOOKS:
1. Zvi Kohavi & Niraj K. Jha, "Switching and finite automata theory," 3rd edition, Cambridge, 2010.
2. M.Morris Mano, Michael D. Ciletti, "Digital design," Pearson, 4th edition, 2012.

REFERENCES:
1. R. P. Jain, "Modern digital electronics," Tata McGraw-Hill, 3rd edition, 2007.
2. Charles H. Roth, "Fundamentals of logic design," Cengage Learning, 5th edition, 2004.
3. A. Anand Kumar, "Switching theory and logic design," PHI, 2nd edition, 2013.

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EMPOWERING THROUGH INNOVATION
MLRS

2440226: **CONTROL SYSTEMS**

B.TECH II Year II SEM   L T P C
                                                                                                          2 1 0 3

Prerequisites: Matrix Algebra, Calculus, Differential Equations, Complex Variables

Course Objectives:

1. To understand open-loop and closed-loop control systems and their mathematical models using block diagrams and signal flow graphs.
2. To analyze system representations using transfer function and state space techniques.
3. To evaluate system performance using time and frequency domain analysis.
4. To examine different stability concepts and apply Routh-Hurwitz and Root Locus techniques.
5. To design controllers and compensators to improve steady state and transient performance.

Course Outcomes: After Completion of the Course, Students should be able to

1. Distinguish between open-loop and closed-loop systems and develop mathematical models in time and S-domain.
2. Evaluate transfer functions using block diagram reduction and Mason's Gain Formula.
3. Analyze stability using Routh-Hurwitz criterion, Root Locus and Nyquist techniques.
4. Analyze time response and frequency response characteristics of control systems.
5. Design controllers and compensators to meet steady state and transient specifications.

UNIT – I: Introduction to Control Systems
Classification of control systems, Effects of feedback, Mathematical modeling of electrical systems, Transfer function, Block diagram reduction techniques, Signal flow graph, Mason's gain formula.

UNIT – II: Time Domain Analysis
Standard test signals, Transient response of first and second order systems for unit step input, Time domain specifications: rise time, peak time, peak overshoot and settling time, Steady state errors and error constants, Effects of P, PI, PD and PID controllers.

UNIT – III: Stability Analysis and Root Locus Technique
Concept of stability, Routh-Hurwitz criterion, Absolute and relative stability, Root locus concept, Construction rules, Angle and magnitude conditions, Effect of adding poles and zeros, Determination of gain (K).

UNIT – IV: Frequency Response Analysis and Control System Design
Frequency domain specifications, Bode plot, Stability analysis using Bode plots, Polar plot, Nyquist plot, Gain margin and Phase margin, Introduction to Lag, Lead and Lag-Lead compensators.

UNIT – V: State Space Analysis

Concept of state variables and state model, Derivation of state models, Transfer function from state model, State transition matrix, Solution of state equation, Controllability and Observability.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. K. Ogata, 'Modern Control Engineering', Prentice Hall, 1991.
2. M. Gopal, 'Control Systems: Principles and Design', McGraw Hill Education, 1997.

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2440227: **ELECTRICAL POWER GENERATION**

B.TECH II Year II SEM   L T P C
                                                                                                          2 0 0 2

Prerequisites: Electrical Engineering, Electromagnetic Fields

Course Objectives: The students will try to learn
1. Understand the fundamental concepts of power generation and gain knowledge about different renewable and non-renewable energy sources.

2. Study the detailed theory on the construction and working principles of thermal, hydro-electric, nuclear, and gas power plants.

3. Analyze the key aspects of solar and wind power energy systems and their environmental impacts in the present-day scenario to achieve clean energy.

4. Examine the various factors affecting the cost of generation and explore different tariff methods for electrical energy consumption to attain optimum utilization of generated electrical energy.

5. Develop the ability to apply knowledge of electrical power generation in minor and major projects, and to pursue research work in the future.

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

1. Explain the operating principles of thermal and nuclear power stations to evaluate their significance.
2. Describe the working principles and layout of hydroelectric power stations (HPS) along with their multipurpose utilities.
3. Summarize the process of solar power generation using the photovoltaic effect and its applications.
4. Explain the working principles of wind energy systems (WES), the different types of turbines, and the importance of WES.
5. Analyze the impact of tariffs on the cost of power generation.

UNIT – I: CONVENTIONAL POWER GENERATION SYSTEMS

Thermal Power Stations: Evaluation of power systems, present day scenario, Line diagram of thermal power station (TPS) showing paths of coal, steam, water, air, ash and flue gasses;

Brief description of TPS components: Economizers, boilers, super heaters, turbines, condensers, chimney and cooling towers.

Gas power stations: Principle of operation and components (Block diagram approach only).

UNIT– II: HYDROELECTRIC POWER STATIONS

Hydroelectric Power Stations: Elements of hydroelectric power station, types, concept of pumped storage plants, estimation of power developed from a given catchment area, heads and efficiencies;

Hydraulic turbines: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine hydraulic design, draft tube theory, functions and efficiency.

UNIT - III: SOLAR ENERGY

Solar radiation: Environmental impact of solar power, physics of the sun, solar constant, extraterrestrial and terrestrial solar radiation, solar concentrators, collectors, thermal applications, design of standalone solar systems, simple problems.

Photovoltaic systems: Photovoltaic effect, semiconducting materials, electrostatic field across the depletion layer, voltage developed, I-V characteristics, module structure and fabrication, output power and efficiency, fill factor, maximum power point tracking (MPPT), solar grid connected inverters, simple problems.

UNIT– IV: WIND ENERGY

Wind energy: Sources and potential, power from wind, Betz criterion, components of wind energy conversion system, types of turbines, horizontal and vertical axis wind turbines, aerodynamics, momentum theory (actuator disk concept), operational characteristics, blade
element theory, types of generating systems for wind energy, permanent magnet generators, DC generators, induction generators, doubly fed induction generators, applications of wind energy, safety and environmental aspects, simple problems.

UNIT– V: Economic Aspects of Power Generation

Terms commonly used in system operation, various factors affecting cost of generations; load curves, connected load, maximum demand, peak load, base load and peak load power plants, load factors, plant capacity factor, plant use factor, demand factors, diversity factor, cost of power plant, tariffs.

TEXTBOOKS:

1. C L Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", New Age International Limited, New Delhi, 3rd Edition, 2005.

2. G D Rai, "Non-Conventional Energy Sources", Khanna Publishers, 1st Edition, 2011.

3. G N Tiwari, M K Ghosal, "Fundamentals of Renewable Energy Sources", Narosa Publications, New Delhi, 1 st Edition, 2007.

4. Chetan Singh Solanki, "Solar Photovoltaics", PHI Publications, 2nd Edition, 2011.

5. M L Soni, P V Gupta, U S Bhatnagar and A Chakraborti, "A text book on Power system engineering", Dhanpat Rai and Co. Pvt. Ltd, 1999.

REFERENCES:

1. J B Gupta, "A Course in Electrical Power", S K Kataria and Sons, New Delhi, 15th Edition, 2013.
2. M V Deshpande, "Elements of Power Station design", Prentice Hall India Learning Private Limited, New Delhi, 1st Edition, 1992.
3. Mukund R Patel, "Wind and Solar Power Systems", CRC Press, 1st Edition, 1999.
4. V K Mehta and Rohit Mehta, "Principle of Power Systems", S Chand & Company, Ltd, New Delhi, 3rd Edition, 2005.

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244EXL2: Prototype/ Model development and Entrepreneurship

B.TECH II Year II SEM

L T P C
0 0 2 1

Prerequisites: • Nil

Week 1
Entrepreneurial Journey
Entrepreneurial Discovery **Week 2**
Ideation and Prototyping
Week 3
Testing and Validation
Commercialization and Disruption as Success Drivers
Week 5
Technological Innovation and Entrepreneurship
Week 6
Technology, Business, and Operations Strategies
Week 7
Raising Finances and Developing Financial Strategy
Week 8
Education and Entrepreneurship
Beyond Founders and Founder-
Families **Week 9**
Beyond Founders and Founder-Families India as
A Start-up Nation
Week 10
National Entrepreneurial Culture
Entrepreneurial Thermodynamics
Human Resources Strategy **Week
11**
Entrepreneurship and Employment
Corporate Governance
Marketing Strategy
Week 12
Start-up Case Studies

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2440279: **AC MACHINES LABORATORY**

B.TECH II Year II SEM   L T P C
                                                              0 0 2 1

Prerequisites: BEE, DC MACHINES

Course Objectives:

1. To train students in conducting fundamental tests on transformers, induction motors, and synchronous machines using standard procedures and equipment.
2. To develop practical skills in analyzing machine performance through experimental data collection, interpretation, and parameter calculation.
3. To provide hands-on experience with different testing methods including O.C., S.C. tests, load tests, regulation tests, and special transformer connections.
4. To enable students to understand and validate theoretical concepts through practical experiments and characteristic curve analysis.
5. To prepare students for industrial applications by teaching safety protocols, technical documentation, and standardized testing procedures.

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

1. Analyze transformer characteristics through O.C., S.C., and Sumpner's tests to evaluate performance parameters
2. Examine three-phase induction motor behavior and determine alternator regulation through experimental testing
3. Investigate synchronous motor characteristics and construct equivalent circuits through V-curve analysis
4. Analyze salient pole machine parameters and measure induction motor performance under load conditions
5. Evaluate transformer core losses and calculate three-phase alternator efficiency using standard procedures

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

1. O.C. & S.C. Tests on Single phase Transformer
2. Sumpner's test on a pair of single-phase transformers
3. No-load & Blocked rotor tests on three phase Induction motor
4. Regulation of a three –phase alternator by synchronous impedance & m.m.f. methods
5. V and Inverted V curves of a three—phase synchronous motor.
6. Equivalent Circuit of a single-phase induction motor
7. Determination of Xd and Xq of a salient pole synchronous machine
8. Load test on three phase Induction Motor
9. Efficiency of a three-phase alternator
10. Parallel operation of Single-phase Transformers

TEXTBOOKS:
1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I.J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010
REFERENCES:
1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, "Electrical Machines", Oxford, 2017.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
4. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

2440280: **CONTROL SYSTEMS LABORATORY**

B.TECH II Year II SEM

L T P C
0 0 2 1

Prerequisites: Control Systems

COURSE OBJECTIVES:

1. To study time and frequency response characteristics.
2. To understand modeling using simulation tools.
3. To analyze stability of control systems.
4. To design controllers and compensators.
5. To study servo motor performance.

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

1. Use simulation tools for system analysis.
2. Model systems using transfer functions.
3. Analyze controller effects.
4. Examine stability using plots.
5. Design and verify control systems.

List of experiments / demonstrations:

PART A: The following experiments are required to be conducted compulsory experiments:

1. Time response of second order system.
2. Characteristics of Synchro's.
3. PLC study and motor speed control.
4. Effect of feedback on DC servo motor.
5. Transfer function of DC motor.
6. Transfer function of DC generator.
7. Temperature controller using PID.
8. Characteristics of AC servo motor.

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

9. Effect of P, PI, PD, PID controller.
10. Lag and Lead compensation.
11. Simulation of controllers.
12. Stability analysis using plots.
13. State space model verification.
14. Design of Lead-Lag compensator.

TEXTBOOKS:

15. I. J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International, 2009.

B. C. Kuo, 'Automatic Control System', Prentice Hall, 1995.

REFERENCE BOOKS:

1. K. Ogata, 'Modern Control Engineering', Prentice Hall, 1991.

M. Gopal, 'Control Systems: Principles and Design', McGraw Hill Education, 1997.

TEXT BOOKS

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

REFERENCE BOOKS

3. K. Ogata, 'Modern Control Engineering', Prentice Hall, 1991.
4. M. Gopal, 'Control Systems: Principles and Design', McGraw Hill Education, 1997.

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2440482: ANALOG & DIGITAL ELECTRONICS LABORATORY

B.TECH II Year II SEM   L T P C
                                                                               0 0 2 1

Prerequisites: Analog Electronics

Course Objectives:

The students will try to learn

- Components such as diodes, BJTs and FETs their switching characteristics, applications
- Various types of basic and feedback amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers
- Number systems in logic circuits
- Basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems
- Simple logical operations using combinational logic circuits and design of sequential logic circuits

Course Outcomes:

After successful completion of the course, students shall be able to

- Design and analyze various rectifiers, small signal amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- Understanding the functioning of OP-AMP, designs OP-AMP based circuits with linear integrated circuits.
- Design and analyze small combinational circuits and to use standard Combinational functions   to build larger m
- Implement small sequential circuits and devices and to use standard sequential Function blocks to build larger more complex circuits

List of Experiments:

Part A: Analog Electronics Lab:

1. PN Junction diode characteristics: Forward and Reverse bias.
2. Full Wave Rectifier with & without filters.
3. Common Emitter amplifier characteristics.
4. Inverting and Non-inverting Amplifiers using Op-Amp.
5. Current Shunt Feedback amplifier.
6. RC Phase shift Oscillator.

Part B: Digital Electronics Lab:

1. Realization of Boolean Expressions using Gates
2. Design and realization logic gates using universal gates
3. Design a 4 – bit Adder / Subtractor
4. Design and realization of an 8 bit parallel load and serial out shift register using flip-flops.
5. Design and realization a Synchronous and Asynchronous counter using flip-flops
6. Design and realization 8x1 using 2x1 mux
7. Design and realization 2-bit comparator

NOTE: Minimum of 12 experiments (6 from Analog electronics Lab and 6 from Digital electronics Lab) are to be completed.

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2430574: DATA VISUALIZATION - POWER BI

B.TECH II Year II SEM
L T P C
0 0 2 1

Prerequisites: **There are no prerequisites to take this course.**

Course Objectives:

1. Importing of data from various sources.
2. PowerBI Concepts
3. Mapping of Visual Layouts and Graphical Properties.
4. How to create Dashboard using PowerBI
5. Developing of charts using PowerBI.

Course Outcomes: After Completion of the Course, Students should be able to

1. Understand How to import data into Power BI
2. Understand Power BI concepts of Dimensions and Measures.
3. Develop Programs and understand how to map Visual Layouts and Graphical Properties.
4. Create a Dashboard that links multiple visualizations.

5. Use graphical user interfaces to create Frames for providing solutions to real world problems.

List of Experiments:

1. Understanding Data, What is data, where to find data, Foundations for building Data Visualizations, Creating Your First visualization?
2. Getting started with Power BI Software using Data file formats, connecting your Data to Power BI , creating basic charts(line, bar charts, Tree maps),Using the Show me panel.
3. Power BI Calculations, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields.
4. Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view.
5. Editing and Formatting Axes, Manipulating Data in Power BI data, Pivoting Power BI data.
6. Structuring your data, Sorting and filtering Power BI data, Pivoting Power BI data.
7. Advanced Visualization Tools: Using Filters, Using the Detail panel, using the Size panels, customizing filters, Using and Customizing tooltips, Formatting your data
8. Creating Dashboards, adding interactivity to your Dashboard, Distributing & Publishing your Visualization.
9. Power BI file types, publishing to Power BI Online, Sharing your visualizations, printing, and Exporting.
10. Creating custom charts, cyclical data and circular area charts, Dual Axis charts.

REFERENCE BOOKS:

1. Microsoft Power BI cookbook, Brett Powell, 2nd edition.
2. R Programming for Data Science by Roger D. Peng (References)
3. The Art of R Programming by Norman Matloff Cengage Learning India.

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2450228: **POWER ELECTRONICS**

B.TECH III Year I SEM

L T P C
3 1 0 4

Prerequisites: Analog Electronics, Digital Electronics

Course Objectives:

1. To understand the characteristics and operation of power switching devices and SCR circuits used in power electronics.
2. To study the principles and performance of single-phase and three-phase AC–DC converters with various load conditions.
3. To explain the operation and performance of AC voltage controllers and cyclo-converters with various load conditions.
4. To illustrate the operation and performance of basic DC–DC converters under steady-state conditions.
5. To describe the operation and control techniques of single-phase and three-phase inverters.

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

1. Analyze the characteristics, commutation methods and firing circuits of power switching devices.
2. Evaluate the performance of single-phase and three-phase AC–DC converters with different loads and source conditions.
3. Apply the principles of AC–AC converters and cyclo-converters with R and RL loads.
4. Design DC–DC converters such as buck, boost, and buck–boost for desired output voltage regulation.
5. Demonstrate the operation and control methods of single-phase and three-phase inverters with different loads.

UNIT–I: POWER SWITCHING DEVICES

Thyristors – Silicon Controlled Rectifiers (SCR's) – BJT - Power MOSFET - Power IGBT and their characteristics and other thyristors - Basic theory of operation of SCR - Static characteristics – Turn-on methods of SCR - Dynamic characteristics of SCR – Turn on and Turn off times - Line Commutation and Forced Commutation circuits. Two transistor analogy of SCR - R, RC, UJT firing circuits - Series and parallel connections of SCRs – Snubber circuit details – Numerical problems.

UNIT–II: AC-DC CONVERTERS

Phase control technique - Single phase Line commutated converters - Single phase Half controlled converters – Single Phase Full Controlled Midpoint and Bridge connections with R, RL loads and RLE load - Derivation of average load voltage and current - Expressions of load voltage and current - Numerical problems.

Three phase converters - Three pulse converters and bridge connections with R, RL load voltage and current with R and RL loads - Effect of Source inductance – Effect of source inductance –Dual Converters Wave forms - Numerical Problems.

UNIT –III: AC-AC CONVERTERS

AC voltage controllers – Single phase two SCR's in anti-parallel with R and RL loads, modes of operation of Triac – Triac with R and RL loads – Derivation of RMS load voltage, current and power factor-waveforms, Numerical problems - Single phase cycloconverters-bridge type and midpoint (principle of operation only).

UNIT –IV: DC-DC CONVERTERS

Choppers – Time ratio control and Current limit control strategies – Step down choppers-Derivation of load voltage and currents with R, RL and RLE loads- Step up Chopper – load voltage expression. Morgan's chopper – Jones chopper - (Principle of operation only) waveforms - Problems.

UNIT –V: DC-AC CONVERTERS

Inverters – Single phase inverter – Basic series inverter, parallel Capacitor inverter, bridge inverter-Waveforms. Simple bridge inverters, Voltage control techniques for inverters- Pulse width modulation techniques – Numerical problems.

TEXTBOOKS:
1. M.Gopal, "Modern Control System Theory", New Age International, 1984.
2. Ogata. K, "Modern Control Engineering", Prentice Hall, 1997

REFERENCES:
1. Vedam Subramanyam, "Power Electronics", New Age International (P) Limited, Publishers, 2nd Edition 2008.
2. M.S.JamilAsghar, "Power Electronics", PHI Private Limited, 2004.
3. P.C.Sen, "Power Electronics", Tata Mc Graw-Hill Publishing, 2001.

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2450428: **MICROPROCESSORS AND MICROCONTROLLERS**

B.TECH III Year I SEM
L T P C
3 0 0 3

Prerequisites: Knowledge on digital systems and designs.

Course Objectives:

The students will try to learn
- Architecture of microprocessors
- Programming of microprocessors
- Architecture of microcontrollers, interfacing devices, and interfacing techniques
- Basic concepts of ARM architecture
- Fundamentals of STM32 architecture

Course Outcomes:

After successful completion of the course, students shall be able to
- Understand the Architecture and Operation of the 8086 Microprocessor
- Develop Assembly Language Programs for Processor Applications
- Design and Implement Practical Applications Using Microprocessors
- Apply ARM Processor Architecture in System Design and Development
- Design and Integrate Embedded Systems for Practical Automation Applications

Module – I Introduction of microprocessors 6L

Introduction of microprocessor, Review, and evolution of advanced microprocessors:8085,8086,8088, 80186/286/386/486/Pentium. Introduction to 8086 Processor**:** features of 8086, Register organization of 8086, Architecture of 8086, signal description of 8086, Memory Segmentation, Physical Memory Organization. Minimum mode and Maximum mode 8086 systems and timings diagram.

Module – II: Instruction Set and Assembly Language Programming of 8086 7L

Instruction formats, addressing modes, Instruction set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations. Interrupts of 8086,

Interrupt Procedure.

Module – III: Introduction to Microcontrollers, Interrupts, and Interfaces 7L

Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes, and Instruction set of 8051.
Interrupts and Interfaces: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Introduction to the various interfacings' chips like 8255, 8251, Interfacings key boards, LCD, Stepper motor, ADC, DAC.

Module – IV: ARM Architecture 6L

ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions, and interrupts interrupt vector table.
ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

Module – V: STM32 microcontroller   **6L**

STM32 fundamentals, types of STM32 microcontroller, advantages and its features and applications, architecture of STM32 microcontroller, GPIO Registers in STM32, Control Registers in STM32.

TEXT BOOKS:
1. A. K. Ray and K.M. Bhurchandani, "Advanced Microprocessors and Peripherals," MHE, 3rd Edition 2017.
2. Kenneth. J. Ayala, "The 8051 Microcontroller," Delmar Cengage Learning, 3rd Edition, 2015.

REFERENCE BOOKS:
1. D. V. Hall, "Microprocessors and Interfacing," MGH, 3rd Edition 2017.
2. K. Uma Rao, Andhe Pallavi, "The 8051 Microcontrollers, Architecture and Programming and Applications," Pearson, 3rd Edition, 2019.
3. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developers guide," Elsevier, 2nd Edition, 2012.

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2450229: ELECTRICAL TRANSMISSION AND DISTRIBUTION

B.TECH III Year I SEM   L T P C
                                                                                                          3 0 0 3

Prerequisites: Electrical power Generation and Network Analysis

Course Objectives:

1. To introduce the fundamental parameters of transmission lines and their effect on power transfer capability.
2. To explain the performance characteristics of short, medium, and long transmission lines using equivalent circuit models and efficiency analysis.
3. To illustrate the mechanical design aspects of transmission lines including insulators, string efficiency, sag and tension calculations.
4. To analyze power system transients, travelling waves and corona effects influencing the performance of transmission lines.
5. To describe the construction, characteristics and applications of underground cables, and voltage drop calculations in DC and AC distributors.

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

1. Calculate the electrical parameters of transmission lines by considering conductor configurations and associated effects.
2. Analyze the voltage regulation and efficiency of short, medium and long transmission lines using suitable models.
3. Determine the sag, tension and string efficiency of overhead lines under mechanical and environmental constraints.
4. Examine the impact of transients, travelling waves and corona on transmission line performance.
5. Evaluate underground cable design and distribution system performance through grading methods and voltage drop assessment.

UNIT–I : TRANSMISSION LINE PARAMETERS

Transmission line parameters: Types of conductors, calculation of resistance for solid conductors, description and effect of resistance on solid conductors, calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR, GMD, symmetrical and asymmetrical conductor configuration with and without transposition, Skin and Proximity effect;

Numerical Problems: 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

Performance of short and medium length transmission lines: Classification of transmission lines, short, medium and long line and their model representations, nominal-T, nominal-Pie and A, B, C, D constants for symmetrical and asymmetrical networks, numerical problems, mathematical solutions to estimate regulation and efficiency of all types of lines, numerical problems.

Performance of long transmission lines: Long transmission line, rigorous solution, evaluation of A, B, C, D constants, representation of long lines, equivalent-T and equivalent Pie network models (numerical problems); Ferranti effect, charging current, effect on regulation of the transmission line, surge impedance and SIL of long lines, wave length and velocity of propagation of waves.

UNIT –III: MECHNAICAL DESIGN OF TRANSMISSION LINES

Over head line insulators: Types of insulators, string efficiency and methods for improvement, numerical problems, voltage distribution, calculation of string efficiency, capacitance grading and static shielding, testing of insulators;

Sag and tension calculations: Sag and tension calculations with equal and unequal heights of towers, effect of wind and ICE on weight of conductor, numerical problems, stringing chart and sag template and its applications.

UNIT–IV: POWER SYSTEM TRANSIENTS AND FACTORS GOVERNING PERFORMANCE OF TRANSMISSION LINES

Power systems transients: Incident reflected and refracted waves, Types of system transients, travelling or propagation of surges, attenuation, distortion, reflection and refraction coefficients, termination of lines with different types of conditions, open circuited line, short circuited line, T-junction, lumped reactive junctions (numerical problems), Bewley's lattice diagrams (for all the cases mentioned with numerical examples);

Corona: description of the phenomenon, factors affecting corona, critical voltages and power loss, radio interference, Electrostatic and electromagnetic interference with communication lines.

UNIT–V: UNDER GROUND CBALES AND DISRIBUTION SYSTEMS

Underground cables: Types of cables, construction, types of insulating materials, calculation of insulation resistance and stress in insulation, numerical problems, capacitance of single and 3core belted cables, numerical problems, grading of cables, capacitance grading, numerical problems, description of inter-sheath grading, HV cables.

Distribution Systems: DC Distribution: Classification of distribution Systems, Voltage Drop Calculations in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal Voltages) and Ring Main Distributor.

AC Distribution: Introduction, ac distribution, single phase,3-phase 4 wire system. Voltage Drop Calculations in ac distributors for the following cases: Power factors referred to receiving end voltage and with respect to respective load voltage.

TEXTBOOKS:

1. CL Wadhwa, "Electric Power Systems", New age publications, New Delhi, 9th Edition, 2007.

2. D.P Kothari and I.J Nagrath, "Power System Engineering", Mc Graw- Hill Education, 2nd Edition, 2007.

3. V.K.Mehta and Rohit Mehta, "Principles of Power System", S.Chand, 3rd revised Edition, 2015.

4. B R Guptha, "Power System Analysis and Design", S.Chand Publishing, 2nd Edition,1998.

REFERENCES:

1. D Das, "Electrical Power Systems", New age international publishers, 2nd Edition, 2006.

2. Turan Gonen, "Electrical Power Distribution System Engineering", CRC Press, 3rd Edition, 2014.

3. V Kamaraju, "Electrical Power Distribution Systems", TMH, Publication, Edition 2009.

4. Singh S N, "Electric Power Generation, Transmission and Distribution", Prentice Hall of India Pvt. Ltd., New Delhi, 2nd Edition, 2002.

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2450235: SPECIAL ELECTRICAL MACHINES
(PROFESSIONAL ELECTIVE- I)

B.TECH III Year I SEM   L T P C
                                                              3 0 0 3

Prerequisites: DC Machines and Transformers & AC Machines
Course Objectives:

1. To understand the principles and operating characteristics of special electrical machines beyond conventional types.
2. To learn the analysis, control and applications of various special electrical machines.
3. To develop proficiency in selecting suitable machines for different industrial and renewable energy applications.
4. To explore the design and performance evaluation of machines like stepper motors, switched reluctance motors and brushless DC motors

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

1. Understand the construction, working principles and characteristics of special electrical machines.
2. Analyze and model different types of special electrical machines for industrial applications.
3. Develop control strategies for operation and drive of special electrical machines.
4. Evaluate the performance and select appropriate machines for applications including renewable energy systems.
5. Gain insights into modern trends and innovations in special electrical machine technologies.

UNIT–I: INTRODUCTION TO SPECIAL ELECTRICAL MACHINES
Introduction to special electrical machines, classification, comparison with conventional machines, applications and advantages. Basic construction and operating principles of stepper motors, switched reluctance motors (SRM) and brushless DC (BLDC) motors.

UNIT –II: STEPPER MOTORS
Types of stepper motors, construction details, operating principles, torque-speed characteristics, driver circuits and control techniques. Applications in precision positioning and robotics.

UNIT –III: SWITCHED RELUCTANCE MOTORS (SRM)
Construction and operating principle of switched reluctance motors, torque production, static and dynamic modeling, performance characteristics, control strategies, and drive circuits.

UNIT –IV: BRUSHLESS DC (BLDC) MOTORS

Construction, principle of operation, back EMF, commutation methods, speed and torque control, drive circuits, and applications in electric vehicles and aerospace.

UNIT –V: MODERN TRENDS AND APPLICATIONS

Innovations in special electrical machines including axial flux machines, permanent magnet synchronous machines, linear motors, and applications in renewable energy, electric traction, and automation.

TEXTBOOKS:

1. R.K. Krishnan, "Electric Motor Drives: Modeling, Analysis and Control", Prentice Hall, 2001.

2. T.J.E. Miller, "Brushless Permanent Magnet and Reluctance Motor Drives", Oxford University Press, 1989.

REFERENCES:

1. J.R. Hendershot and T.J.E. Miller, "Design of Brushless Permanent-Magnet Motors", Magna Physics Publishing, 1994.

2. M. A. Rahman (Ed.), "Switched Reluctance Motor Drives: Modeling, Simulation, Analysis, Design, and Applications", CRC Press, 2015.

3. S. Butterfield, "Stepper Motors: Fundamentals, Applications and Design", CRC Press, 2014.

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2450236: WIND AND SOLAR ENERGY SYSTEMS
(PROFESSIONAL ELECTIVE- I)

B.TECH III Year I SEM   L T P C
                                                                                                              3 0 0 3

Prerequisites: None
Course Objectives:

1. To provide fundamental knowledge of wind power physics, characteristics and control aspects influencing wind energy conversion.
2. To introduce various wind generator technologies, power electronic interfaces and control strategies for efficient wind energy conversion.
3. To provide an understanding of solar radiation principles, photovoltaic technologies, characteristics and converter control with MPPT techniques.
4. To provide knowledge of technical requirements, operational challenges and power quality issues in integrating wind and solar systems with the grid.
5. To introduce solar thermal power generation technologies and their working principles with elementary performance analysis.

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

1. Explain the physical principles and statistical characteristics of wind power.
2. Differentiate wind generator topologies and their converter control methods.
3. Analyze solar resource availability and photovoltaic system performance with converter control.
4. Evaluate grid integration issues of wind and solar PV systems under different operating conditions.
5. Describe different solar thermal technologies and their operating principles.

UNIT–I: PHYSICS OF WIND POWER
History of wind power, Indian and Global statistics, Wind physics, stall and pitch control, Wind speed statistics-probability distributions, and Wind power-cumulative distribution functions.

UNIT –II: WIND GENERATOR TOPOLOGIES
Review of modern wind turbine technologies, Fixed and Variable speed wind turbine, Permanent Magnet Synchronous Generators, Power electronics converters. Generator configurations, Converter Control.

UNIT –III: THE SOLAR RESOURCE
Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability. Solar Photovoltaic: Technologies-Amorphous, mono-crystalline, polycrystalline.

UNIT -III: STATIC RELAYS

Static Relays verses Electromagnetic Relays Amplitude and Phase comparators, Duality between AC and PC, Static amplitude comparator, integrating and instantaneous comparators., static phase comparators, coincidence type of phase comparator, static over current relays, static directional relay, static differential relay, static differential relay, static distance relays, Multi input comparators, concept of quadrilateral and elliptical relay characteristics.

UNIT –IV: NETWORK INTEGRATION ISSUES

Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

UNIT –V: SOLAR THERMAL POWER GENERATION

Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.

TEXTBOOKS:
1. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.
2. G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.

REFERENCES:
1. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 1984.
2. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" John Wiley and Sons Ltd., 2006.
3. G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications, 2004.
4. J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons, 1991.

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MLRS
EMPOWERING THROUGH INNOVATIONS

2450460: PRINCIPLES OF SIGNALS AND SYSTEMS
(PROFESSIONAL ELECTIVE- I)

B.TECH III Year I SEM

L T P C
3 0 0 3

Prerequisites: Basics of Mathematics

Course Objectives:

The students will try to learn
- The knowledge of signals and systems
- The behavior of signals in time and frequency domain
- The characteristics of LTI systems
- Concepts of Signals and Systems and its analysis using different Transform techniques
- The relation between two same signals and two different signals

Course Outcomes:

After successful completion of the course, students shall be able to
- Differentiate various signal functions
- Inspect any arbitrary signal in time domain and frequency domain
- Understand the characteristics of linear time invariant systems
- Analyze the signals with different Transform techniques
- Design a system for sampling a signal

Module – I: Signal Analysis   9L

Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, mean square error, Closed or complete set of orthogonal functions, elementary signals, singularity functions, Classification of signals, Operations on signals: time shifting, time scaling, time reversal, differentiation, and integration.

Module – II: Fourier Series and Fourier Transforms   10L

Fourier Series: Representation of Fourier series, Dirichlet's conditions, Trigonometric Fourier series, exponential Fourier series and its properties.

Fourier Transforms: Fourier Transform of arbitrary signals, standard signals, and periodic signals, Properties of Fourier Transform, Introduction to Hilbert Transform and properties.

Module – III: Signal Transmission through Linear Systems   9L

Classification of systems, Impulse response, Linear time invariant (LTI) system, Transfer function of a LTI system, Filter characteristics of linear system, Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF, and BPF characteristics, Relationship between bandwidth and rise time, Convolution of signals, Concept of convolution in time domain and frequency domain, Graphical representation of convolution

Module – IV: Laplace Transforms and Z–Transforms   10L Laplace

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

Z–Transforms: Concept of Z-Transform of a discrete sequence, Distinction between Laplace, Fourier and Z Transforms, Region of convergence, Properties of ROC, Properties of Z-Transforms, Inverse Z-Transform.

Module – V: Sampling Theorem and Correlation   **10L**

Sampling Theorem: Graphical and analytical proof for band limited signals, Impulse sampling, Natural and flat top sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing.

Correlation: Cross correlation and auto correlation of functions, Properties of correlation functions, Energy density spectrum, Parsevals theorem, Power density spectrum, Relation between autocorrelation function and energy/power spectral density function, Relation between convolution and correlation.

TEXT BOOKS:

1. B.P. Lathi, "Signals, Systems & Communications," BSP, 2nd Edition 2001.
2. A. Anand Kumar, "Signals and Systems," PHI, 3rd Edition, 2013.

REFERENCES:

1. Simon Haykin and Van Veen, "Signals and Systems," John Wiley 2nd Edition, 2007.
2. A.V. Oppenheim, A.S. Willsky and S.H. Nawabi, "Signals and Systems," Pearson India 2nd Edition, 1996
3. Michel J. Robert, "Fundamentals of Signals and Systems," MGH International, 2nd Edition, 2008.

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2450237: PROGRAMMABLE LOGIC CONTROLLERS
(PROFESSIONAL ELECTIVE- I)

B.TECH III Year I SEM

L T P C
3 0 0 3

Prerequisites: Electrical Engineering, Digital Electronics
Course Objectives:

1. To construct a simple PLC ladder diagram by applying knowledge of I/O modules.
2. To develop ladder diagrams using input instructions, outputs, contacts and coils to represent digital logic gate operations.
3. To demonstrate the use of PLC.
4. To implement PLC data-handling functions.
5. To develop a PLC program that applies analog signal processing.

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

1. Analyze the interfacing of PLC I/O modules with field devices
2. Interpret flow charts for process control systems like drill press and spray process operation.
3. Analyze PLC functional blocks such as timers, counters, comparison
4. Optimize data handling and robotic process control in industrial automation systems.
5. Justify the most effective configuration for stable and accurate process control.

UNIT– I: PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT–II: PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-Press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT–III: PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT–IV: Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT–V: Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing, analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions.

TEXTBOOKS:
1. John W Webb and Ronald A Reiss, "Programmable Logic Controllers – Principle and Applications", PHI, 5 th Edition 2003.
2. JR Hackworth and F. D Hackworth Jr, "Programmable Logic Controllers – Programming Method and Applications" by - Pearson, 2004

REFERENCES:
1. W. Bolton, "Programmable Logic Controllers", Newnes, 4 th Edition 2000.

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EMPOWERING THROUGH INNOVATIONS
MLRS

2450210: ESTIMATION & COSTING OF ELECTRICAL SYSTEMS
(OPEN ELECTIVE-I)

B.TECH III Year I SEM

L T P C
3 0 0 3

Prerequisites: None

Course Objectives:

1. To Gain knowledge of wiring systems, cables, switches, fuses and domestic installations.
2. To Learn estimation of power loads, pumps and earthing practices.
3. To Develop skills in estimating overhead lines, substations and underground cables.
4. To Acquire design considerations for electrical installations as per rules and standards.
5. To Build capability to estimate and plan electrical installations for residential, commercial and small industries.

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

UNIT– I: WIRING SYSTEMS AND ESTIMATION OF LIGHTING / DOMESTIC LOAD
Types of house wiring systems - Various types of cables - Various types of Main switches - Different types of fuses, fuse carriers, isolators and MCBs - Types of service mains - Estimation of domestic lighting installation and their specifications - quantity of materials required - Estimation and selection of interior wiring system suitable to a given building.

UNIT –II: ESTIMATION OF POWER LOADS, IRRIGATION PUMPS AND EARTHING SYSTEM
Wiring layouts - Estimate for a small work shop - Estimate for the installation of Irrigation pump up to 10 HP - Estimate for the installation of submersible pump - estimation of materials required in electrical Earthing.

UNIT –III: ESTIMATION OF OH LINES AND DISTRIBUTION SUBSTATIONS
Distribution lines of 11kV and 400VoIt OH lines – estimation - Cross arms – clamps - insulators - Estimation of quantity of materials required for structures - pole mounted substation and plinth mounted substation - Indian Electricity act 2003.
OVERHEAD AND UNDERGROUND TRANSMISSION AND DISTRIBUTION LINES
Introduction, supports for transmission lines, Distribution lines - Materials used, Underground cables, Mechanical Design of over head lines, Design of underground cables.

UNIT –IV: DESIGN CONSIDERATIONS OF ELECTRICAL INSTALLATIONS
Electric Supply System, Three phase four wire distribution system, Protection of Electric Installation against over load, short circuit and Earth fault, Earthing, General requirements of electrical installations, testing of installations, Indian Electricity rules, Neutral and Earth wire, Types of loads, Systems of wiring, Service connections Service Mains, Sub-Circuits, Location of Outlets, Location of Control Switches, Location of Main Board and Distribution board, Guidelines for Installation of Fittings, Load Assessment, Permissible voltage drops and sizes of wires, estimating and costing of Electric installations.

UNIT –V: ELECTRICAL INSTALLATION FOR DIFFERENT TYPES OF BUILDINGS AND SMALL INDUSTRIES

Electrical installationsfor residential buildings - estimating and costing of material, Electrical installations for commercial buildings, Electrical installations for small industries.

TEXTBOOKS:
1. K. B. Raina, S. K. Bhattacharya, "Electrical Design Estimating and Costing", New Age International Publisher, 2010.
2. Er.V.K.Jain, Er.Amitabh Bajaj, "Design of Electrical Installations", University Science Press.

REFERENCES:
1. Gupta J.B., Katson, Ludhiana, "Electrical Installation, estimating and costing", S.K. Kataria and Sons, 2013.

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EMPOWERING THROUGH INNOVATIONS
MLRS

2450475: MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

B.TECH III Year I SEM   L T P C
                                                                                   0 0 2 1

Prerequisites: Basic concepts of microprocessors and microcontrollers.

Course Objectives:

The students will try to learn

- Arithmetic and string operations on 16 bit and 32-bit data
- Sorting and searching operation an array for 8086
- Bit level logical operations, rotate, shift, swap and branch operations
- The interfacing of 8051
- Communication between 8051 to interfacing devices

Course Outcomes:

After successful completion of the course, students shall be able to

- Implement and Debug Complex Operations in Assembly Language for 8086 Microprocessor
- Apply Interfacing Techniques for External Devices with the 8051 Microcontroller
- Analyze and Optimize the Performance of Triangular Wave Generation Using 8051 and DAC.
- Write a program for establishing Serial Communication Using 8051
- Create Sequence Generation Using Serial Communication in 8051

List of Experiments:

The following experiments are performed using 8086 Processor Kits and/or Assembler

1. Write a program for 16-bit arithmetic operations for 8086 (using Various Addressing Modes).
2. Write a program for sorting an array for 8086.
3. Write a program for searching for a number or character in a string for 8086.
4. Write a program for string manipulations for 8086.
5. Write a program for rotate, shift and branch instruction for 8086.
6. Parallel communication between two microprocessors.

The following experiments are performed using 8051 Processor Kits and interfacing Kits

7. Write a program using arithmetic, logical and bit manipulation instructions of 8051.
8. Perform interfacing ADC to 8051.
9. Generate Triangular wave through DAC interfacing with 8051.
10. Program and verify interrupt handling in 8051.
11. Perform Time delay Generation Using Timers of 8051.
12. Perform interfacing to 8086 and programming to control stepper motor.
    13. Perform interfacing matrix/keyboard to 8051.

NOTE: Minimum of 12 experiments to be conducted.

2450281: POWER ELECTRONICS LABORATORY

B.TECH III Year I SEM
L T P C
0 0 2 1

Prerequisites: : Power Electronics

Course Objectives:

1. To study the characteristics of power semiconductor devices and the operation of SCR
2. gate firing circuits.
3. To examine the operation of single-phase AC voltage controllers and controlled rectifiers with different loads.
4. To illustrate the operation of forced commutation circuits and single-phase cycloconverters with various load conditions.
5. To demonstrate the operation of single-phase inverters with different configurations and loads.
6. To illustrate the operation of single-phase converters, AC voltage controllers and cycloconverters using simulation.

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

1. Analyze the characteristics of SCR, MOSFET, IGBT and also the working of SCR firing circuits.
2. Apply the principles of AC voltage controllers and bridge converters with R and RL loads.
3. Evaluate the performance of forced commutation techniques and cycloconverters with R and RL loads.
4. Demonstrate the performance of single-phase inverters with R and RL loads.
5. Study the performance of single-phase converters, AC voltage controllers and cycloconverters with R, RL and RLE loads by using simulation tools.

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

1. Study of Characteristics of SCR, MOSFET & IGBT,
2. Gate firing circuits for SCR's
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase half controlled & fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
6. Single Phase Cycloconverter with R and RL loads
7. Single Phase series & parallel inverter with R and RL loads
8. Single Phase Bridge inverter with R and RL loads

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

1. DC Jones chopper with R and RL Loads
2. Three Phase half-controlled bridge converter with R-load
3. Single Phase dual converter with RL loads
4. (a)Simulation of single-phase Half wave converter using R and RL loads
   (b)Simulation of single-phase full converter using R, RL and RLE loads
     (c)Simulation of single-phase Semi converter using R, RL and RLE loads
5. (a)Simulation of Single-phase AC voltage controller using R and RL loads
   (b)Simulation of Single phase Cyclo-converter with R and RL-loads
6. Simulation of Buck chopper
7. Study of PWM techniques

Proposed open ended experiments:

1. Simulation of closed loop control of chopper fed dc motor

TEXTBOOKS:

1. M.D. Singh & K.B. Kanchandhani, "Power Electronics", Tata Mc Graw Hill Publishing Company, 1998.
2. M.H. Rashid, "Power Electronics: Circuits, Devices and Applications", Prentice Hall of India, 2nd edition, 1998
3. V.R. Murthy, "Power Electronics", Oxford University Press, 1st Edition 2005.

REFERENCES:

1. Vedam Subramanyam, "Power Electronics", New Age International (P) Limited, Publishers, 2nd Edition 2008.
2. M.S. Jamil Asghar, "Power Electronics", PHI Private Limited, 2004.
3. P.C.Sen, "Power Electronics", Tata Mc Graw-Hill Publishing, 2001.

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MLRS

2450592: OOPS Through JAVA LAB

B.TECH III Year I SEM   L T P C

           0 0 2 1

Co requisites: A Course on Problem solving Using C and C++

Course Objectives: The students will try to learn
     1. Concepts and features of object oriented programming
     2. Java Standard API library such as util, io, applets, GUI based controls.
     3. Exception handling mechanism, multithreading, packages and interfaces.
     4. How to use Collection framework
     5. Internet programming using applets and AWT.

Course Outcomes: After Completion of the Course, Students should be able to

1. Solve real world problems using OOP concepts.
2. Understand the use of abstract classes and Interfaces
3. Develop multithreaded applications with synchronization.
4. Solve problems using java collection framework
5. Develop applications using Event Handling

List of Experiments:
1. a) Use Eclipse or Net bean platform and acquaint with the various menus. Create a test project, add a test class, and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables,methods, and classes. Try debug step by

step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.
b) Write a java program that prints all real solutions to the quadratic equation $ax^2+bx+c=0$.
Read in a, b, c and use the quadratic formula.
c) Write a java program to implement Fibonacci series.
d) Write a java program to print prime numbers between 1 to 100.

2. a) Write a java program to implement method overloading and constructors overloading.
b) Write a java program to implement method overriding.

3. a) Write a java program to check whether a given string is palindrome.
b)Write a Java program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.

4. a) Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num 2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.
b).Write a java program to create user defined exception class and test this class.

5. a) Write a Java program to list all the files in a directory including the files present in all its subdirectories.
b) Write a java program that displays the number of characters, lines and words in a text file.

6. a) Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even,
second thread computes the square of the number and prints.
If the value is odd, the third thread will print the value of cube of the number.
b) Write a Java program that correctly implements the producer – consumer problem using the concept of inter thread communication.

7. Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab (\t). It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables).

8. Write Java Programs to perform following:
a. To count occurrence of each character in a string.
b. To remove duplicate words from a string.
c. To print all permutations of a string.

9. Write programs to implement following using Collection Framework:
a. to add, retrieve & remove element from ArrayList
b. to Sort & reverse the LinkedList elements
c. to sort ArrayList using Comparable and Comparator

10. Write programs to implement following using Collection Framework:
a. to copy elements from HashSet to Array
b. to remove duplicate key from hashtable

c. to iterate TreeMap

11. Suppose that a table named Table.txt is stored in a text file.
The first line in the file is the header, and the remaining lines correspond to rows in the table.
The elements are separated by commas. Write a java program to display the table using Labels in Grid Layout.

12. a) Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes).
b) Write a java program to demonstrate the key event handlers.
  REFERENCE BOOKS:

1. Java for Programmers, P. J. Deitel and H. M. Deitel, 10th Edition Pearson education.
2. Thinking in Java, Bruce Eckel, Pearson Education.
3. Java Programming, D. S. Malik and P. S. Nair, Cengage Learning.
4. Core Java, Volume 1, 9th edition, Cay S. Horstmann and G
Cornell.

III-II

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2460230: POWER ELECTRONIC APPLICATIONS TO RENEWABLE ENERGY SYSTEMS

B.TECH III Year II SEM

L T P C
3 0 0 3

Prerequisites: Power Electronics

Course Objectives:

1. To illustrate the characteristics, modeling and control techniques of solar cells, PV modules and associated power conditioning systems.
2. To describe inverter topologies, configurations and sizing methods for different solar PV systems.
3. To explain the characteristics, components and converter topologies of wind energy conversion systems.
4. To illustrate the modeling of wind turbine generators and control of power converters in wind energy conversion systems.
5. To describe the architecture, operation and grid integration aspects of hybrid solar–wind energy systems.

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

1. Analyze the performance of solar cells, PV arrays and MPPT-based power conditioning systems.
2. Evaluate inverter models, battery sizing and PV system configurations for grid-connected and stand-alone applications.
3. Elucidate wind turbine generators, their grid integration and power converter topologies.
4. Design control strategies for power converters used with different wind turbine generators.
5. Compare different hybrid energy systems and their grid integration challenges.

UNIT–I: SOLAR CELL

Solar cell characteristics and their measurement, PV Module, PV array, Partial shading of a solar cell and a module, the diode, Power conditioning unit, Implementation of Perturb and Observe Method, Incremental Conductance Method, Battery charger/discharge controller.

UNIT–II: INVERTERS

Centralized Inverters, String Inverters, Multi-string Inverters, Module Integrated Inverter/Micro-inverters, Inverter Topology, Model of Inverter, Sizing Batteries and Inverters for a Solar PV Types of PV Systems: Grid-Connected Solar PV System, Stand-Alone Solar PV System.

UNIT –III: WIND ENERGY CONVERSION SYSTEMS

Introduction to wind: Characteristics, Wind Turbine, Fixed and Variable-Speed Wind Turbines, Components of WECS, Description of Components, Types of Wind Turbine Generators, Economics of Wind Energy Conversion Systems, Linking Wind Turbines onto the Grid, Power

Converter Topologies for Wind Turbine Generators.

UNIT –IV: MODELING OF GENERATORS
Modeling of Permanent Magnet Synchronous Generators, Doubly Fed Induction Generators, Squirrel cage Induction Generators wind turbine, Control of Power converters for WECS.

UNIT –V:HYBRID ENERGY SYSTEMS
Hybrid Energy Systems, Need for Hybrid Energy Systems ,Range and types of Hybrid systems, Hybrid Solar PV/Wind Energy System, Architecture of Solar-Wind Hybrid System and Grid connected issues.

TEXTBOOKS:
1. S.N. Bhadra, D.Kastha & S.Banerjee, "Wind Electrical Systems", Oxford University Press, 2005.
2. S.N. Bhadra, D.Kastha & S. Banerjee, "Wind Electrical Systems", Oxford University Press, 2009.
3. Rashid.M.H, "Power Electronics Hand book", Academic Press, 2001.

REFERENCES:

1. Rai.G.D, "Non-conventional energy sources", Khanna Publishers, 1993.

2. Rai.G.D, "Solar energy utilization", Khanna Publishes,1993.

3. Gray, L. Johnson, "Wind energy system", Prentice Hall of India, 1995.

4. B.H.Khan, "Non-conventional Energy sources", McGraw-hill, 2ndEdition, 2009

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2460231: POWER SYSTEMS ANALYSIS

B.TECH III Year II SEM   L T P C
                                                                                                             3 1 0 4

Prerequisites: Electrical power Generation & Electrical transmission & Distribution
Course Objectives:

1. To introduce per unit representation, graph theory and network matrix formulation for power system modeling.
2. To develop numerical methods for solving power flow problems in power systems.
3. To provide knowledge of fault analysis in power systems using symmetrical components and network theorems.
4. To explain stability concepts of synchronous machines and methods for improving steady state stability.
5. To analyze transient stability of power systems using equal area criterion under various disturbances.

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

1. Formulate Y_{bus} and Z_{bus} matrices using per-unit representation and graph theory.
2. Analyze power flow in power systems using Gauss-Seidel, Newton-Raphson and decoupled methods.
3. Compute fault currents and construct sequence networks for symmetrical and unsymmetrical faults.
4. Evaluate steady-state stability limits and suggest methods for enhancing system stability.
5. Elucidate transient stability using equal area criterion and recommend methods for improve stability.

UNIT–I: PER UNIT SYSTEM REPRESENTATION AND NETWORK MATRICES

Per unit system representation: Single line diagram, reactance diagram of a three-phase power system. Network Matrices: Definitions of graph theory, bus incidence matrix, Y_{bus} formation by direct inspection and singular transformation methods; Formation of Z_{bus}: Partial network, algorithm for the modification of Z_{bus} matrix for addition of element from a new bus to reference bus, addition of element from a new bus to an old bus, addition of element between an old bus to reference bus and addition of element between two old busses, modification of Z_{bus} for the changes in network without mutual impedance, numerical Problems.

UNIT –II: LOAD FLOW STUDIES

Load flow studies: Necessity of power flow studies, classification of power system buses, derivation of static load flow equation, Load flow solution using Gauss Seidel method with and without PV buses, acceleration factor, algorithm and flowchart; Determination of bus voltages, injected active and reactive powers (Sample one iteration only) and finding line flows / losses for the given bus voltages; Load flow solution using Newton Raphson method in rectangular and polar coordinates form with or without PV busses, derivation of Jacobian elements, algorithm and flow chart; decoupled and fast decoupled methods, numerical problems.

UNIT –III: SHORT CIRCUIT ANALYSIS

Symmetrical fault analysis: short circuit (SC) in an unloaded synchronous machine, SC Fault current computation using reactance diagram and thevenin's theorem, SC MVA interrupting capacity of Circuit breaker, current limiting reactors, numerical problems.

Symmetrical components: Symmetrical component transformation, Sequence impedances and networks for transmission line, synchronous machine and transformer, sequence diagram of a power system, Unsymmetrical fault analysis: LG, LL, LLG faults with and without fault impedance, numerical problems.

UNIT –IV: STEADY STATE STABILITY ANALYSIS

Elementary concepts of steady state, dynamic and transient stabilities, dynamics of synchronous machine, swing equation, power flow under steady state, power angle equation and power angle curve, transfer reactance, steady state power limit, determination of steady state stability, synchronizing power coefficient and methods to improve steady state Stability, numerical problems.

UNIT –V: TRANSIENT STABILITY ANALYSIS

Transient stability by equal area criterion, application of equal area criterion to sudden changes in mechanical input, sudden loss of one of the parallel lines, sudden short circuit on one of the parallel lines, critical clearing angle and time, methods to improve transient stability, application of auto reclosing circuit breakers, numerical problems.

TEXTBOOKS:

1. I J Nagrath & D P Kothari, "Modern Power system Analysis", Tata Mc Graw-Hill Publishing Company, 2ndEdition.

2. M APai, "Computer Techniques in Power System Analysis", TMH Publications.

3. K Umarao, "Computer Techniques and Models in Power Systems", IK International Pvt. Ltd.

REFERENCES:

1. Stagg, El Abiad, "Computer Methods In Power System". Tata Mc Graw-Hill.1968.

2. B.R.Gupta, "Power System Analysis and Design", S.CHAND publications

3. Grainger and Stevenson, "Power System Analysis", Tata Mc Graw-Hill, 3rdEdition, 2011.

4. J Duncan Glover and MS Sarma, "Power System Analysis and Design", Thompson, 3rdEdition 2006.

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2460232: ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

B.TECH III Year II SEM   L T P C
                                                                                          3 0 0 3

Prerequisites: Electrical Engineering, Network analysis and Analog Electronics.

Course Objectives:

1. To understand the working principles, construction and errors of conventional electrical measuring instruments.
2. To learn the principle, operation and applications of DC/AC potentiometers and instrument transformers.
3. To study the methods and instruments used for measuring electrical power and energy in single-phase and three-phase systems.
4. To understand the principles and applications of DC and AC bridges for measurement of electrical parameters.
5. To familiarize with electrical transducers, their characteristics and modern digital measuring devices.

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

1. Analyze the operation of analog measuring instruments and error compensation methods.
2. Measure resistance, current and voltage using potentiometers, including ratio and phase angle errors of CTs and PTs..
3. Evaluate active, reactive power and energy in balanced and unbalanced systems.
4. Apply suitable bridge circuits for accurate measurement of resistance, inductance and capacitance.
5. Select appropriate transducers for physical quantity measurement and digital instruments for metering.

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

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

UNIT–III: MEASUREMENT OF POWER & ENERGY

Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamometer wattmeter's, expression for deflecting and control torques–Extension of range of wattmeter using instrument transformers – Measurement of active and reactive powers in balanced and unbalanced systems. Single phase induction type energy meter — driving and braking torques – errors and compensations. Three phase energy meter, maximum demand meters and net metering.

UNIT–IV: DC & AC BRIDGES

Method of measuring low, medium and high resistance – sensitivity of Wheat-stone's bridge –Carey Foster's bridge, Kelvin's double bridge for measuring low resistance, measurement of high resistance loss of charge method. Measurement of inductance - Maxwell's bridge, Hay's bridge, Anderson's bridge - Owen's bridge. Measurement of capacitance and loss angle – Desauty's Bridge - Wien's bridge — Schering Bridge.

UNIT-V: TRANSDUCERS

Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Piezoelectric transducers, photovoltaic, photoconductive cells, and photo diodes. Introduction to Smart and Digital Metering: Digital Multi-meter, True RMS meters, Clamp-on meters, Digital Energy meter, cathode ray oscilloscope, Digital Storage Oscilloscope.

TEXTBOOKS:
1. A.K.Sawhney, "Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai & Co. Publications, 2005.
2. E.W.Golding and F. C.Widdis, "Electrical Measurements and measuring Instruments", fifth Edition, Wheeler Publishing, 2011.

REFERENCES:
1. G.K.Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition, 2016
2. S.C.Bhargava,"Electrical Measuring Instruments and Measurements", BS Publications, 2012.
3. R.K.Rajput, "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd., 2007.
4. Buckingham and Price,"Electrical Measurements", Prentice – Hall,1988.
5. Reissland, M.U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition2010.

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EMPOWERING THROUGH INNOVATIONS
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2460238: POWER SEMICONDUCTOR DRIVES

B.TECH III Year II SEM
L T P C
3 0 0 3

Prerequisites: Power Electronics, AC Machines.

Course Objectives:

1. To introduce the drive system and operating modes of drive and its characteristics.
2. To understand Speed – Torque characteristics of different motor drives by various power converter topologies.
3. To appreciate the motoring and braking operations of drive.
4. To differentiate DC and AC drives.
5. To understand the principles of separate control and self-control of synchronous motors.

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

1. Identify the drawbacks of speed control of motor by conventional methods.
2. Differentiate phase controlled and chopper-controlled DC drives speed-torque characteristics merits and demerits.
3. Understand AC motor drive speed–torque characteristics using different control strategies its merits and demerits.
4. Describe slip power recovery schemes.
5. Evaluate the performance of synchronous motor drives fed by different converters.

UNIT –I: CONTROL OF DC MOTORS

Introduction to Thyristor controlled Drives, Single Phase semi and fully controlled converters connected to D.C separately excited and D.C series motors – continuous current operation – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque Characteristics- Problems on Converter fed D.C motors. Three phase semi and fully controlled converters connected to D.C separately excited and D.C series motors – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque characteristics – Problems.

UNIT –II: FOUR QUADRANT OPERATION OF DC DRIVES

Introduction to Four quadrant operation – Motoring operations, Electric Braking – Plugging, Dynamic, and Regenerative Braking operations. Four quadrant operation of D.C motors by single phase and three phase dual converters – Closed loop operation of DC motor (Block Diagram Only) Control of DC Motors by Choppers: Single quadrant, two quadrant and four quadrant chopper fed dc separately excited and series motors – Continuous current operation – Output voltage and current wave forms – Speed and torque expressions – speed-torque characteristics – Problems on Chopper fed D.C Motors – Closed Loop operation (Block Diagram Only).

UNIT –III: CONTROL OF INDUCTION MOTOR

Variable voltage characteristics-Control of Induction Motor by Ac Voltage Controllers – Waveforms – speed torque characteristics. Variable frequency characteristics-Variable frequency control of induction motor by Voltage source and current source inverter and cycloconverter-PWM control – Comparison of VSI and CSI operations – Speed torque characteristics – numerical problems on induction motor drives – Closed loop operation of induction motor drives (Block Diagram Only).

UNIT –IV: ROTOR SIDE CONTROL OF INDUCTION MOTOR

Static rotor resistance control – Slip power recovery – Static Scherbius drive – Static Kramer Drive – their performance and speed torque characteristics – advantages, applications, problems.

UNIT –V: CONTROL OF SYNCHRONOUS MOTORS

Separate control and self-control of synchronous motors – Operation of self-controlled synchronous motors by VSI, CSI and cyclo converters. Load commutated CSI fed Synchronous Motor – Operation – Waveforms – speed torque characteristics – Applications – Advantages and Numerical Problems – Closed Loop control operation of synchronous motor drives (Block Diagram Only), variable frequency control - Cyclo converter, PWM based VSI & CSI.

TEXTBOOKS:
1. G K Dubey, "Fundamentals of Electric Drives", CRC Press, 2002.

2. Vedam Subramanyam, "Thyristor Control of Electric drives", Tata McGraw Hill Publications, 1987.

REFERENCES:
1. S K Pillai, "A First course on Electrical Drives", New Age International (P) Ltd. 2nd Edition. 1989

2. P. C. Sen, "Thyristor DC Drives", Wiley-Blackwell, 1981

3. B. K. Bose, "Modern Power Electronics", and AC Drives, Pearson 2015.

4. R. Krishnan, "Electric motor drives - modeling, Analysis and control", Prentice Hall PTR, 2001.

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2460239: IOT APPLICATIONS IN ELECTRICAL ENGINEERING

B.TECH III Year II SEM   L T P C
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Prerequisites: Digital Electronics

Course Objectives:

1. To introduce the fundamental principles, classification and working mechanisms of various sensors used for measuring temperature, humidity, pressure, force and related physical parameters.
2. To provide knowledge on the principles and applications of occupancy, motion, position, displacement, velocity, flow and acoustic sensors.
3. To introduce the concepts of MEMS design, mechanics, actuation methods, fabrication processes and applications in sensors and actuators.
4. To provide an understanding of IoT technologies, applications and standards for smart grid systems at generation, transmission, distribution and consumer levels.
5. To introduce the concept, vision, architecture and applications of the Internet of Energy (IoE) as an extension of the smart grid.

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

1. Analyze the operating principles and applications of different sensors (temperature, humidity, pressure, and force) for engineering applications**.**
2. Evaluate different occupancy, motion, position, displacement, velocity, flow and acoustic sensors.
3. Design MEMS-based sensors and actuators for various applications.
4. Apply IoT concepts in smart grid monitoring and control.
5. Interpret the architecture of the Internet of Energy and its applications.

UNIT–I: Sensors: Definitions, Terminology, Classification, Temperature sensors, Thermoresistive, Resistance, temperature detectors, Silicon resistive thermistors, Semiconductor, Piezoelectric, Humidity and moisture sensors. Capacitive, Electrical conductivity, Thermal conductivity, time domain reflectometer, Pressure and Force sensors: Piezoresistive, Capacitive, force, strain and tactile sensors, Strain gauge, Piezoelectric.

UNIT–II: Occupancy and Motion detectors: Capacitive occupancy, Inductive and magnetic, potentiometric -Position, displacement and level sensors, Potentiometric, Capacitive, Inductive, magnetic velocity and acceleration sensors, Capacitive, Piezoresistive, piezoelectric cables, Flow sensors, Electromagnetic, Acoustic sensors -Resistive microphones, Piezoelectric, Photo resistors.

UNIT –III: MEMS: Basic concepts of MEMS design, Beam/diaphragm mechanics, electrostatic actuation and fabrication, Process design of MEMS based sensors and actuators, Touch sensor, Pressure sensor, RF MEMS switches, Electric and Magnetic field sensors.

UNIT–IV: IoT for Smart grid: Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home.

UNIT–V: Internet of Energy: Concept of Internet of Energy, Evaluation of IoE concept, Vision and motivation of IoE, Architecture, Energy routines, information sensing and processing issues, Energy internet as smart grid**.**

TEXTBOOKS:
1. Jon S. Wilson, "Sensor Technology Hand book", Newnes Publisher, 2004
2. Tai Ran Hsu, "MEMS and Microsystems: Design and manufacture", 1st Edition, McGraw hill Education, 2017
3. Ersan Kabalci and Yasin Kabalci, "From Smart grid to Internet of Energy", 1st Edition, Academic Press, 2019

REFERENCES:
1. Raj Kumar Buyya and Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", Kindle Edition, Morgan Kaufmann Publisher, 2016
2. Yen Kheng Tan and Mark Wong, "Energy Harvesting Systems for IoT Applications": Generation, Storage and Power Management, 1st Edition, CRC Press, 2019
3. RMD Sundaram Shriram, K. Vasudevan and Abhishek S. Nagarajan, "Internet of Things",Wiley, 2019

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2460240: HVDC TRANSMISSION

B.TECH III Year II SEM
L T P C
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Prerequisites: **Electrical Transmission and Distribution, Power Electronics**

Course Objectives:

1. To impart fundamental knowledge on the necessity, economic considerations and modern trends of HVDC transmission systems, along with the comparison between AC and DC transmission.
2. To understand converter configurations and control principles of HVDC systems, including firing angle, current, extinction angle, and reactive power management using SVCs and other methods.
3. To analyze power flow in combined AC/DC systems by modeling DC links, converters and controllers and to apply different methods of AC–DC load flow solutions.
4. To study faults and protection schemes in HVDC converters and transmission systems, including overcurrent, overvoltage, surge arresters, smoothing reactors and DC circuit breakers.
5. To examine harmonics in HVDC systems by studying their generation, calculation, adverse effects and the design of AC filters such as single-tuned and high-pass filters for harmonic mitigation.

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

1. Explain the basic concepts, economics and modern trends of HVDC systems.
2. Analyze HVDC converters, their characteristics and control strategies.
3. Model AC/DC power flow incorporating converter and DC link equations.
4. Evaluate converter faults, protection methods, and system impacts.
5. Design harmonic filters for HVDC systems to mitigate adverse effects.

UNIT–I: BASIC CONCEPTS

Necessity of HVDC systems, Economics and Terminal equipment of HVDC transmission systems, Types of HVDC Links, Apparatus required for HVDC Systems, Comparison of AC and DC Transmission, Application of DC Transmission System, Planning and Modern trendsin D.C. Transmission. Analysis of HVDC Converters: Choice of Converter Configuration, Analysis of Graetz circuit, Characteristics of 6 Pulse and 12 Pulse converters, Cases of two 3 phase converters in Y/Y mode – their performance.

UNIT –II: CONVERTER AND HVDC SYSTEM CONTROL

Principle of DC Link Control, Converters Control Characteristics, firing angle control, Current and extinction angle control, Effect of source inductance on the system, Starting and stopping of DC link, Power Control. Reactive Power Control In HVDC: Introduction, Reactive Power Requirements in steady state, sources of reactive power- Static VAR Compensators, Reactive power control during transients.

UNIT –III: POWER FLOW ANALYSIS IN AC/DC SYSTEMS

Modelling of DC Links, DC Network, DC Converter, Controller Equations, Solution of DC load flow, P.U. System for DC quantities, solution of AC-DC Power Flow-Simultaneous Method-Sequential method.

UNIT E-IV: CONVERTER FAULTS AND PROTECTION

Converter faults, protection against over current and over voltage in converter station, surge arresters, smoothing reactors, DC breakers, Audible noise, space charge field, corona effects on DC lines, Radio interference.

UNIT –V: HARMONICS

Generation of Harmonics, Characteristics harmonics, calculation of AC Harmonics, Non-Characteristics harmonics, adverse effects of harmonics, Calculation of voltage and Current harmonics, Effect of Pulse number on harmonics Filters: Types of AC filters, Design of Single tuned filters –Design of High pass filters.

TEXTBOOKS:

1. E.W.Kimbark, "Direct Current Transmission", John Wiley and Sons, volume1, 1971.
2. K.R.Padiyar, "HVDC Power Transmission Systems: Technology and system Interactions", New Age International (P) Limited, and Publishers, 1990.
3. SK Kamakshaiah, V Kamaraju, "HVDC Transmission", TMH Publishers, 2011
4. S.Rao, "EHVAC and HVDC Transmission Engineering and Practice", Khanna publications,   3rd Edition 1999.

REFERENCES:

1. Jos Arrillaga, "HVDC Transmission, The institution of electrical engineers", IEE power& energy series 29, 2nd edition 1998.
2. E. Uhlmann, "Power Transmission by Direct Current", B.S. Publications, 2009

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2460241: RENEWABLE ENERGY SYSTEMS

B.TECH III Year II SEM   L T P C
                                                                                                          3 0 0 3

Prerequisites: **Electrical Power Generation, Electrical Transmission and Distribution**
Course Objectives:

1. To provide fundamental knowledge on renewable energy sources, distributed generation and modern power system management strategies including economic analysis and electronic control.
2. To introduce the need, types, and working principles of non-conventional energy sources with emphasis on fuel cells.
3. To impart knowledge on tidal energy conversion principles, plant components, power generation methods and prospects of tidal energy in India.
4. To explain the principles, technologies, and applications of ocean and geothermal energy systems.
5. To introduce biomass conversion technologies, processes, and applications with emphasis on biogas and gas.

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

1. Analyze renewable energy economics, generation costs, and management options for efficient power system operation.
2. Explain the principles, types, and applications of fuel cells and non-conventional energy sources.
3. Explain the components, operation and prospects of tidal power generation.
4. Evaluate ocean and geothermal energy technologies for practical applications.
5. Classify biomass conversion technologies and biogas plant types.

UNIT-I: INTRODUCTION
Renewable Sources of Energy-Grid-Supplied Electricity-Distributed Generation-Renewable Energy Economics-Calculation of Electricity Generation Costs –Demand side Management Options –Supply side Management Options-Modern Electronic Controls of Power Systems.

UNIT-II: FUEL CELLS
Need for Non-Conventional energy sources, Types of Non-Conventional energy sources, fuel cells, Principle of operation with special reference to H_2O_2 cell, classification and block diagram of fuel cell systems, Ion exchange membrane cell, Molten carbonate cells, solid oxide electrolyte cells, regenerative system, regenerative fuel cell, advantages and disadvantages of fuel cells, Polarization, conversion efficiency and applications of fuel cells.

UNIT-III: TIDAL ENERGY

Introduction to tidal power. Components of tidal power plants, Double basin arrangement. Power generation. Advantages and limitations of tidal power generation Prospects of tidal energy in India.

UNIT-IV: OCEAN ENERGY

Ocean Thermal Electric Conversion (OTEC) methods, principles of tidal power generation, Advantages and limitations of tidal power generation, Ocean waves, Wave energy conversion devices, Advantages and Disadvantages of wave energy, Geo thermal energy, Types of Geo thermal Energy Systems, Applications of Geo thermal Energy.

UNIT-V: BIOMASS ENERGY

Biomass conversion technologies/ processes, Photosynthetic efficiency, Biogas generation, Selection of site for Biogas plant, Classification of Biogas plants, Details of commonly used Biogas plants in India, Advantages and Disadvantages of Biogas generation, Thermal gasification of biomass, Biomass gasifiers.

TEXTBOOKS:
1. Rai G.D, "Non-Conventional Sources of Energy", Khandala Publishers, New Delhi, 1999.
2. M.M.EI-Wakil, "Power Plant Technology", Mc Graw Hill, 1984.
3. Felix A. Farrent, M. GodoySimoes, "Integration of Alternative Sources of Energy", John Wley& Sons, 2006.
4. Solanki, "Renewable Energy Technologies: Practical Guide for Beginners", PHI Learning Pvt.Ltd., 2008.

REFERENCES:
1. D. Mukherjee, "Fundamentals of Renewable Energy Systems", New Age International publishers, 2007.
2. Remus Teodorescu, Marco Liserre, Pedro Rodriguez, "Grid Converters for Photovoltaic and Wind Power Systems", John Wiley & Sons, 2011.
3. Gilbert M. M asters: "Renewable and Efficient Electric Power Systems", John Wiley & Sons, 2004.

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2460211: UTILIZATION OF ELECTRICAL ENERGY
(Open Elective-II)

B.TECH III Year II SEM

L T P C
3 0 0 3

Prerequisites: **Electrical Engineering, Network analysis and Analog Electronics.**

Course Objectives:

1. To impart knowledge on different electrical heating methods and their industrial applications.
2. To familiarize students with electric welding processes, equipment and electrolysis applications.
3. To provide understanding of lighting principles, sources, measurements and design of lighting schemes.
4. To study the principles of electric traction systems, mechanics of traction movement and performance characteristics.
5. To introduce students to train lighting requirements and methods of obtaining constant polarity supply.

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

1. Explain the principles and applications of resistance, induction and dielectric heating.
2. Study the application of electrolysis in industry along with AC and DC welding techniques.
3. Analyze different lighting systems and suitable lighting schemes for various applications.
4. Evaluate traction systems based on speed-time characteristics, tractive effort and energy consumption.
5. Illustrate train lighting systems including battery-based and 25kV AC supply-based methods.

UNIT-I: Electrical Heating

Advantages and methods of electric heating, resistance heating, induction heating and dielectric heating.

UNIT-II: Electric Welding

Electric welding equipment, resistance welding and arc welding, comparison between AC and DC welding. Electrolysis process: principle of electrolysis, electroplating, metal extraction and metal processing, electromagnetic stirs.

UNIT-III: Illumination

Terminology, Laws of illumination, coefficient of Utilization and depreciation, Polar curves, Photometry, integrating sphere, sources of light, fluorescent lamps, compact fluorescent lamps, LED lamps discharge lamps, mercury vapor lamps, sodium vapor lamps and neon lamps, comparison between tungsten filament lamps and fluorescent tubes. Basic principles of light control, Types and design of lighting scheme, lighting calculations, factory lighting, street lighting and flood lighting.

UNIT-IV: Electric Traction

Systems of electric traction and track electrification- DC system, single phase and 3-phase low frequency and high frequency system, composite system, kando system, comparison between AC and DC systems, problems of single-phase traction with current unbalance and voltage unbalance. The Locomotive – Wheel arrangement and Riding Qualities Mechanics of traction movement, speed – time curves for different services, trapezoidal and quadrilateral speed – time curves, tractive effort, power, specific energy consumption, effect of varying acceleration and braking, retardation, adhesive weight and braking retardation, coefficient of adhesion.

UNIT-V: Systems of Train Lighting

Special requirements of train lighting, methods of obtaining unidirectional polarity constant output- single battery system, Double battery parallel block system, coach wiring, lighting by making use of 25KV AC supply.

TEXTBOOKS:

1. H. Partab, "Modern Electric Traction", Dhanpat Rai & Co, 2007.

2. E. Openshaw Taylor, "Utilization of Electric Energy", Orient Longman, 2010.

REFERENCES:

1. H. Partab, "Art & Science of Utilization of Electric Energy", Dhanpat Rai & Sons, 1998.

2. N.V. Suryanarayana, "Utilisation of Electrical power including Electric drives and ElectricTraction", New Age Publishers, 1997.

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2460213: ELECTRONIC MEASUREMENTS AND INSTRUMENTATION
(Open Elective-II)

B.TECH III Year II SEM

L T P C
3 0 0 3

Prerequisites: : Basics of Electrical and Electronics Engineering

Course Objectives:

1. Functioning of various measuring systems and performance characteristics
2. Principle of operation and working of signal generators, signal analyzers,
3. Characteristics of general and special purpose oscilloscopes
4. Concepts related to various transducers
5. Various measuring techniques for measurement of different physical parameters using different classes of transducers

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

1. Select the signal generators and wave analyzers for different applications
2. Analyze general and special purpose oscilloscopes in measuring various parameters of signals
3. Understand the concepts of various transducers
4. Justify the significance of transducers in measuring various forms of energy
5. Measure physical parameters using various transducers

UNIT – I: Performance Characteristics of Systems, Measuring Instruments

Performance Characteristics of Systems: Static Characteristics: Accuracy, Precision, Resolution, Types of Errors, Dynamic Characteristics: Fidelity, Lag, Repeatability, Reproducibility. Measuring Instruments: D' Arsonval Movement, DC Voltmeters, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters. Meter Protection, Extension of Range.

UNIT – II: Signal Generators, Signal Analyzers

Signal Generators: Oscillators, AF, RF Signal Generators, Standard AF Sine and Square wave Generator, Pulse and Square wave Generators, Function Generators, Video Signal Generators. Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters.

UNIT– III: General Purpose Oscilloscopes, Special Purpose Oscilloscopes

General Purpose Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency Specifications.
Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

UNIT – IV: Transducers, Measurement of Physical Parameters

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Thermistors and Sensistors, Hotwire Anemometers, LVDT, Thermocouples, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers, gyroscopes, accelerometers. Measurement of Physical Parameters: Measurement of Humidity and Moisture, Velocity, Data Acquisition Systems.

UNIT – V: DC and AC Bridges, Bio-Medical Instrumentation

DC and AC Bridges: DC: Wheat Stone Bridge, DC Kelvin Bridge, AC: Maxwell Bridge, Hay's Bridge, Schering Bridge, Resonance Bridge.Bio-Medical Instrumentation: Basics of biomedical signals and electrodes, ECG, EEG and MRI.

TEXTBOOKS:
1. H. S. Kalsi, "Electronic Instrumentation," TMH, 4th Edition, 2019.
2. A.D. Helbincs, W. D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques," PHI, 5th Edition 2003

REFERENCES:

1. K. Lal Kishore, "Electronic Measurements and Instrumentation," Pearson Education, 2010, 2nd Edition, 2012.
2. David A. Bell, "Electronic Instrumentation and Measurements," Oxford Univ. Press, 3rd Edition, 2013.
3. Dr. R. S. Sedha, S. Chand, "Electronic Measurements and Instrumentation," 1st Edition 2013.

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2460477: SMART SENSORS AND SYSTEMS LABORATORY

B.TECH III Year II SEM

L T P C
0 0 2 1

Prerequisites: Computer Networks, Python Programming.

Course Objectives: The students will try to learn

- Fundamentals of Arduino and Raspberry Pi for IoT applications
- Interface sensors, actuators, and communication devices with microcontrollers/microprocessors
- Design and implementation of basic automation systems using Arduino and Raspberry Pi
- Analyzing of sensor data and control real-time operations for embedded IoT applications
- Programming concepts to develop smart prototypes for health, automation, and traffic control

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

- Explain the fundamentals of Arduino and Raspberry Pi platforms for IoT-based applications
- Interface sensors, actuators, and communication devices with microcontrollers/microprocessors
- Design and implement automation systems using Arduino and Raspberry Pi
- Analyze sensor data to control and monitor real-time embedded IoT applications
- Apply programming skills to develop smart IoT prototypes for domains like health, automation, and traffic control

List of Experiments:

The following experiments are performed using any Software (Free/Open recommended like Arduino IDE / Tinkercad Circuits / PlatformIO/ Thonny / VS Code / Geany etc)

1. Programming Raspberry Pi with Python
2. Interfacing LED. DHT11- Temperature and, humidity sensor using Arduino
3. Interfacing Ultrasonic sensor and PIR sensor using Arduino
4. Design of Traffic Light Simulator using Arduino
5. Design of Water flow detection using an Arduino board
6. Interfacing of LED, Push button with Raspberry Pi and Python Program
7. Design of Motion Sensor Alarm using PIR Sensor
8. Interfacing DHT11-Temperature and Humidity Sensor with Raspberry Pi
9. Interfacing DS18B20 Temperature Sensor with Raspberry Pi
10. Implementation of DC Motor and Stepper Motor Control with Raspberry Pi
11. Raspberry Pi based Smart Phone Controlled Home Automation
12. Smart Traffic light Controller
13. Smart Health Monitoring System

NOTE: Minimum of 12 experiments to be conducted.

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2460282: SIMULATION OF POWER ELECTRONICS APPLICATIONS TO RENEWABLE ENERGY SYSTEMS LABORATORY

B.TECH III Year II SEM

L T P C
0 0 2 1

Prerequisites: Power Electronics, Renewable Energy Systems
Course Objectives:

1. To illustrate the characteristics and performance of solar PV systems through simulation studies.
2. To demonstrate the effect of shading and system configuration on the performance of solar PV systems.
3. To illustrate the operating characteristics and performance of wind energy generators through simulation studies.
4. To explain the configuration and performance aspects of hybrid solar–wind power systems through simulation studies.
5. To illustrate the operation and performance of renewable energy systems and intelligent control techniques through simulation studies.

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

1. Analyze the VI characteristics and efficiency of solar PV systems using simulation tools.
2. Evaluate the impact of partial shading and system type (grid-connected / stand alone) on solar PV performance.
3. Interpret the performance of wind energy generators and their micro-scale applications using simulation tools.
4. Differentiate the performance of hybrid solar–wind systems under various operating conditions.
5. Analyze solar PV systems, fuel cells and intelligent controllers for hybrid renewable systems using simulation tools.

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

1. Simulation study on Solar PV Energy System.
2. Simulation study on "VI-Characteristics and Efficiency of 1kWp Solar PV System".
3. Simulation study on the effect of partial shaded solar PV Cell and its Characteristics.
4. Simulation study on Performance assessment of Grid connected and Standalone1kWp Solar Power System.
5. Simulation study on Wind Energy Generator.
6. Simulation study on Performance assessment of micro Wind Energy Generator.
7. Simulation study on Hybrid (Solar-Wind) Power System.
8. Simulation study on Performance Assessment of Hybrid (Solar-Wind) Power System.

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

1. Simulation study on Solar PV Energy System.
2. Simulation study on Performance of Fuel cell.
3. Simulation study on Intelligent Controllers for Hybrid Systems.

TEXTBOOKS:
1. Odeh and Yohanis, "Simulation of Energy Systems", 2nd Edition 2010.
2. Jakob Salomon Sen, "Modelling and simulation of Renewable Energy Systems", 4th Edition 2014.

REFERENCES:
1. B.H.Khan,Non-Conventional Energy Resources, Tata McGraw-Hill Education, New Delhi.
2. G. D. Rai,Non-Conventional Energy Sources,

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2460283: ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LABORATORY

B.TECH III Year II SEM

L T P C
0 0 2 1

Prerequisites: **Electrical Measurements and Instrumentation**
Course Objectives:

1. To develop practical skills in calibration and testing of electrical measuring instruments.
2. To apply bridge methods for measurement of resistance, capacitance and inductance.
3. To analyze performance of CTs, PTs, and energy meters through experimental evaluation.
4. To understand error sources and enhance accuracy in electrical measurements.
5. To gain hands-on experience with modern testing kits and transducers for power, displacement and strain measurements.

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

1. Calibrate electrical measuring instruments such as energy meters, wattmeters, and power factor meters.
2. Measure resistance, inductance, capacitance, and reactive power using bridge techniques.
3. Test CTs, PTs, and transformer ratios and evaluate % ratio error and phase angle.
4. Conduct dielectric, displacement, and strain measurements using LVDT and strain gauges.
5. Evaluate measurement accuracy, errors, and tolerance in various electrical instruments.

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

In addition to the above eight experiments, At least any two of the experiments from the following list are required to be conducted
1. Calibration of LPF wattmeter by Phantom testing.
2. Measurement of 3-phase power with single wattmeter and two CTs.
3. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angle of given CT by Null method.
4. PT testing by comparison –V.G. as Null detector –Measurement of % ratio error and phase angle of the given PT
5. Resistance strain gauge – strain measurements and Calibration.

6. Transformer turns ratio measurement using AC bridges.
7. Measurement of %ratio error and phase angle of given CT by comparison.

Proposed open ended experiments:
1. Measure the temperature of a thermo-couple using a signal conditioning device.
2. Measure the speed using a Proximity Sensor.

TEXTBOOKS:

1. G.K.Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition, 2016

2. S.C.Bhargava,"Electrical Measuring Instruments and Measurements", BS Publications, 2012.

REFERENCES:

1. A.K.Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co. Publications, 2005.

2. R.K.Rajput, "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd., 2007.

3. Buckingham and Price,"Electrical Measurements", Prentice – Hall,1988.

4. Reissland, M.U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition2010.

5. E.W.Golding and F. C.Widdis, "Electrical Measurements and measuring Instruments", fifth Edition, Wheeler Publishing, 2011.

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2460293: INTRODUCTION TO COMPUTER AIDED ELECTRICAL DRAWING

B.TECH III Year II SEM   L T P C
                                                                                                                      0 0 2 1

Prerequisites: Power Electronics, Renewable Energy Systems

Course Objectives:

1. To develop the ability, identify and draw standard electrical symbols and components used in circuits, wiring, and machines.
2. To provide knowledge of preparing wiring layouts for residential, commercial and industrial electrical installations.
3. To familiarize students with internal constructional details of electrical machines through sectional views and drawings.
4. To enable understanding of single line diagrams of substations and renewable energy systems.
5. To impart practical knowledge of transmission line supports and various methods of earthing

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

1. Recall standard symbols of electrical components, machines and fixtures.
2. Explain the purpose and working principle of wiring layouts, machine sections and substation diagrams.
3. Prepare wiring diagrams and layouts for residential, commercial and industrial installations.
4. Differentiate between various machine cores, transformer designs and substation configurations through drawings.
5. Evaluate electrical layouts, transmission line supports and earthing systems as per standards.

The following experiments are required to be conducted as compulsory experiments

1. Draw standard symbols of electrical components: Constant Resistor and variable Resistor, Constant Inductor and variable inductor, Constant capacitor and variable capacitor, transformer.
2. Draw standard symbols of electrical components: DC Voltage Source, DC current source, Battery, Single phase AC voltage source, three phase AC voltage source, Wall mounted lamp fixture, Ceiling fan.
3. Draw standard symbols of electrical fixtures: One-way Switch and two-way Switch, Normally Open & Normally Close Push buttons, Fuse, Circuit breaker, Isolators and Ground.
4. Draw the Wiring diagram of 3 phase Induction motor with energy meter, 1-phase preventer, Y-starter with control panel/switchboard.
5. Draw the wiring layout of Pump shed for given dimensions.
6. Draw the cross section of single stepped core of one limb of transformer.

7. Draw Elevation & End view of a 3-phase Squirrel cage Induction motor.
8. Draw the single line diagram of 33kV / 11kV substation.

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

1. Draw the cross section of 2 stepped core of one limb of transformer.
2. Draw Plan & Elevation of a 3-phase transformer with cooling tubes.
3. Draw single line diagram of Grid connected solar PV system.
4. Draw the sketch of 132 KV steel tower of single circuit.
5. Draw the dimensioned sketch of Plate earthing.

TEXTBOOKS:

1. YOGESH, NAGARAJA, NANDAN, "Computer Aided Electrical Drawing", PHI Publication 2014.
2. Andrew Mustun, "QCAD - An Introduction to Computer-Aided Design", PHI Publication 2008.

REFERENCES:

1. Prof. Sham Tickoo, "Auto CAD Electrical for Electrical Control Designers" CADCIM Technologies 2020.
2. Gaurav Verma, "Auto CAD Electrical 2018 Black Book", BPS Pulications 2018.

IV-I

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2470233: POWER SYSTEM OPERATION AND CONTROL

B.TECH IV Year I SEM
L T P C
3 0 0 3

Prerequisites: **Electrical Power Generation & Electrical Transmission and Distribution**

Course Objectives:

1. To introduce optimal scheduling methods for thermal and hydrothermal power systems considering cost and operational constraints.
2. To develop mathematical models of governors, turbines and excitation systems for dynamic analysis of power systems.
3. To provide knowledge of frequency control strategies in single-area and two-area power systems.
4. To explain methods of power factor improvement and reactive power compensation in transmission and distribution systems.
5. To impart knowledge of computer-based monitoring, control and forecasting techniques in modern power systems.

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

1. Formulate optimal scheduling problems for thermal and hydrothermal power systems.
2. Derive transfer function models of governors, turbines and excitation systems.
3. Analyze load frequency control strategies for single-area and two-area systems.
4. Evaluate compensation techniques for power factor correction and reactive power control.
5. Explain SCADA, EMS and forecasting techniques used in computer control of power systems.

UNIT-I: ECONOMIC OPERATION OF POWER SYSTEMS
Optimal scheduling of thermal power system: Optimal operation of generators in thermal power stations, heat rate curve, cost curve, incremental fuel and production costs, input output characteristics, optimum generation allocation without and with transmission line losses coefficients, general transmission line loss formula, unit commitment; Optimal scheduling of hydrothermal system: Hydroelectric power plant models, scheduling problems, short term hydro thermal scheduling problem.

UNIT-II: MODELING OF GOVERNOR, TURBINE AND EXCITATION SYSTEMS
Modeling of governor: Mathematical modeling of speed governing system, derivation of small signal transfer function; Modeling of turbine: First order turbine model, block diagram representation of steam turbines and approximate linear models; Modeling of excitation system: Fundamental characteristics of an excitation system, transfer function, block diagram representation of IEEE type-1 model.

UNIT-III: SINGLE AREA AND TWO AREA LOAD FREQUENCY CONTROL
Load frequency control of single area system: Necessity of keeping frequency constant, definitions of control area, single area control, block diagram representation of an isolated power

system, steady state analysis, dynamic response, uncontrolled case.

Load frequency control of two area system: Uncontrolled case and controlled case, tie line bias control; Load frequency controllers: Proportional plus integral control of single area and its block diagram representation, steady state response, load frequency control and economic dispatch.

UNIT-IV: COMPENSATION FOR POWER FACTOR IMPROVEMENT AND REACTIVE POWER CONTROL

Voltage control: Equipment for voltage control, effect of series capacitors, line drop compensation, effect of AVR, power factor control using different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (fixed and switched), power factor correction, capacitor allocation, economic justification, procedure to determine the best capacitor location; Reactive power control: Reactive power compensation in transmission systems, advantages and disadvantages of different types of compensating equipment for transmission systems; Uncompensated and compensated transmission lines: Shunt and series compensation.

UNIT-V: COMPUTER CONTROL OF POWER SYSTEMS

Need of computer control of power systems. Concept of energy control centre (or) load dispatch centre and the functions - system monitoring - data acquisition and control. System hardware configuration – SCADA and EMS functions. Network topology – Importance of Load Forecasting and simple techniques of forecasting.

TEXTBOOKS:
1. C L Wadhwa, "Electrical power systems", New age International, 3rd Edition, 2005.
2. I J Nagarath, D P Kothari, "Modern power system analysis", Tata Mc Graw-Hill, 2nd Edition, 2006.

REFERENCES:
1. Singh SN, "Electric Power Generation, Transmission and Distribution", Prentice Hall of India Pvt. Ltd., New Delhi, 2nd Edition, 2002.
2. T J E Miller, "Reactive power control in Electrical system", Wiley Inter science Publication,1982.
3. VK Mehta and Rohit Mehta, "Principles of Power System", S Chand, 3rd revised Edition, 2015.

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2470234: POWER SYSTEM PROTECTION

B.TECH IV Year I SEM

L T P C
2 0 0 2

Prerequisites: Electrical Power Generation & Electrical Transmission and Distribution

Course Objectives:

1. To understand the fundamental principles of arc interruption, circuit breaker ratings and operation of different types of circuit breakers.
2. To study the construction, operating principles and applications of different electromagnetic relays used in power system protection.
3. To learn the concepts, operation and characteristics of static relays and their advantages over electromagnetic relays.
4. To provide knowledge of protection schemes for generators, transformers, transmission lines, and bus bars under different fault conditions.
5. To understand the importance of neutral grounding and analyze various grounding methods used in power systems.

Course Outcomes: After completion of the course, students will be able to:
1. Analyze the principles of arc interruption and the performance of various circuit breakers used in power systems.
2. Explain the operation and applications of electromagnetic relays for effective system protection.
3. Compare electromagnetic and static relays for advanced protection schemes.
4. Design suitable protection schemes for generators, transformers, transmission lines, and bus bars.
5. Evaluate different neutral grounding methods and recommend appropriate grounding practices for system stability and safety.

UNIT- I: INTRODUCTION TO CIRCUIT BREAKERS
Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages.- Restriking Phenomenon, Average and Maximum RRRV, Numerical Problems - Current Chopping and Resistance Switching - CB ratings and Specifications: Types and Numerical Problems. – Autoreclosures. Description and Operation of following types of circuit breakers: Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum, and SF6 circuit breakers.

UNIT-II: ELECTROMAGNETIC RELAYS
Principle of Operation and Construction of Attracted armature, Balanced Beam, induction Disc and Induction Cup relays. Types of Over Current Relays: Instantaneous, DMT and IDMT types. Application of relays: Over current/ under voltage relays, Direction relays, Differential Relays and Percentage Differential Relays. Universal torque equation, Distance relays: Impedance, Reactance, and Mho and Off-Set Mho relays, Characteristics of Distance Relays and Comparison.

UNIT-III: STATIC RELAYS

Static Relays verses Electromagnetic Relays Amplitude and Phase comparators, Duality between AC and PC, Static amplitude comparator, integrating and instantaneous comparators., static phase comparators, coincidence type of phase comparator, static over current relays, static directional relay, static differential relay, static differential relay, static distance relays, Multi input comparators, concept of quadrilateral and elliptical relay characteristics.

UNIT-IV: PROTECTION OF POWER EQUIPMENT
Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on % Winding Unprotected. Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CTs Ratio, Buchholtz relay Protection. Protection of Lines: Over Current, Carrier Current and Three-zone distance relay protection using Impedance relays. Translay Relay. Protection of Bus bars – Differential protection.

UNIT-V: 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.

UNIT-V: STABILITY ANALYSIS
Stability in the sense of Lyapunov, Lyapunov's stability and Lypanov's instability theorems, Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method, Generation of Lyapunov functions, Variable gradient method, Krasooviski's method.

TEXTBOOKS:
1. M.Gopal, "Modern Control System Theory", New Age International, 1984.

2. Ogata. K, "Modern Control Engineering", Prentice Hall, 1997

REFERENCES:
1. Badri Ram, D. N Viswakarma, "Power System Protection and Switchgear", TMH Publications, 2011.
2. Sunil S Rao, "Switchgear and Protection", Khanna Publishers, 2008.

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EMPOWERING THROUGH INNOVATIONS
MLRS

2470010: Business Economics & Financial Analysis

B.TECH IV Year I SEM   L T P C
                                                                                                                    3 0 0 3

Co requisites: BEFA

Course Objective:

To learn the basic Business types, impact of the Economy on Business and Firms specifically. To analyze the Business from the Financial Perspective.

Course Outcome:

The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The Students can study the firm's financial position by analyzing the Financial Statements of a Company

UNIT-I: Introduction to Business and Economics

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT – II: Demand and Supply Analysis

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT-III: Production, Cost, Market Structures & Pricing

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly and Monopolistic Competition.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

UNIT - IV: Financial Accounting:

Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting. Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

UNIT- V: Financial Analysis through Ratios:

Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).Introduction to Fund Flow and Cash Flow Analysis (simple problems).

TEXTBOOKS:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.

2. Dhanesh K Khatri, Financial Accounting, Tata McGrawHill,2011.

3. GeethikaGhosh, PiyaliGosh, PurbaRoyChoudhury, ManagerialEconomics, 2e, Tata McGrawHill Education Pvt. Ltd. 2012.

REFERENCE BOOKS:

1. Paresh Shah, FinancialAccountingforManagement2e, OxfordPress, 2015.

2. S.N.Maheshwari, Sunil K Maheshwari, SharadKMaheshwari, Financial Accounting, 5e, VikasPublications, 2013.

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2470242: INDUSTRIAL ELECTRICAL SYSTEMS

B.TECH IV Year I SEM

L T P C
3 0 0 3

Prerequisites: Electrical Engineering

Course Objectives:

1. To comprehending concepts like voltage, current, resistance and their relationships in both DC and AC circuits.
2. To learn how to control and protect motors using contactors, overloads and other control devices.
3. To gaining knowledge about how power is generated, distributed and utilized in industrial environments.
4. To mastering preventive and corrective maintenance strategies for industrial electrical systems.
5. To competently using millimeters, grip-ones and other tools to test and troubleshoot systems.

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

1. Identify different electrical components, including transformers, Circuit breakers, fuses, relays, etc.
2. Understand the National Electrical Code (NEC) and other relevant regulations governing electrical installations in residential and commercial buildings.
3. Design lighting schemes for various spaces, including interior and exterior.
4. Design lighting systems for various industrial environments, considering factors like illumination levels and light fittings.
5. Evaluate different process of battery banks, selection of UPS and battery banks.

UNIT-I: ELECTRICAL SYSTEM COMPONENTS

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, RCCB,MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices

UNIT -II: RESIDENTIAL AND COMMERCIAL ELECTRICAL SYSTEMS

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

UNIT -III: ILLUMINATION SYSTEMS

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premise, flood lighting.

UNIT -IV: INDUSTRIAL ELECTRICAL SYSTEMS-I

HT connect ion, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

UNIT -V: INDUSTRIAL ELECTRICAL SYSTEMS-II

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

TEXTBOOKS:
1. S.L. Uppaland G.C.Garg, "Electrical Wiring, Estimating & costing", Khanna publishers,2008.
2. K.B.Raina, "Electrical Design, Estimating & Costing", New age International, 2007.

REFERENCES:
1. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.
2. Website for IS Standards.
3. H.Joshi, "Residential Commercial and Industrial Systems", Mc Graw Hill Education, 2008.

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2470243: SMART GRID TECHNOLOGIES

B.TECH IV Year I SEM   L T P C
                                                                               3 0 0 3

Prerequisites: Electrical Power Generation & Electrical Transmission and Distribution

Course Objectives:
1. To introduce the concepts, functions, benefits and challenges of Smart Grid with emphasis on Indian and global perspectives.
2. To provide knowledge of Smart Grid design architectures and their fundamental components for automation and renewable integration.
3. To impart knowledge of computational and intelligence-based techniques used for Smart Grid planning and operation.
4. To explain renewable integration, storage systems, microgrids, EVs and communication technologies relevant to Smart Grid.
5. To develop an understanding of control methods for load frequency, voltage and reactive power in Smart Grid with case studies.

Course Outcomes: After completion of this course the student will be able to
1. Summarize the concepts, functions, advantages and challenges of Smart Grid.
2. Illustrate Smart Grid architecture and its major components.
3. Apply computational and AI-based techniques for Smart Grid analysis.
4. Differentiate distributed generation and communication technologies for Smart Grid applications.
5. Analyze control strategies for Smart Grid operation.

UNIT-I: INTRODUCTION TO SMART GRID
Working definitions of Smart Grid and Associated Concepts –Smart grid Functions-Traditional Power Grid and Smart Grid –New Technologies for Smart Grid – Advantages –Indian Smart Grid –Key Challenges for Smart Grid.

UNIT -II: SMART GRID ARCHITECTURE
Components and Architecture of Smart Grid Design –Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid designs – Transmission Automation – Distribution Automation –Renewable Integration

UNIT -III: TOOLS AND TECHNIQUES FOR SMART GRID
Computational Techniques –Static and Dynamic Optimization Techniques –Computational Intelligence Techniques –Evolutionary Algorithms –Artificial Intelligence techniques.

UNIT -IV: DISTRIBUTION GENERATION TECHNOLOGIES

Introduction to Renewable Energy Technologies –Micro grids –Storage Technologies –Electric Vehicles and plug –in hybrids –Environmental impact and Climate Change –Economic Issues. Communication Technologies And Smart Grid: Introduction to Communication Technology – Synchro-Phasor Measurement Units (PMUs) –Wide Area Measurement Systems (WAMS).

UNIT -V: CONTROL OF SMART POWER GRID SYSTEM

Load Frequency Control (LFC) in Micro Grid System –Voltage Control in Micro Grid System – Reactive Power Control in Smart Grid. Case Studies and Test beds for the Smart Grids.

TEXTBOOKS:
1. Stuart Borlase, "Smart Grids, Infrastructure, Technology and Solutions", CRC Press, 2013
2. Gil Masters, "Renewable and Efficient Electric Power System", Wiley-IEEE Press, 2004

REFERENCEBOOKS:
1. A.G. Phadke and J.S. Thorp, "Synchronized Phasor Measurements and their Applications",
   Springer Edition, 2010.
2. T. Ackermann, "Wind Power in Power Systems", Hoboken, NJ, USA, John Wiley, 2005

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2470244: ELECTRIC AND HYBRID VEHICLES

B.TECH IV Year I SEM   L T P C
                                                                                                                        3 0 0 3

Prerequisites: AC Machines, Special Electrical Machines

Course Objectives:

1. To understand the fundamental concepts, principles and design aspects of hybrid and electric vehicles.

2. To learn the various configurations and types of hybrid and electric drive trains.

3. To gain knowledge about different types of electric machines used in hybrid and electric vehicles.

4. To understand the role and types of energy storage devices used in hybrid and electric vehicles.

5. To analyze the integration and operational aspects of hybrid and electric vehicle components such as regenerative braking and control systems.

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

1. Understand the basic principles of conventional vehicle performance.

2. Apply the historical development, social and environmental importance of hybrid and electric vehicles.

3. Analyze the basic concepts and topologies of electric drive-trains, power flow control in electric traction, electric propulsion units.

4. Classify the different energy storage technologies used in hybrid and electric vehicles and their performance.

5. Elucidate various energy management strategies used in hybrid and electric vehicles, their classifications and practical implementation challenges.

MODULE– I: INTRODUCTION

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

MODULE-II: INTRODUCTION TO HYBRID ELECTRIC VEHICLES

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-Trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

MODULE-III: ELECTRIC TRAINS

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

MODULE- IV: ENERGY STORAGE

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems

MODULE-V: ENERGY MANAGEMENT STRATEGIES

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies

TEXTBOOKS:

1. C.Mi,M.A.Masrur and D.W.Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. S.Onori,L.Serrao and G.Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.

REFERENCES:

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
2. T.Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

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EMPOWERING THROUGH INNOVATIONS
MLRS

2470245: ADVANCED CONTROL OF ELECTRIC DRIVES

B.TECH IV Year I SEM   L T P C
                                                                                                                       3 0 0 3

Prerequisites: **Power Electronics , Power Semiconductor Drives**
Course Objectives:

1. To know the power electronic converters
2. To analyze the various control strategies of power converters for drives control
3. To enable students to apply modeling and control techniques
4. To understand the advanced control techniques for DC and AC motor drives
5. **To go through the control strategies for drives using digital signal processors.**

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

1. Understand the operation of power electronic converters and their control strategies.
2. Explain the vector control strategies for ac motor drives
3. Apply the concepts of synchronous machine modeling and implement various control strategies.
4. Analyze the speed–torque control characteristics of BLDC, PMSM and SRM drives
5. Justify the choice of a specific DSP for industrial applications

UNIT-I: POWER CONVERTERS FOR AC DRIVES
PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H Bridge as a 4-Q drive.

UNIT –II: INDUCTION MOTOR DRIVES
Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control (DTC).

UNIT -III: SYNCHRONOUS MOTOR DRIVES
Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.

UNIT –IV: PERMANENT MAGNET MOTOR DRIVES
Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.
SWITCHED RELUCTANCE MOTOR DRIVES
Evolution of switched reluctance motors; various topologies for SRM drives, comparison, closed loop speed and torque control of SRM.

UNIT -V: DSP BASED MOTION CONTROL

Use of DSPs in motion control, various DSPs available, and realization of some basic blocks in DSP for implementation of DSP based motion control.

TEXTBOOKS:

1. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, Asia, 2003.
2. P. C. Krause, O. Wasynczuk and S. D. Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley & Sons, 2013.

REFERENCES:

1. H. A. Taliyat and S. G. Campbell, "DSP based Electromechanical Motion Control", CRC press, 2003.
2. R. Krishnan, "Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press, 2009.

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2470212: FUNDAMENTALS OF ELECTRIC AND HYBRID VEHICLES

(Open Elective-III)

B.TECH IV Year I SEM

L T P C
3 0 0 3

Prerequisites: None

Course Objectives:

1. To understand the basics of electric vehicles (EV) and hybrid electric vehicles (HEV) and their advantages over conventional vehicles.
2. To know various types of electric and hybrid vehicle architectures and components.
3. To learn the operation of electric traction motors and their control techniques.
4. To understand battery technologies, energy management, and charging infrastructure for EVs and HEVs.

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

1. Understand the evolution, types and fundamentals of electric and hybrid vehicles.
2. Analyze different electric drive systems and motor control techniques used in EVs and HEVs.
3. Gain knowledge of battery technologies, energy storage and management in electric vehicles.
4. Understand various charging methods, infrastructure and standards for electric vehicles.
5. Identify environmental benefits and challenges associated with electric and hybrid vehicles.

UNIT-I: INTRODUCTION

Conventional Vehicles: Basics of vehicle performance, vehicle power Source characterization, transmission characteristics and mathematical models to describe vehicle performance.

UNIT -II: INTRODUCTIONTOHYBRIDELECTRICVEHICLES

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNIT -III: ELECTRIC TRAINS

Electric Drive Trains: Basic concept of electric traction. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT -IV: ENERGYSTORAGE

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

UNIT -V: ENERGYMANAGEMENTSTRATEGIES

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies and implementation issues of energy management strategies.

TEXTBOOKS:

1. C.Mi,M.A.Masrur and D.W.Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. S.Onori,L.Serrao and G.Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.

REFERENCES:

1. M. Ehsani, Y. Gao, S. E. Gayand A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
2. T.Denton, "Electric and HybridVehicles",Routledge,2016

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2470246: MODERN CONTROL THEORY
(PROFESSIONAL ELECTIVE-IV)

B.TECH IV Year I SEM   L T P C
                                                                          3 0 0 3

Prerequisites: Electrical Engineering

Course Objectives:

1. To provide knowledge on mathematical foundations and state-space modeling of dynamic systems.
2. To develop understanding of controllability and observability concepts for system analysis.
3. To equip students with design skills of state feedback controllers and observers.
4. To study and analyze nonlinear system behavior using describing functions and phase-plane methods.
5. To understand and apply stability analysis techniques based on Lyapunov's methods

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

1. Explain the fundamental mathematical concepts, state-space representation, and solution of dynamic systems.
2. Apply the principles of controllability and observability to state models of engineering systems.
3. Design state feedback controllers and observers using pole-placement and Ackermann's formula.
4. Analyze nonlinear systems using describing function and phase-plane methods for determination of system behavior and stability.
5. Evaluate the stability of linear and nonlinear systems using Lyapunov's methods and related techniques.

UNIT-I: MATHEMATICAL PRELIMINARIES AND STATE VARIABLE ANALYSIS
Fields, Vectors and Vector Spaces, Linear combinations and Bases, Linear Transformations and Matrices, Scalar Product and Norms, Eigen values, Eigen Vectors and a Canonical form representation of Linear systems, The concept of state, State space model of Dynamic systems, Time invariance and Linearity, Non uniqueness of state model, State diagrams for Continuous-Time State models, Existence and Uniqueness of Solutions to Continuous-Time State Equations, Solutions of Linear Time Invariant Continuous-Time State Equations, State transition matrix and it's properties. Complete solution of state space model due to zero input and due to zero state.

UNIT -II: CONTROLLABILITY AND OBSERVABILITY
General concept of controllability, Controllability tests, Different state transformations such as diagonalization, Jordon canonical forms and Controllability canonical forms for Continuous-Time Invariant Systems, General concept of Observability tests for Continuous-Time.Invariant Systems, Observability of different State transformation forms.

UNIT -III: STATE FEEDBACK CONTROLLERS AND OBSERVERS

State feedback controller design through Pole Assignment, using Ackkermans formula. State observers: Full order and Reduced order observers.

UNIT -IV: NON-LINEAR SYSTEMS

Introduction to Non-Linear Systems, Types of Non-Linearities, Saturation, Dead-Zone, Backlash, Jump Phenomenon etc., Linearization of nonlinear systems, Singular Points and its types, describing function, describing function of different types of nonlinear elements, Stability analysis of Non-Linear systems through describing functions.

Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Stability analysis of nonlinear systems based on phase-plane method.

UNIT -V: STABILITY ANALYSIS

Stability in the sense of Lyapunov, Lyapunov's stability and Lypanov's instability theorems, Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method, Generation of Lyapunov functions, Variable gradient method, Krasooviski's method.

TEXTBOOKS:
1. M.Gopal, "Modern Control System Theory", New Age International, 1984.
2. Ogata. K, "Modern Control Engineering", Prentice Hall, 1997

REFERENCES:
1. N K Sinha, "Control Systems", New Age International, 3rd Edition.
2. Donald E.Kirk, "Optimal Control Theory an Introduction", Prentice Hall Network series, 1st Edition

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2470461: VLSI DESIGN

(PROFESSIONAL ELECTIVE-IV)

B.TECH IV Year I SEM

L T P C
3 0 0 3

Prerequisites: **Electronic Circuit Analysis; Switching Theory and Logic Design**

Course Objectives:

1. Understand the different steps involved in the fabrication of ICs
2. Explain electrical properties of MOS and BiCMOS devices to analyze the behavior of inverters designed with various loads
3. Understand the design rules to be followed to draw the layout of any logic circuit
4. Provide design concepts to design building blocks of data path of sub-system using gates
5. Understand basic programmable logic devices and testing of CMOS circuits

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

1. Acquire qualitative knowledge about the fabrication process of integrated circuits using MOS transistors
2. Draw the layout of logic circuits which helps to understand and estimate parasitic effect of any logic circuits
3. Design building blocks of data path systems, memories and simple logic circuits using PLA, PAL, FPGA and CPLD
4. Understand different types of faults that can occur in a system and learn the concept of testing and adding extra hardware to improve testability of system
5. Analyze standard cells and design a complex circuit

UNIT-I: Introduction: Introduction to IC Technology, MOS, PMOS, NMOS, CMOS, BiCMOS. Basic Electrical Properties: Basic Electrical Properties of MOS and BiCMOS Circuits: Ids – Vds relationships, MOS Transistor Threshold Voltage, gm, gds, Figure of merit, Pass Transistor, NMOS Inverter, Various Pull-ups, CMOS inverter analysis and design, BiCMOS Inverters.

UNIT-II: VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

UNIT-III: Gate Level Design: Logic Gates, Other Complex Gates, Switch Logic, Alternate Gate Circuits, Time Delays, Driving Large Capacitive Loads, Wiring Capacitance, Fan-in, Fan-out.

UNIT-IV: Data Path Sub Systems: Sub System Design, Shifters, Adders, ALUs, Multipliers, Parity Generators, Comparators, Zero/One Detectors, Counters. Array Sub Systems: SRAM, DRAM, ROM, Serial Access Memories.

UNIT-V: Programmable Logic Devices: Design Approach –PLA, PAL, Standard Cells, FPGAs, CPLDs. CMOS Testing: CMOS TESTING, Test Principles, Design Strategies for Test, Chip Level Test Techniques.

TEXTBOOKS:

1. Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, "Essentials of VLSI Circuits and Systems," PHI, 2nd Edition 2009.
2. Neil H. E. Weste, David Harris, Ayan Banarjee, "CMOS VLSI DESIGN - A Circuits and Systems Perspective," 4th Edition, Pearson, 2nd Edition, 2015.

REFERENCEBOOKS:

1. Ming- BO Lin, "Introduction to VLSI Systems: A Logic, Circuit and system Perspective." CRC Press, 2011.
2. John. P. Uyemura, "CMOS Logic Circuit Design," Springer, 2nd Edition, 2013.
3. Wayne Wolf, "Modern VLSI Design," Pearson Education, 4th Edition, 2015.

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2470247: COMPUTER AIDED ELECTRICAL MACHINE DESIGN
(PROFESSIONAL ELECTIVE-IV)

B.TECH IV Year I SEM   L T P C
                                                                       3 0 0 3

Prerequisites: D C Machines and Transformer &AC Machines

Course Objectives:

1. To provide knowledge on major considerations in electrical machine design, including materials, loadings and thermal aspects.
2. To impart understanding of transformer design parameters, dimensions and cooling methods.
3. To develop knowledge of design principles of induction motors including rotor design, leakage reactance and performance characteristics.
4. To introduce synchronous machine design aspects such as salient pole, turbo alternators, field windings and stability considerations.
5. To familiarize students with computer-aided design techniques, optimization methods and modern machine structures using FEM tools.

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

1. Explain the considerations, materials and loadings involved in electrical machine design.
2. Design the main dimensions, cooling systems and operating characteristics of transformers.
3. Analyze the design of induction motors including rotor slots, bars, leakage reactance and operating performance.
4. Illustrate the design of synchronous machines, including salient poles, turbo alternators and field windings.
5. Apply computer-aided design principles and FEM techniques for modern electrical machines such as PMSM, BLDC and SRM.

UNIT-I: Introduction: Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

UNIT–II: Transformers: Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

UNIT–III: Induction Motors: Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of poly-phase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

UNIT–IV: Synchronous Machines: Sizing of a synchronous machine, main dimensions, design

of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

UNIT–V: Computer Aided Design (CAD): Limitations (assumptions) of traditional designs need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

TEXTBOOKS:
1. A. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
2. M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBS London.

REFERENCES:
1. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006.
2. K. L. Narang, "A Text Book of Electrical Engineering Drawings", Satya Prakashan, 1969.
3. Shanmugasundaram, G. Gangadharan and R. Palani, "Electrical Machine Design Data Book", New Age International, 1979.
4. M. V. Murthy, "Computer Aided Design of Electrical Machines", B.S. Publications, 2008.
5. Electrical machines and equipment design exercise examples using Ansoft's Maxwell 2D machine design package.

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2470462: BASICS OF DIGITAL SIGNAL PROCESSING

(PROFESSIONAL ELECTIVE-IV)

B.TECH IV Year I SEM

L T P C
3 0 0 3

Prerequisites: Signals and Systems

Course Objectives:

- Understand the basic concepts related to the analysis and processing of digital signals
- Understand the fast computation of DFT and appreciate the FFT processing
- Study the designs of IIR digital filters and analyze and synthesize
- Designs of FIR digital filters and analyze and synthesize
- Realize the structures of digital filters and acquaint in multi-rate signal processing techniques

Course Outcomes:

After completion of this course the student will be able to:

- Understand the LTI system characteristics and Multirate signal processing.
- Apply the knowledge of FFT Algorithms for computation of DFT
- Design a IIR digital filter using various techniques
- Design FIR filters using various methods
- Understand the significance of various filter structures and Apply decimation and interpolation concepts.

Module – I:

Introduction: Introduction to digital signal processing, Classification of discrete time signals & systems, Conversion of continuous to discrete time signal. Linear constant coefficient difference equations, Solution of linear constant coefficient difference equation: Zero input response, Impulse response, and Step response. Frequency domain representation of discrete time signals and systems

Module – II:

Discrete Fourier series: DFS representation of periodic sequences, Properties of DFS.

Discrete Fourier Transforms: Properties of DFT, Linear convolution of sequences using DFT, Relation between DTFT, DFS, DFT and Z-Transform.

Fast Fourier Transforms: Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms.

Module – III:

IIR Digital Filters- Analog filter approximations- Butterworth and Chebyshev filters, Design of IIR Digital Filters from Analog Filters, Step and Impulse invariant techniques.

Module – IV:

FIR Digital Filters - Characteristics of FIR digital filters, Frequency response. Design of FIR Filters: Fourier method, Frequency sampling technique, Comparison of IIR & FIR filters.

Module – V:

Realization of Digital Filters: Applications of Z-transforms, Solution of difference equations of digital filters, System function, Stability criterion, Frequency response of stable systems.

Multirate Digital Signal Processing: Introduction, Decimation by a factor D, Spectrum of decimator, Interpolation by a factor I, Spectrum of interpolator

TEXTBOOKS:

1. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, algorithms and applications," Prentice Hall, 4th Edition, 2015.
2. A.V. Oppenheim, R.W. Schaffer, "Discrete time signal processing," PHI, 2nd Edition, 2015.

REFERENCEBOOKS:

1. S. Salivahanan, Vallavaraj, Gnanapriya, "Digital signal processing," Tata McGraw-Hill Education, 2nd Edition, 2009.
2. A. Nagoorkani, "Digital signal processing," Tata McGraw-Hill Education, 2nd Edition, 2012.
3. P. Ramesh Babu, "Digital signal processing," SCI Tech, 7th Edition, 2020

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2470284: ELECTRICAL SYSTERMS SIMULATION LABORATORY

B.TECH IV Year I SEM   L T P C
                                                                                                          0 0 2 1

Prerequisites: Network Analysis, Analog Electronics, Power Electronics, Electrical transmission and distribution.

Course Objectives:

1. To Simulate and analyze electrical and electronic systems.
2. To evaluate the performance of transmission lines.
3. To Analyze various Faults in power systems
4. To Model, simulate and analyze the performance of DC Machines and Induction Motors.
5. To Analyze performance of feedback and load frequency control of the systems

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

1. Perform matrix operations and generate periodic and aperiodic signals for system analysis.
2. Analyze signals and system functions by performing operations and evaluating pole-zero characteristics in S- and Z-planes.
3. Simulate the behavior of a battery pack and evaluate its performance in EV applications.
4. Analyze signals and electrical circuits in time and frequency domains using Fourier techniques and circuit design principles.
5. Analyze transmission lines, transformers, and power system models under normal and fault conditions using symmetrical components and fault analysis techniques.

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

1. Basic Operations on Matrices
2. Generation of various signals and sequences (Periodic and Aperiodic), such as unit Impulse, Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc.
3. Operations on signals and sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy, and Average Power
4. Locating Poles and Zeros and Plotting Pole-Zero Maps In S-Plane And Z-Plane for The Given Transfer Function
5. Battery Pack Modeling for EV Applications
6. Impact of Ambient Temperature on Battery Performance.
7. Finding the Fourier Transform of a Given Signal and Plotting Its Magnitude and Phase Spectrum
8. Design of first and second order circuits in time and frequency domain.

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

9. Performance evaluation of medium and long transmission lines
10. Symmetrical component analysis
11. Transmission Line Fault Analysis

12. LG,LL and 3-Φfault analysis of Transformer
13. Short Circuit Analysis of Power system models

Proposed open ended experiments:
1. Battery Charger Modeling with Power Factor Correction
2. Battery Energy Management in Smart Grid / V2G

TEXTBOOKS:
1. C.L.Wadhwa: Electrical Power Systems –Third Edition, New Age International Pub. Co., 2001.
2. Hadi Sadat: Power System Analysis –Tata Mc GrawHillPub.Co.2002.

REFERENCES:
1. Signals, Systems, and Circuit Analysis Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab "Signals and Systems", 2nd Edition, Pearson Education.
2. Power Systems, EV Batteries, and Smart Grid Applications. Hadi Saadat "Power System Analysis", 3rd Edition, McGraw-Hill Education.

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2470285: POWER SYSTEM LABORATORY

B.TECH IV Year I SEM   L T P C
                                                                                                                  0 0 2 1

Prerequisites: **Electrical transmission and distribution, Power System Protection ,Power System Operation and Control, Electrical Machines**

Course Objectives:

1. To provide practical knowledge of protection schemes for power system components using conventional and microprocessor-based relays.
2. To understand and analyze the sequence impedances of machines and transformers.
3. To develop modeling and analytical skills for transmission line parameters and network matrices.
4. To perform load flow studies using iterative numerical methods for real-world power system operation.
5. To enhance skills in simulating, analyzing and testing protection and power system performance under different operating conditions.

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

1. Evaluate the operating characteristics of over-current and voltage relays, both conventional and microprocessor-based.
2. Apply protection techniques such as differential protection for transformers and analyze their performance.
3. Determine sequence impedances of synchronous machines and transformers through experimentation.
4. Construct Y_{BUS} and Z_{BUS} matrices and use them for power system analysis.
5. Perform load flow analysis using Gauss-Seidel, Newton-Raphson, and Fast Decoupled methods and interpret simulation results.

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

1. Characteristics of IDMT Over-Current Relay.
2. Differential protection of 1-Φtransformer.
3. Characteristics of Micro Processor based Over Voltage / Under Voltage relay.
4. A,B,C,D constants of a Long Transmission line
5. Finding the sequence impedances of 3-Φ synchronous machine.
6. Finding the sequence impedances of 3-Φ Transformer.

In addition to the above six experiments, at least any four of the experiments from the following list are required to be conducted.

1. Formation of Y_{BUS}.
2. Load Flow Analysis using Gauss Seidal (GS) Method.
3. Load Flow Analysis using Fast Decoupled (FD) Method.
4. Formation of Z_{BUS}.
5. Simulation of Compensated Line

Proposed open ended experiments:

1. Experimental Verification of the Ferranti Effect in Transmission Lines.
2. Simulation of Renewable Energy Integration in a Transmission System.

TEXTBOOKS:

1. C.L.Wadhwa "Electrical Power Systems", New Age International Pub.Co. 3rd Edition,2001.
2. Hadi Sadat "Power System Analysis" Tata Mc Graw Hill Pub.Co.2002.

REFERENCES:

1. D.P.Kothari "Modern Power System Analysis" Tata Mc Graw Hill Pub.Co.2003.

IV-II

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2480248: POWER QUALITY AND FACTS

B.TECH IV Year II SEM

L T P C
3 0 0 3

Prerequisites: Power Electronics, Power System Operation and Control ,HVDC Transmission

Course Objectives:
1. To define the power quality and different terms of power quality short and long interruption, voltage sag magnitude and three phase unbalanced voltage sag.
2. To understand the fundamentals of FACTS controllers,
3. To know the importance of controllable parameters and types of FACTS controllers & their benefits.
4. To understand the objectives of Shunt and Series compensation.
5. To Control STATCOM and SVC and their comparison and the regulation of STATCOM, Functioning and control of GCSC, TSSC and TCSC

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

1. Identify various power quality issues such as voltage sags in distribution systems.
2. Apply custom power devices for improve power quality insensitive loads.
3. Select appropriate controllers for specific applications based on system requirements.
4. Analyze the control circuits of shunt controllers (SVC & STATCOM) for stability and damping functions.
5. Explain the power and control circuits of series controllers (GCSC,TSSC,TCSC).

UNIT-I: POWER QUALITY PROBLEMS IN DISTRIBUTION SYSTEMS
Power Quality problems in distribution systems: Transient and steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and it's measurement.

UNIT-II: TRANSMISSION LINES AND SERIES/SHUNT REACTIVE POWER COMPENSATION
Basics of AC Transmission. Analysis of un compensated AC transmission lines –Passive Reactive Power Compensation–Shunt and series compensation at the mid-poin to fan AC line-Comparison of Series and Shunt Compensation.

UNIT-III: STATIC SHUNT COMPENSATORS
Objectives of shunt compensation, Methods of controllable VAR generation, Static Var Compensator, its characteristics, TCR,TSC, FC-TCR configurations, STATCOM, basic operating principle, control approaches and characteristics.

UNIT-IV: STATICSERIES COMPENSATORS
Objectives of series compensator, variable impedance type of series compensators ,GTO thyristor controlled series capacitor GSC,TCSC,TSSC-operating principles and control schemes, SSSC Characteristics.

UNIT-V: COMBINEDCOMPENSATORS

Introduction to Unified Power Flow Controller-Basic operating principles - Conventional control capabilities - Independent control of real and reactive power.

TEXTBOOKS:

1. Dugan Roger C, Santoso Surya, Mc Granaghan, Marks F.Beatyand H.Wayre, "Electrical Power Systems Quality", Mc Graw Hill, 3rd Edition, 2017
2. J.Arillaga,N.R.Watson,S.Clon,"Power Systems Quality Assessment",JohnWiley,2000.

REFERENCEBOOKS:

1. Math H.Bollen, "Understanding power quality problems", IEEE Press,2017.
2. C.Sankaran,"Power Quality", CRC Press4.
3. Narain G.HIngorani,"Understanding FACTS–Concepts and Technology of Flexible AC Transmission Systems", Laszlo Gyugyi, 1999.

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2480249: ADVANCED POWER SYSTEMS

B.TECH IV Year II SEM

L T P C
3 0 0 3

Prerequisites: Electrical Power Generation, Electrical Transmission and Distribution, Power electronics

Course Objectives:

1. To provide a comprehensive understanding of electrical transmission networks and conventional control mechanisms.
2. To impart knowledge of reactive power and compensation techniques in power transmission systems.
3. To familiarize students with conventional reactive power compensators and their applications.
4. To develop an understanding of HVDC transmission systems, their development, equipment and limitations.
5. To introduce HVDC converter technologies, including six-pulse and twelve-pulse operations and modern VSC systems.

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

1. Explain conventional control mechanisms in electrical transmission networks including AGC, excitation control and FACTS devices.
2. Analyze the role of reactive power and the effects of shunt and series compensation on power transfer capacity.
3. Compare the operating principles and configurations of conventional reactive power compensators such as TCR, TSC and SVC.
4. Differentiate AC and DC transmission systems with reference to equipment, rated voltages, and limitations.
5. Evaluate the operation of HVDC converters, including six-pulse, twelve-pulse and VSC-based systems.

UNIT-I: ELECTRICAL TRANSMISSION NETWORKS & CONVENTIONAL CONTROL MECHANISMS

Electrical Transmission Networks and Conventional Control Mechanisms, Automatic Generation Control (AGC), Excitation Control, Transformer Tap-Changer Control, Phase Shifting Transformers, Flexible AC Transmission Systems(FACTS), Power Electronics and Switching Devices, Semiconductor Switches and their Applications, Emerging Transmission Networks.

UNIT-II: REACTIVE POWER CONTROL INELECTRICAL POWER TRANSMISSION SYSTEMS
Reactive Power and its role in Power Transmission Systems, Uncompensated Transmission Lines and Lossless Distributed Parameter Lines, Passive Compensation, Shunt Compensation, and Series Compensation, Effect of Shunt and Series Compensation on Power Transfer Capacity.

UNIT-III: RINCIPLES OF CONVENTIONAL REACTIVE POWER COMPENSATORS
Synchronous Condensers and their Configurations, Thyristor Controlled Reactor (TCR), Single Phase TCR, Three Phase TCR, Segmented TCR, 12-Pulse TCR, Thyristor-Switched Capacitor (TSC), Mechanically Switched Capacitor-Thyristor-Controlled Reactor (MSCTCR), Static VAR

Compensators (SVCs) Comparison.

UNIT-IV: HVDCTRANSMISSION– DEVELOPMENT
Historical Development of HVDC Transmission Systems, Equipment required for HVDC Systems, Comparison of AC and DC Transmission, Limitations of HVDC Transmission Lines, Standard Rated Voltages of HVDC and EHV AC Systems, HVDC-VSC Transmission System.

MODULE-V: HVDC CONVERTERS AND SIX PULSE CONVERTER OPERATION
HVDC Converters and Insulated Gate Bipolar Transistor (IGBT), HVDC Converter Valve and its Assembly, HVDC-VSC Operation Principles, Six Pulse Converter Operation and Analysis, DC Output Voltage, Conduction Sequence, and Voltage Waveform Analysis, Twelve Pulse Converters and VSC Converters.

TEXTBOOKS:

1. K.R.Padiyar, "FACTS Controllers in Power Transmission and Distribution", NewAge International Publishers, 2007.
2. Narain G.Hingorani and L.Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", Wiley-IEEE Press, 2000.
3. P.Kundur, "Power System Stability and Control", McGraw Hill, 1994.
4. K.R.Padiyar,"HVDCPowerTransmissionSystems:TechnologyandSystemInteractions", New Age International Publishers, 2012.
5. J. Arrillaga, "High Voltage Direct Current(HVDC) Transmission", IET Power & Energy Series, 1998

REFERENCEBOOKS:

1. Padiyar K.R,"Analysis of Subsynchronous Resonance in Power Systems",Springer,1999.
2. Debapriya Das,"Electrical Power Systems",New Age International Publishers,2006.
3. Ewald F.Fuchs and Mohammad A.S.Masoum, "Power Quality in Power Systems and Electrical Machines", Academic Press, 2011.
4. R.Mohan Mathur and Rajiv K.Varma,"Thyristor-Based FACTS Controllers for Electrical Transmission Systems", Wiley-IEEE Press, 2002.
5. S. Rao, "EHV-AC,HVDC Transmission and Distribution Engineering", Khanna Publishers, 2018.

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2480463: EMBEDDED SYSTEMS APPLICATIONS

(PROFESSIONAL ELECTIVE-V)

B.TECH IV Year II SEM   L T P C

                                                     3 0 0 3

Prerequisites: Microprocessor & Microcontroller concepts and applications, Operating system concepts

Course Objectives:
1. The basics of an embedded system
2. Programming an embedded system
3. Designing an embedded System for different applications
4. Various operating systems concepts and choosing RTOS
5. Design, implement and test an embedded system

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

1. Describe the design process and components involved in building embedded systems.
2. Demonstrate understanding of basic operating systems and real-time operating systems (RTOS).
3. Identify and categorize different types of memory used in embedded applications.
4. Apply different embedded firmware design approaches for system development.
5. Explain and implement task communication and synchronization techniques in embedded systems

UNIT - I: Introduction to Embedded Systems

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT - II: The Typical Embedded System

The Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off- The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT - III: Embedded Firmware:

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages. Difference between C and Embedded C, why C for Embedded.

UNIT - IV: RTOS Based Embedded System Design

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling. Booting process of OS.

UNIT - V: Task Communication

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Device Drivers, How to Choose an RTOS. Linux basic and utilities UNIX/lINUX/Window, advantages of Linux, Linux Device drivers , Role of Drivers.

TEXTBOOKS:

1. Shibu K.V, "Introduction to Embedded Systems," Mc Graw Hill, 3rd Edition, 2017.
2. Morgan Kaufmann, "Computers as Components," Wayne Wolf, 4th Edition, 2019.

REFERENCEBOOKS:

1. Raj Kamal, "Embedded Systems-Architecture, programming and Design," TMH, 2nd Edition, 2007.

2. Frank Vahid, Tony Givargis, "Embedded System Design- Unified Hardware / Software Introduction," John Wiley, 1st Edition, 2006.

3. Lyla B. Das, "Embedded Systems- An integrated approach," Pearson, 1st Edition, 2013.

2480255: ELECTRICAL SAFETY MANAGEMENT
(PROFESSIONAL ELECTIVE-V)

B.TECH IV Year II SEM   L T P C
                                                                                                 3 0 0 3

Prerequisites: Electrical Engineering

Course Objectives:
1. To gain knowledge of electrical hazards, types of shocks, their effects and preventive safety measures.
2. To learn safe practices and precautions during installation of electrical plants, transformers, switchyards and rotating machines.
3. To acquire safety awareness in residential, commercial and agricultural electrical installations.
4. To understand safety requirements in hazardous areas, including equipment classification, earthing and grounding methods.
5. To develop awareness of safety management policies, statutory rules and the Electricity Act, 2003 for workplace safety.

Course Outcomes: After completion of this course the student will be able to
1. Elucidate the types of electrical hazards, kinds of shocks and fundamental preventive measures.
2. Describe risks during installation of electrical equipment, transformers and rotating machines, and outline safe operating procedures.
3. Apply safety practices in residential, commercial and agricultural electrical installations.
4. Analyze earthing systems, grounding methods and safety measures in hazardous areas.
5. Evaluate safety management strategies, examine statutory rules, workplace safety frameworks as per the Electricity Act, 2003.

UNIT-I: INTRODUCTION TO ELECTRICAL SAFETY, SHOCKS AND THE IRPREVENTION
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 DURINGI NSTALLATION OFP LANT AND EQUIPMENT
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 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

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: ELECTRICALSAFETYINHAZARDOUS AREAS

Hazardousz ones–class0,1 and 2–spark, flash overs and corona discharge and functional requirements– Specifications of electrical plants, equipments for hazardous locations– Classification of equipment enclosure for various hazardous sgases and vapours –classification of equipment/enclosure for hazardous locations.

EQUIPMENTE ARTHING AND SYSTEM NEUTRALE ARTHING

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: SAFETYMANAGEMENTOFELECTRICALSYSTEMS

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

REVIEW OF IERULES AND ACTS AND THEIR SIGNIFICANCE

Objective and scope–ground clearances and section clearances–standards one electrical safety-safe limits of current, voltage –Rules regarding first aid and firefighting facility. The electricity Act, 2003.

TEXTBOOKS:
1. S.Rao, Prof .H.L.Saluja, "Electrical safety,   fire safety Engineering and safety management",1st edition Khanna Publishers. New Delhi, 2016 Reprint.

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

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2480251 CYBER-PHYSICAL SYSTEMS

(PROFESSIONAL ELECTIVE-VI)

B.TECH IV Year II SEM   L T P C

       3 0 0 3

Prerequisites: **None**

Course Objectives:

1. To provide knowledge of the design principles, validation methods and applications of Cyber-Physical Systems in Industry 4.0, IIoT and automation domains.

2. To introduce the hardware, networking and software components of CPS platforms, including processors, sensors, actuators, networks and real-time operating systems.

3. To introduce the fundamentals of dynamical systems, stability analysis and automated control design methods under different system conditions.

4. To provide knowledge on implementation aspects of CPS, including software mapping, scheduling, bus latency, fault handling and performance evaluation.

5. To impart knowledge of formal modeling, verification and secure deployment techniques for CPS, including case studies in automotive and smart grids.

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

1. Explain the principles and applications of Cyber-Physical Systems.
2. Identify the hardware, network and software components of CPS platforms.
3. Analyze automated control design techniques for dynamical systems and stability.
4. Assess the performance of CPS implementations under practical constraints.
5. Apply formal methods and security techniques for analysis and secure deployment of CPS.

UNIT–I: INTRODUCTION TO CYBER-PHYSICAL SYSTEMS (CPS)

Cyber-Physical Systems in the real world, Basic principles of design and validation of CPS, Industry 4.0 and its implications, Auto SAR and IIOT (Industrial Internet of Things), Applications in Building Automation and Medical CPS.

UNIT–II: CPS PLATFORM COMPONENTS: CPS HARDWARE PLATFORMS

Processors, Sensors, Actuators, CPS Network: Wireless Hart, CAN, Automotive Ethernet, CPS Software stack: Real-Time Operating Systems (RTOS), Scheduling, Overview of CPS Software components and their mapping to Electronic Control Units (ECUs).

UNIT–III: PRINCIPLES OF AUTOMATED CONTROL DESIGN

Dynamical Systems and Stability, Controller Design Techniques, Stability Analysis using Common Lyapunov Functions (CLFs) and Multiple Lyapunov Functions (MLFs), Performance analysis under Packet drop and Noise.

UNIT–IV: CPS IMPLEMENTATION AND PERFORMANCE ANALYSIS

Translating features into software components, Mapping software components to ECUs, Performance Analysis of CPS, considering scheduling, bus latency, and faults, Network congestion and its impact on control performance.

UNIT–V: **FORMAL METHODS, SOFTWARE ANALYSIS, AND SECURE DEPLOYMENT**

Advanced Automata-based modeling and analysis, Timed and Hybrid Automata for CPS, Formal Analysis techniques: Flow pipe construction, reachability analysis, Analysis of CPS Software: Weakest Pre-conditions, Bounded Model Checking, Frama-C, CBMC, Secure Deployment of CPS: Attack models, Secure Task mapping, and Partitioning, State estimation for attack detection. Case Studies in CPS Automotive Case Study: Vehicle ABS hacking, Power Distribution Case Study: Attacks on Smart Grids.

TEXTBOOKS:

1. Raj Rajkumar, Dionisio De Niz, and Mark Klein, "Cyber-Physical Systems", ddison-Wesley Professional.
2. Rajeev Alur, "Principles of Cyber-Physical Systems", MIT Press, 2015.

REFERENCES:

1. André Platzer, "Logical Analysis of Hybrid Systems: Proving Theorems for Complex Dynamics", Springer, 2010. 426 pages, ISBN 978-3-642-14508-7.
2. Jean J. Labrosse, "Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C", The publisher, Paul Temme, 2011.
3. E. A. Lee and S. A Seshia, "Introduction to Embedded Systems - A Cyber-Physical Systems Approach", 2014.

2480252: **ELECTRICAL DISTRIBUTION SYSTEMS**

(PROFESSIONAL ELECTIVE-VI)

B.TECH IV Year II SEM   L T P C
                                                                                                          3 0 0 3

Prerequisites: Electrical Power Generation, Electrical Transmission and Distribution

Course Objectives:
1. To provide knowledge on load modeling and characteristics of different types of consumers in a distribution system.
2. To impart understanding of the classification, design requirements and practices of distribution systems.
3. To familiarize students with the location, rating, layout and bus bar arrangements of distribution substations.
4. To develop the ability to study voltage drop, power loss and methods of power factor improvement in distribution networks.
5. To create awareness of protection objectives, common faults and the operation and coordination of protective devices in distribution systems.

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

1. Explain load modeling and load characteristics of residential, commercial, agricultural and industrial categories.
2. Classify distribution systems with design practices for feeders and secondary distribution networks.
3. Illustrate the layout and bus bar arrangements of distribution substations with suitable diagrams.
4. Analyze voltage drop, power losses and power factor improvement methods in distribution networks.
5. Evaluate protective devices and coordination procedures for distribution system protection.

UNIT–I: GENERALCONCEPTS

Introduction to distribution system, Distribution system planning, Factors effecting the Distribution system planning, Load modeling and characteristics. Coincidence factor-contribution factor-Loss factor- Relationship between the load factor and loss factor. Load growth, Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics. Smart Grid Concepts in Distribution Systems (Integration of Distributed Energy Resources, Smart Meters and Demand Response).

DISTRIBUTION FEEDERS: Design Considerations of Distribution Feeders: Radial, loop and network types of primary feeders, Introduction to low voltage distribution systems (LVDS) and High voltage distribution systems (HVDS), voltage levels, Factors effecting the feeder voltage level, feeder loading, Application of general circuit constants (A, B, C, D) to radial feeders, basic design practice of the secondary distribution system, secondary banking, secondary network types, secondary mains.

UNIT–II: SUBSTATIONS

Location of Substations: Rating of distribution substation, service area with 'n' primary feeders. Benefits derived through optimal location of substations. Optimal location of Substations (Perpendicular bisector rule and X, Y co-ordinate method). System Analysis: Voltage drop and power-loss calculations: Derivation for voltage drop and power loss in lines, manual methods of solution for radial networks, three phase balanced primary lines, analysis of non-three phase systems, method to analyze the distribution feeder cost.

UNIT–III: PROTECTION

Objectives of distribution system protection, types of common faults and procedure for fault calculations, over current Protective Devices: Principle of operation of Fuses, Auto-Circuit Recloser - and Auto-line sectionalizes, and circuit breakers. COORDINATION: Coordination of Protective Devices: Objectives of protection co-ordination, general coordination procedure, Types of protection coordination: Fuse to Fuse, Auto- Recloser to Fuse, Circuit breaker to Fuse, Circuit breaker to Auto-Recloser.

MODULE –IV: COMPENSATIONFORPOWERFACTOR IMPROVEMENT

Capacitive compensation for power-factor control -Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched), effect of series capacitors, difference between shunt and series capacitors, Calculation of Power factor correction, capacitor allocation - Economic justification of capacitors - Procedure to determine the best capacitor location.

UNIT –V: VOLTAGE CONTROL

Voltage Control: Importance of voltage control, methods of voltage control, Equipment for voltage control, effect of shunt capacitors, effect of series capacitors, effect of AVB/AVR on voltage control, line drop compensation, voltage fluctuations.

TEXTBOOKS:

1. Turan Gonen, "Electric Power Distribution System Engineering", CRC Press, 3rd Edition 2014.
2. V. Kamaraju, "Electrical Power Distribution Systems",Tata Mc Graw Hill Publishing Company, 2nd edition, 2010.

REFERENCEBOOKS:

1. G.Ram Murthy,"Electrical Power Distribution handbook", 2ndedition,University Press 2004.
2. A.S.Pabla, "Electrical Power Distribution", Tata Mc Graw Hill Publishing company, 6thedition, 2013

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2480253: **MACHINE LEARNING APPLICATIONS IN ELECTRICAL ENGINEERING**

(PROFESSIONAL ELECTIVE-VI)

B.TECH IV Year II SEM
L T P C
3 0 0 3

Prerequisites: Basic understanding of electrical engineering concepts, Course on Data Structures, Knowledge on statistical methods.

Course Objectives:

1. To introduce the fundamentals of concept learning, hypothesis evaluation and decision tree learning approaches in machine learning.
2. To explain neural network learning models and methods for evaluating hypotheses in machine learning.
3. To describe Bayesian learning approaches, computational learning theory and instance-based learning methods in machine learning.
4. To illustratenetic algorithms, rule-based learning approaches and reinforcement learning techniques for adaptive problem solving.
5. Toexplainanalyticallearningtechniquesandtheintegrationofinductiveandanalytical approaches using prior knowledge.

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

1. Apply concept learning methods and decision tree algorithms for solve classification problems.
2. Implement artificial neural networks and hypothesis evaluation techniques for classification and prediction tasks.
3. Differentiate probabilistic, theoretical, and instance-based learning models for solving machine learning tasks.
4. Formulate solutions for complex learning tasks using evolution ary, rule-based and reinforcement learning methods.
5. Integrate inductive and analytical learning methods for effective knowledge-based problem solving

UNIT–I: Introduction-Well-posed learning problems, designing alearning system, Perspectives and issues in machine learning Concept learning and the general to specific ordering - introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias. Decision Tree Learning - Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypo thesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

UNIT–II: Artificial Neural Networks: Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm. Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks. Evaluation Hypotheses –

Motivation, estimation hypothesis accuracy, basics of sampling theory, ageneral approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning

algorithms.

UNIT–III: Bayesian learning: Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm. Computational learning theory - Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning. Instance-Based Learning- Introduction, k-nearest neighbor algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT–IV: Genetic Algorithms: Motivation, Genetic algorithms, an illustrative example , hypo thesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms. Learning Sets of Rules - Introduction, sequential covering algorithms, learning rule sets: summary, learning First- Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution. Reinforcement Learning - Introduction, the learning task, Q- learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT–V: Analytical Learning: Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation- based learning of search control knowledge. Analytical Learning-2-Using prior knowledge to alter the search objective, using prior knowledge to augment search operators. Combining Inductive and Analytical Learning-Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis.

TEXTBOOKS:

1. Tom M. Mitchell, "Machine Learning" MGH
2. E. Alpaydin, "Introduction to Machine Learning", 3rdEdition, Prentice Hall(India)2015.
3. C.M.Bishop, "Pattern Recognition and Machine Learning (Information Science and Statistics)", Springer, 2006.
4. S.O.Haykin,"Neural Networks and Learning Machines", 3rd Edition, Pearson Education (India), 2016

REFERENCEBOOKS:

1. Stephen Marshland, Taylor and Francis, "Machine Learning: An Algorithmic Perspective", CRC Press (Taylor & Francis Group) 2014.

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2480254: DIGITAL CONTROL SYSTEMS

(PROFESSIONAL ELECTIVE-VI)

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B.TECH IV Year II SEM   L T P C
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Prerequisites: Control systems

Course Objectives: To understand the various types of systems in control system and analysis of different control system methods.
1. Mathematical modeling of sample hold circuits
2. Z- transform theory analysis
3. Stability analysis in digital control systems
4. Designing of digital control systems

Course Outcomes: After completion of this course the student will be able to
1. Understand the fundamentals of discrete-time systems and their representation.
2. Apply Z-transform techniques for analyze discrete-time systems.
3. Analyze the stability of discrete-time systems using various methods.
4. Evaluate sate-space models for control ability, observe ability and stability.
5. Design digital control systems using PID controllers, state feedback and observers.

UNIT–I: DISCRETE REPRESENTATION OF CONTINUOUS SYSTEMS
Basics of Digital Control Systems. Discretere presentation of continuous systems. Sample and hold circuit. Mathematical modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.

UNIT–II: DISCRETESYSTEM ANALYSIS
Z-Transform and Inverse Z Transform for analyzing discrete time systems mapping from s-plane to z plane. Solution of Discrete time systems . Time response of discrete time system.

UNIT–III: STABILITY OF DISCRETETIME SYSTEM
Stability analysis by Jury test. Stability analysis using bilinear transformation. Design of digital control system with dead beat response. Practical issues with dead beat response design.

UNIT –IV: STATE SPACE APPROACH FOR DISCRETE TIME SYSTEMS
State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reach- ability, Recon structibility and observ ability analysis. Effect of pole zero cancellationon the controllability & observability.

UNIT–V: DESIGN OFDIGITAL CONTROL SYSTEM & DISCRETE OUTPUT FEEDBACK CONTROL CLASSES
Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of discrete compensator. Design of discrete output feedback control.

TEXTBOOKS:

1. K.Ogata,"DigitalControlEngineering",PrenticeHall,EnglewoodCliffs,1995.
2. M.Gopal,"DigitalControlEngineering",WileyEastern,1988.
3. G.F.Franklin, J.D.Powell and M.L.Workman,"Digital Control of Dynamic Systems", Addison-Wesley, 1998.
4. B.C.Kuo,"Digital Control System",Holt, Rinehart and Winston,1980

REFERENCEBOOKS:

1. Ioan Doré Landau, "Digital Control Systems: Design, Identification and Implementation", Springer Publications, 2011.
2. Charles L Phillips and Troy Nagle "Digital Control System Analysis and Design" Prentice Hall Publications, 5th Edition 2013.