SEMESTER I

Course Code: 24HSM101	**Course Title: Professional English - I**	
Course Category: HSMC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
To improve the communicative competence of learners
To help learners use language effectively in academic /work contexts
To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.
To use language efficiently in expressing their opinions via various media.

UNIT I	**INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION**	**9**

Listening –for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form **Speaking** - Self Introduction; Introducing a friend; Conversation - politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form.

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. **Writing** - Writing emails / letters introducing oneself **Grammar** - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags **Vocabulary** - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II	**NARRATION AND SUMMATION**	**9**

Listening - Listening to podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities. **Speaking** - Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarizing of documentaries / podcasts/ interviews. **Reading** - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. **Writing** - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions **Vocabulary** - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III	DESCRIPTION OF A PROCESS / PRODUCT	9
Listening - Listen to a product and process descriptions; a classroom lecture; and advertisements about a products. **Speaking** – Picture description; giving instruction to use the product; Presenting a product; and Summarizing a lecture. Reading – Reading advertisements, gadget reviews; user manuals. **Writing** - Writing definitions; instructions; and Product /Process description. **Grammar** - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. **Vocabulary** - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words)		
UNIT IV	**CLASSIFICATION AND RECOMMENDATIONS**	**9**
Listening – Listening to TED Talks; Scientific lectures; and educational videos. Speaking – Small Talk; Mini presentations and making recommendations. Reading – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie charts etc,.) Writing – Note-making / Note-taking (*Study skills to be taught, not tested; Writing recommendations; Transferring information from nonverbal (chart, graph etc, to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.		
UNIT V	**EXPRESSION**	**9**
Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. **Speaking** –group discussions, Debates and Expressing opinions through Simulations & Role play. **Reading** – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). **Grammar** – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. **Vocabulary** - Cause & Effect Expressions – Content vs Function words.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: To listen and comprehend complex academic texts
CO2: To read and infer the denotative and connotative meanings of technical texts
CO3: To write definitions, descriptions, narrations and essays on various topics
CO4: To speak fluently and accurately in formal and informal communicative contexts
CO5: To express their opinions effectively in both oral and written medium of communication

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1	1	1	3	3	3	1	3	-	3	-	-	-
CO2	1	1	1	1	1	3	3	3	1	3	-	3	-	-	-

CO3	2	3	2	3	2	3	3	3	2	3	3	3	-	-	-
CO4	2	3	2	3	2	3	3	3	2	3	3	3	-	-	-
CO5	2	3	3	3	-	3	3	3	2	3	-	3	-	-	-

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
T2.	English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOK (S)	
R1.	Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
R2.	A Course Book on Technical English By Lakshmi Narayanan, Scitech Publications (India) Pvt. Ltd.
R3.	English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education, ISBN: 0070264244.
R4.	Effective Communication Skill, Kulbhusan Kumar, R S Salaria, Khanna Publishing House.

Course Code: 24BSC101	Course Title: Matrices and Calculus	
Course Category: BSC	Credits: 4	
L:T:P (Hours/Week) 3:1:0	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
To develop the use of matrix algebra techniques for practical applications in engineering.
To use derivatives to analyze functions such as maxima / minima, concavity, inflection points.
To apply advanced techniques of partial differentiation and Jacobian's matrices.
To develop a strong understanding of double integral calculus, apply double integrals to solve real world problems.
To enhance problem solving skills using triple integral calculus.

UNIT I	MATRICES	9+3
Eigen values and Eigenvectors of a real matrix – Properties of Eigen values and Eigenvectors – Cayley Hamilton theorem(excluding proof) – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation .		
UNIT II	**DIFFERENTIAL CALCULUS**	**9+3**
Representation of functions – Limit of a function – Continuity – Derivatives – Differentiation rules – Applications Maxima and Minima of functions of one variable – Absolute maximum and Absolute minimum – Concave upward, Concave downward.		
UNIT III	**MULTI VARIABLE CALCULUS**	**9+3**
Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobian's – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.		
UNIT IV	**DOUBLE INTEGRAL**	**9+3**
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves– Change of variables in double integrals.		
UNIT V	**TRIPLE INTEGRAL AND ITS APPLICATIONS**	**9+3**
Evaluation of Triple integrals – Simple Problems – Volume as triple integrals – Volume of solids – Change of variables in triple integrals.		
		Total: 60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Identify and solve algebraic Eigen value problems from the practical areas in the engineering.
CO2: Understand the concepts of derivatives, limit, continuity and to demonstrate the critical thinking, analytical skills in mathematical problem solving.
CO3: Apply differentiation to optimize functions of multiple variables using partial derivatives and Lagrange multiplier.
CO4: Evaluate different integration techniques to solve problems related to areas, volumes, and surface areas.
CO5: Apply triple integrals in cylindrical and spherical coordinates to compute the volumes of solids.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1		2						1			
CO2	3	3	3	1		2						1			
CO3	3	3	3	1		2						1			
CO4	3	3	3	1		2						1			
CO5	3	3	3	1		2						1			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Kreyszig Erwin, "Advanced Engineering Mathematics",10th Edition, John Wiley And Sons (Asia) Limited, New Delhi, 2019.
T2.	James Stewart, "Calculus: Early Transcendentals" ,9th Edition, Cengage Learning, New Delhi, 2017.
T3.	David C Lay, "Linear Algebra and its Applications", 5th Edition, Pearson Publications, India, 2016.

REFERENCE BOOK(S)	
R1.	Jain, R. K. and Iyengar, S.R.K., "Advanced Engineering Mathematics",5th Edition, Narsa Publications, New Delhi, 2017.
R2.	Srimantha Pal and Bhunia, S.C, "Engineering Mathematics", Oxford University Press, 2015.
R3.	Patrick M and Fitz Patrick, "Advanced Calculus", 2nd Edition, American Mathematical Society, 2006.

Course Code: 24BSC102	Course Title: Engineering Physics	
Course Category: BSC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
To apply the knowledge of properties of matter in real world engineering applications.
To analyze and characterize fiber optics and laser beams.
To analyze thermal properties of matter and energy transfer processes.
To analyze and explain the semiconductor materials and its application.
To understand and apply the fundamental principles and mathematical formalism of quantum physics.

UNIT I	PROPERTIES OF MATTER	9
Introduction– Elasticity– Stress– strain: Types of strain– Hooke's law– Stress – Strain Diagram and uses – Yield point– Elastic limit– Elastic moduli – Types of elastic moduli – Relation between elastic constants– Poisson's Ratio – Factors affecting elasticity– Bending of beam– Expression for bending moment and depression – Cantilever: Theory and Experimental determination– Expression for Young's modulus by Non uniform– Uniform bending and experimental determination– I– shape girders– Other states of matter.		
UNIT II	**LASER AND FIBER OPTICS**	**9**
LASER: Interaction of radiation with matter (Quantum mechanical view) : Principle of spontaneous emission and stimulated emission – Einstein Coefficients– Derivation – Difference between spontaneous emission and stimulated emission – Basic components in Laser – Principle of laser – properties of laser – Types of lasers: Nd– YAG laser, CO_2 laser, Semiconductor laser: Homojunction – Heterojunctions – Application of laser. FIBER OPTICS: Principle of optical fibers – acceptance angle– total internal reflection – numerical aperture – types of optical fibre– losses in fibres: scattering losses– absorption losses – fiber optics sensors: Displacement sensors– pressure sensor with micro bending concept– application of fiber optic sensors– characteristics advantages of fiber optical sensors.		
UNIT III	**THERMAL PHYSICS**	**9**
Transfer of heat energy – conduction– convection– radiation – Thermal expansion of solids: Relation between α and β – Thermal expansion of liquids– Thermal Conduction/Conductivity: Heat conduction in solids – Heat Conduction through Compound media Series and Parallel – Radial flow of Heat – Analogy between thermal and electrical		

conduction – Experimental Measurement of Thermal Conductivity: Forbes Method (Good Conductor) – Lee's Disc Method for finding Thermal Conductivity (Bad Conductor) – Convection: Thermal insulation – U– values– Radiation: High temperature furnace – Heat Exchangers – Greenhouse effect – Solar power – Refrigerators – Ovens.		
UNIT IV	**SEMICONDUCTOR AND ITS APPLICATION**	**9**
Introduction – Basics of the band theory of solids – Types of semiconductors – Hall effect – determination of Hall coefficient – P– N junction diode – voltage – current characteristics of a P– N junction diode – Introduction to opto electronic devices – LED– construction, working and applications – OLED – construction, working and applications – Solar cell– construction, working and applications.		
UNIT V	**QUANTUM PHYSICS**	**9**
Introduction – Black body radiation – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one– dimensional box – Tunnelling – Scanning tunnelling microscope.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Apply the knowledge of properties of matter to real world engineering applications.
CO2: Analyze and characterize fiber optics and laser beams.
CO3: Understand the behavior of thermal system.
CO4: Analyze and explain the semiconductor materials and its application.
CO5: Understand fundamental principles and mathematical formalism of quantum physics.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	2	2								
CO2	3	2	2	1	2	2	2					1			
CO3	3	2	2	2	2	2	1				1				
CO4	3	2	2	2	2	2	2					1			
CO5	3	2	1	2	2	2	2								

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Avathanulu, M.N and Kshirsagar, P.G, "A text book of Engineering Physics", 11th Edition,S. Chand and company, 2014.

T2.	Bhattacharya, D.K and Poonam, T., "Engineering Physics", Oxford University Press, 2017.
T3.	Halliday, D., Resnick, R. and Walker, J., "Principles of Physics",9th Edition, Wiley, 2010.
REFERENCE BOOK(S)	
R1.	Arthur Beiser, "Concepts of Modern Physics",9th Edition, Tata McGraw Hill, 2015.
R2.	Gaur, R. K. and Gupta, S. L., "Engineering Physics", DhanpatRai Publications, Edition 2014.
R3.	Muhammad H.Rashid, "Power Electronics", Pearson Education / PHI, 2004.

Course Code: 24ESC102	Course Title: Basic Civil and Mechanical Engineering	
Course Category: ESC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
To understand the properties and applications of essential building materials.
To learn the principles of foundation construction, types of masonry, and various flooring finishes for residential and industrial buildings.
To gain knowledge of basic manufacturing processes, metal joining techniques, and fundamental machining operations.
To understand the classification, working principles, and recent developments of boilers and different types of power plants.
To learn the principles of refrigeration and air conditioning systems, including the terminology, processes, and typical layouts of domestic and commercial units.

UNIT I	BUILDING MATERIALS	9
Overview of civil engineering – Qualities of good building stone – Qualities of good brick – Cement composition, types and uses – Properties and uses of tor steel, structural steel sections, timber – Concrete – Grade of concrete – Properties of reinforced concrete– Smart materials.		
UNIT II	**COMPONENTS OF STRUCTURE**	**9**
Foundation –Different types of foundation – Failures – Bearing capacity of soil – Masonry – Brick masonry –Types of bond– Stone masonry –Beams –Columns –Lintels– Roofing– Flooring – Types of floor finishing for Residential, Industrial buildings– Plastering.		
UNIT III	**INTRODUCTION TO JOINING AND MACHINING PROCESSES**	**9**
Overview of Mechanical Engineering, Manufacturing Process: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications. Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing and their applications. Basic Machining operations: Turning, Drilling, Milling and Grinding.		
UNIT IV	**BOILERS AND POWER PLANTS**	**9**
Classification of Boilers – Working principle of Boilers– Applications and recent developments of Boilers – Classification of Power Plants– Working principle of steam, Gas, Diesel, Hydro – electric and Nuclear Power plants.		

UNIT V	REFRIGERATION AND AIR CONDITIONING SYSTEM	9
Terminology of Refrigeration and Air Conditioning.Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner.Properties of air – water mixture, concepts of psychometric and its process.		
		Total: 45Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Identify and evaluate the properties of various building materials for construction projects.
CO2: Analyze different types of foundations and masonry techniques to ensure structural integrity.
CO3: Apply knowledge of manufacturing and metal joining processes to practical engineering tasks.
CO4: Understand and explain the operational principles and classifications of various types of power plants and boilers.
CO5: Design and evaluate refrigeration and air conditioning systems for residential and commercial applications.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		1	1	1	1	2	1	2		2	2	1	1
CO2	3	2			1	1	1	2	1	2		2	2	1	1
CO3	3	2			1	1	1	2	2	2		2	2	1	1
CO4	3	2			1	1	1	2	1	2		2	2	1	1
CO5	3	2		1	1	1	1	2	1	2		2	2	1	1

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Shanmugam,G. and Palanichamy,M. S.,"Basic Civil and Mechanical Engineering", 1st Edition, McGraw Hill Education, 2018.
T2.	Venugopal,K. andPrabhu Raja, G.,"Basic Civil and Mechanical Engineering" , 1st Edition, AnuradhaPublicaions, 2018.
T3.	Ramamrutham S., "Basic Civil Engineering",DhanpatRai Publishing Co.(P) Ltd, 2013.

REFERENCE BOOK(S)	
R1.	Palanikumar, K.,"Basic Mechanical Engineering", ARS Publications, 2018.
R2.	Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, 2005.
R3.	Shantha Kumar S.R.J., "Basic Mechanical Engineering", Hi–tech Publications, Mayiladuthurai,2000.

Course Code: 24ESC103	Course Title: Engineering Graphics	
Course Category: ESC	Credits: 4	
L: T:P (Hours/Week) 2:4:0	Total Contact Hours: 90	Max Marks: 100

COURSE OBJECTIVES
• To provide knowledge on fundamentals of engineering drawings and conic sections.
• To impart skill on orthographic projections of points and lines.
• To familiarize on projection of planes and simple solids.
• To provide knowledge on section of solids and development of surfaces of simple solids.
• To impart skill on conversion of isometric view to orthographic projection and vice versa.

UNIT I	CONCEPTS AND PLANE CURVES	6+12
Definition, standards, drawing tools, drawing sheets, scales, line and its types. Practices on lettering, numbering, dimension of drawings. Construction of conic sections – ellipse, parabola and hyperbola using eccentricity method – Cycloid and involute of circle and square.		
UNIT II	**PROJECTION OF POINTS, LINES AND PLANE SURFACE**	**6+12**
Orthographic projection – principles– Principal planes – First angle projection – projection of points. Projection of straight lines inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes inclined to both the principal planes by rotating object method (Square, Circle, Polygonal surfaces).		
UNIT III	**PROJECTION OF SOLIDS AND FREE HAND SKETCHING**	**6+12**
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Layout of views – Freehand sketching of multiple views from pictorial views of objects by free hand sketching.		
UNIT IV	**PROJECTION OF SECTIONED SOLIDS AND DEVLOPMENT OF SURFACES**	**6+12**
Introduction to section of solids. Section of simple solids in simple vertical position, when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones. Application of sections of solids and development of lateral surfaces.		
UNIT V	**ISOMETRIC AND PERSPECTIVE PROJECTION**	**6+12**
Principles of isometric projection – isometric scale – Isometric projections of simple solids		

and truncated solids – Prisms, pyramids, cylinders, cones – combination of two solid objects in simple vertical positions – Applications of isometric projection. Perspective projection of simple solids – Prisms, pyramids and cylinders by visual ray method – Applications of perspective projection.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY NOT FOR EXAMINATION)

Introduction to computer aided drafting and dimensioning using appropriate software. 2D drawing commands: Zoom, Picture editing commands, Dimensioning, Isometric drawing, Isoplanes and 3D drafting. Plotting of drawing. Practice includes drawing the projection of lines and solids. Prepare isometric view of simple solids like prisms, pyramids, cylinders and cones.

Total : 90 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Construct the conic curves, involutes and cycloid.
CO2: Construct the projections of points, lines and planes.
CO3: Draw the projections of simple solids.
CO4: Draw the development of simple solids.
CO5: Draw the orthographic, isometric and perspective projections of simple solids.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2		2					3		2	2	2	
CO2	3	1	2		2					3		2	2	2	
CO3	3	1	2		2					3		2	2	2	
CO4	3	1	2		2					3		2	2	2	
CO5	3	1	2		2					3		2	2	2	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Venugopal, K. and PrabhuRaja, V., “Engineering Graphics”, New Age International (P) Limited,2019.
T2.	Natrajan, K.V., “A text book of Engineering Graphics” , Dhanalakshmi Publishers, Chennai,2019.

T3.	Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015.

REFERENCE BOOK(S)	
R1.	Bhatt, N.D, “Engineeirng Drawing” , 1st Edition,Charotar Publishing House, 2010.
R2.	BasantAgarwal and Agarwal C.M., “Engineering Drawing”, 1stEdition, Tata McGraw HillPublishing Company Limited, 2008.
R3.	K Leo Dev Wins., “Engineering Drawing”, Pearson (Wins) Publications, 2019.

Course Code: 24HSM102	Course Title: Heritage of Tamils	
Course Category: HSMC	Credits: 1	
L: T: P(Hours/Week): 1:0:0	Total Contact Hours: 15	L: T:P (Hours/Week): 1:0:0

அலகு I	மொழி மற்றும் இலக்கியம்	3
இந்திய மொழிக்குடும்பங்கள்தமிழ்ஒருசெம்மொழி -திராவிடமொழிக- தமிழ்செவ்விலக்கியங்கள் சங்க -இலக்கியத்தின் சமயச்சார்பற்ற தன்மை சங்க -இலக்கியத்தில் பகிர்தல் அறம் -திருக்குறளில் மேலாண்மைக்கருத்துக்கள் தமிழ் -காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள்- சிற்றிலக்கியங்கள் -தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.		
அலகு II	மரபு- பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரைசிற்பக்கலை -	3
நடுகல் முதல் நவீனசிற்பங்கள் வரை - ஐம்பொன்சிலைகள்- பழங்குடியினர்மற்றும் அவர்கள் தயாரிக்கும் கைவினைப்பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை -சுடுமண் சிற்பங்கள் - குமரி -நாட்டுப்புறதெய்வங்கள்முனையில் திருவள்ளுவர் சிலை - இசைக்கருவிகள்மிருதங்கம்-, பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின்சமூகபொருளாதார வாழ்வில் கோவில்களின் பங்கு.		
அலகு III	நாட்டுப்புறக் கலைகள் மற்றும் வீரவிளையாட்டுகள்	3
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஒயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி,புலியாட்டம் தமிழர்களின் விளையாட்டுகள்.		
அலகு IV	தமிழர்களின்திணைக்கோட்பாடுகள்	3
தமிழகத்தின் தாவரங்களும், விலங்குகளும் தொல்காப்பியம்-மற்றும் சங்க இலக்கியத்தில்அகம் மற்றும் புறக்கோட்பாடுகள் தமிழர்கள்- போற்றிய அறக்கோட்பாடு சங்ககாலத்தில்–தமிழகத்தில் எழுத்தறிவும்,		

கல்வியும் சங்ககால-நகரங்களும் துறைமுகங்களும் சங்ககாலத்தில்– ஏற்றுமதி மற்றும் இறக்குமதி கடல்கடந்த– நாடுகளில் சோழர்களின் வெற்றி.		
அலகு V	**இந்திய தேசிய இயக்கம் மற்றும் இந்தியபண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு**	**3**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு -இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப்பண்பாட்டின் தாக்கம் சுயமரியாதை - இயக்கம் இந்தியமருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு- கல்வெட்டுகள், கையெழுத்துப்படிகள்தமிழ்புத்தகங்களின் -- .அச்சுவரலாறு.		

UNIT I	**LANGUAGE AND LITERATURE**	**3**
Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidasan.		
UNIT II	**HERITAGE -ROCK ART PAINTINGS TO MODERN ART– SCULPTURE**	**3**
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.		
UNIT III	**FOLK AND MARTIAL ARTS**	**3**
Therukoothu, Karagattam, VilluPattu, KaniyanKoothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.		
UNIT IV	**THINAI CONCEPT OF TAMILS**	**3**
Flora and Fauna of Tamils &Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.		
UNIT V	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL**	**3**

	MOVEMENT AND INDIAN CULTURE	
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.		
		Total: 15 Hours

TEXT BOOK(S)	
T1.	தமிழகவரலாறு –மக்களும்பண்பாடும் –கே .கே .பிள்ளைவெளிமீது : தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்.

REFERENCE BOOK(S)	
R1.	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print).
R2	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
R3	Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
R4	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
R5	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
R6	Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
R7	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
R8	Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)

Course Code 24ESC121	**Course Title: Engineering Physics Laboratory**

Course Category: ESC	Credits: 2	
L: T: P (Hours/Week): 0:0:4	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES:

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student an active participant in each part of all lab exercises

LIST OF EXPERIMENTS	
1.	Determination of Young's modulus -Non-uniform bending method.
2.	Determination of Rigidity modulus – Torsion Pendulum.
3.	Determination of Young's modulus – Cantilever method.
4.	Determination of thickness of a thin wire – Air Wedge.
5.	Determination of Planck's constant – Photoelectric effect.
6.	Determination of band gap of a semiconductor.
7.	Lee's disc – Determination of thermal conductivity of a bad conductor.
8.	Determination of the wavelength of the laser using grating–Laser.
9.	Hall Effect in Semiconductor. Determine the Hall coefficient, carrier concentration and carrier mobility.
10.	Semiconductor Laser: a. Determination of wavelength of laser b. Determination acceptance angle and numerical aperture of an optical fibre.
	Total: 60 Hours

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-

High-3; Medium-2; Low-1; No Correlation - -

TEXT BOOK(S)

T1.	Practical physics G.L squires Cambridge university plus
T2.	Jayaraman: Engineering Physics laboratory manual Edition, 2013
T3.	Sesha Sai kumar Vemula:" Engineering Physics laboratory Lab manual Edition 2017
T4.	D.K Bhattacharya and Poonam Tandon :"Engineering Physics Edition 2015.

REFERENCE BOOK(S)	
R1.	Naidu: "Engineering Physics "(Pearson).
R2	Malik and Singh : " Engineering Physics (Tata McGraw-Hill Education Pvt. Ltd.,)

Course Code: 24HSM103	**Course Title: Professional English - II**

Course Category: HSMC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To engage learners in meaningful language activities to improve their LSRW skills
• To enhance learners' awareness of general rules of writing for specific audiences
• To help learners understand the purpose, audience, contexts of different types of writing
• To develop analytical thinking skills for problem solving in communicative contexts
• To demonstrate an understanding of job applications and interviews for internship and placements

UNIT I	MAKING COMPARISONS	9
Listening – Evaluative Listening: Advertisements, Product Descriptions, -Audio / video; Listening and filling a Graphic Organiser (Choosing a product or service by comparison) **Speaking** – Marketing a product, Persuasive Speech Techniques. **Reading** - Reading advertisements, user manuals, brochures; **Writing** – Professional emails, Email etiquette - Compare and Contrast Essay; **Grammar** – Mixed Tenses, Prepositional phrases **Vocabulary** – Contextual meaning of words		
UNIT II	**EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING**	**9**
Listening - Listening to longer technical talks and completing– gap filling exercises. Listening technical information from podcasts – Listening to process/event descriptions to identify cause & effects - **Speaking** – Describing and discussing the reasons of accidents or disasters based on news reports. **Reading** - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, **Writing** - Writing responses to complaints. **Grammar** - Active Passive Voice transformations, Infinitive and Gerunds **Vocabulary** – Word Formation (Noun-Verb-Adj-Adv), Adverbs		
UNIT III	**PROBLEM SOLVING**	**9**
Listening – Listening to / Watching movie scenes/ documentaries depicting a technical problem and suggesting solutions. **Speaking** – Group Discussion (based on case studies), - techniques and Strategies, **Reading** - Case Studies, excerpts from literary texts, news reports etc. **Writing** – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay **Grammar** – Error correction; If conditional sentences **Vocabulary** - Compound Words, Sentence Completion.		
UNIT IV	**REPORTING OF EVENTS AND RESEARCH**	**9**

Listening – Listening Comprehension based on news reports – and documentaries – Precise writing, Summarising, **Speaking** – Interviewing, Presenting an oral report, Mini presentations on select topics; **Reading** –Newspaper articles; **Writing** – Recommendations, Transcoding, Accident Report, Survey Report **Grammar** – Reported Speech, Modals **Vocabulary** – Conjunctions- use of prepositions		
UNIT V	**THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY**	**9**
Listening – Listening to TED Talks, Presentations, Formal job interviews, (analysis of the interview performance); **Speaking** – Participating in a Role play, (interview/telephone interview), virtual interviews, Making presentations with visual aids; **Reading** – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; **Writing** – Job / Internship application – Cover letter & Resume; **Grammar** – Numerical adjectives, Relative Clauses **Vocabulary** – Idioms.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: To compare and contrast products and ideas in technical texts.
CO2: To identify cause and effects in events, industrial processes through technical texts
CO3: To analyze problems in order to arrive at feasible solutions and communicate them orally and in the written format.
CO4: To report events and the processes of technical and industrial nature
CO5: To present their opinions in a planned and logical manner, and draft effective resumes in context of job search.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
CO2	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
CO3	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
CO4	3	3	3	3	2	3	3	3	2	3	3	3	-	-	-
CO5	-	-	-	-	-	-	-	-	3	3	3	3	-	-	-

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
T2.	English for Science & Technology Cambridge University Press 2021.Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
T3	Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOK(S)	
R1.	Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
R2.	Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
R3.	Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
R4	Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
R5	Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

Course Category: BSC	Credits: 4	
L:T:P (Hours/Week) 3:1:0	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To apply probability measures in random variables and distribution functions.
• To implement the concepts of joint distributions, marginal and conditional distributions with regression analysis.
• To analyze the techniques in random processes and limiting distributions.
• To illustrate the concepts of vector space, subspaces, bases and dimension
• To acquire the concepts of linear transformations, inner product spaces and Gram Schmidt orthogonalization.

UNIT I	PROBABILITY AND RANDOM VARIABLES	9+3
Axioms of probability – Conditional probability – Baye's theorem – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.		
UNIT II	**TWO – DIMENSIONAL RANDOM VARIABLES**	**9+3**
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).		
UNIT III	**RANDOM PROCESSES**	**9+3**
Classification – Stationary process – Markov process – Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations (Statement only) – Limiting distributions.		
UNIT IV	**VECTOR SPACES**	**9+3**
Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions**.**		
UNIT V	**LINEAR TRANSFORMATION AND INNER PRODUCT SPACES EQUATIONS**	**9+3**
Linear transformation – Null spaces and ranges – Dimension theorem – Matrix representation of a linear transformations – Inner product – Norms – Gram Schmidt orthogonalization process – Adjoint of linear operations.		
Total: 60 Hours		

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

CO1: Explain the various fundamental concepts of probability.
CO2: Illustrate the basic concepts of one and two dimensional random variables and apply to modern engineering problems.
CO3: Comprehend and Use the properties of random processes in real world situations.
CO4: Describe the concept of vector spaces, linear independence and linear dependence.
CO5: Interpret the concept of linear transformation, matrix representation of linear Transformation.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3						3			1			
CO2	3	3	3						3			1			
CO3	3	3	3						3			1			
CO4	3	3	3						3			1			
CO5	3	3	3						3			1			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Gross, D., Shortle, J.F., Thompson, J.M., and Harris. C.M., "Fundamentals of Queuing Theory", 4th Edition, Wiley Student 2014.
T2.	Ibe, O.C., "Fundamentals of Applied Probability and Random Processes",1st Edition, Elsevier, Indian Reprint, 2007.
T3.	Friedberg. A.H., Insel. A.J. and Spence. L., "Linear Algebra", 4th Edition, Prentice Hall of India, New Delhi, 2004.

REFERENCE BOOK(S)	
R1.	Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
R2.	Trivedi, K.S., "Probability and Statistics with Reliability, Queuing and Computer Science Applications", 2ndEdition, John Wiley and Sons, 2002.
R3.	Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2ndEdition, Wiley India Pvt. Ltd., Bangalore, 2012.
R4.	Kolman. B. Hill. D.R., "Introductory Linear Algebra", Pearson Education, New Delhi, First Reprint, 2009.

Course Code: 24BSC103	**Course Title: Engineering Chemistry**
Course Category: BSC	**Credits: 3**

L: T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To inculcate sound understanding of water quality parameters and water treatment techniques.
• To impart knowledge on the basic principles and preparatory methods of Nano materials.
• To familiarize the students by relating the principles and preventive methods of corrosion and inculcate the working process and application of storage devices.
• To acquire knowledge in synthetic methods of fuels and understanding the combustion characteristics of different fuels.
• To gain knowledge about fuels and science of polymer and polymer reactions.

UNIT I	WATER TECHNOLOGY	9
Water: Sources and impurities, Water Quality Parameters: Definition and Significance of Colour, Odour, Turbidity, pH, Hardness, Alkalinity, TDS, COD and BOD, Flouride and Arsenic. Domestic water treatment: Sedimentation with Coagulant– Sand Filtration – Disinfection methods (UV, Ozonation, Break– point Chlorination). Desalination of Brackish water: Reverse Osmosis. Boiler troubles: Scale and Sludge, Boiler Corrosion, Caustic Embrittlement, Priming and Foaming. Treatment of Boiler Feed Water: Internal Treatment (Phosphate, Colloidal, Sodium Aluminate and Calgon Conditioning) and External Treatment – Ion Exchange demineralization and Zeolite process.		
UNIT II	**NANO CHEMISTRY**	**9**
Basics: Distinction between Molecules, Nano materials and Bulk materials; Size– Dependent Properties (Optical, Electrical, Mechanical and Magnetic); Types of Nanomaterial's: Definition, Properties and Uses of – Nanoparticle, Nano cluster, Nano rod, Nanowire and Nanotube. Preparation of Nanomaterial: Sol–Gel, Solvothermal, Laser Ablation, Chemical Vapour Deposition, Electrochemical Deposition and Electro Spinning. Applications of nanomaterial's in Medicine, Agriculture, Energy, Electronics and Catalysis.		
UNIT III	**BATTERIES AND CORROSION**	**9**
Batteries: Introduction – Types of Batteries – Primary battery (Dry Cell) – Secondary battery (Lead Acid battery, Lithium– Ion– battery) –Fuel cells H2– O2 Fuel cell, Microbial fuel cell. Corrosion – Causes– Factors – Types – Chemical, Electrochemical Corrosion (Galvanic, Differential Aeration Theory) – corrosion control – material selection and design aspects – Electrochemical protection– Sacrificial anode method and Impressed current cathodic method. Paints – constituents and function. Electroplating of copper and electroless plating of nickel.		
UNIT IV	**FUELS AND COMBUSTION**	**9**
Fuels – Solid Fuel: Coal – analysis of coal (Proximate analysis only) – Carbonization,		

Manufacture of Metallurgical Coke (Otto Hoffmann Method) – Liquid fuel – Manufacture of synthetic Petrol (Bergius process) – Octane Number, Cetane Number, Knocking in Engines – Anti Knocking Agents, Gasoline Additives, Gaseous fuel: Compressed Natural Gas(CNG) – Liquefied Petroleum Gases(LPG) – composition only – Liquid Hydrogen fuel. Combustion: Calorific value – higher and lower calorific values – Flue gas analysis (ORSAT method).		
UNIT V	**POLYMER TECHNOLOGY**	**9**
Introduction– Terminologies– Thermoplastics and Thermosetting Plastics– Types and mechanism of Polymerization: Addition (free radical)– Condensation and Copolymerization– Properties and applications of polymers– some commercial thermosetting resin– Phenol Formaldehyde resin, Amino resins, Silicone resins– some thermoplastics– Polyethylene, PVC, Polyvinyl acetate– Conducting polymer – application – LED and Liquid crystals.		
Total: 45 Hours		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the quality of water, and its treatment methods.
CO2: Understand the basic principles and preparatory methods of Nano materials.
CO3: Apply the principles of electro chemistry and corrosion in engineering.
CO4: Understand the different types of fuels, their preparation, properties and combustion characteristics.
CO5: To Apply the science of polymer and its application.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1		1	1					2			
CO2	3	2	2	1		2	2					1			
CO3	3	2	2			2	1					1			
CO4	3	2	2			1	2					1			
CO5	3	2	2	1		2						1			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Jain, P. C. and Monica Jain, "Engineering Chemistry", 17th Edition, DhanpatRaiPublishing Company (P) Ltd, New Delhi, 2018.
T2.	Sivasankar, B., "Engineering Chemistry", Tata McGraw– Hill Publishing Company Ltd, New Delhi, 2008.

T3.	Dara, S.S., "A text book of EngineeringChemistry",12th Edition,S.Chand Publishing, 2018.

REFERENCE BOOK(S)	
R1.	Murty, B. S., Shankar, P., Baldev Raj, Rath, B. B. and James Murday, "Text book of Nano science and Nanotechnology" , Universities Press– IIM Series in Metallurgy and Materials Science, 2018.
R2.	Palanna, O.G., "Engineering Chemistry", 2nd Edition, McGraw Hill Education (India) Private Limited, 2017.
R3.	Friedrich Emich, "Engineering Chemistry", Scientific International PVT. LTD, New Delhi, 2014.

Course Code: 24ESC111	**Course Title: Problem Solving and Python Programming**
Course Category: ESC	**Credits: 4**

L:T:P (Hours/Week) 3:0:2	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To understand the basics of algorithmic problem solving.
• To learn to solve problems using Python conditionals and loops.
• To define Python functions and use function calls to solve problems.
• To use Python data structures– lists, tuples, dictionaries to represent complex data.
• To do input/output with files in Python.

UNIT I	COMPUTATIONAL THINKING AND PROBLEM SOLVING	9
Fundamentals of Computing – Identification of Computational Problems – Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.		
UNIT II	**DATA TYPES, EXPRESSIONS, STATEMENTS**	**9**
Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.		
UNIT III	**CONTROL FLOW, FUNCTIONS, STRINGS**	**9**
Conditionals: Boolean values and operators, conditional (if), alternative (if– else), chained conditional (if– elif– else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, Immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.		
UNIT IV	**LISTS, TUPLES, DICTIONARIES**	**9**
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation		
UNIT V	**FILES, MODULES, PACKAGES**	**9**
Files and exceptions: text files, reading and writing files, format operator; command line		

arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0– 100).

PRACTICALS	
1.	Write an algorithm, pseudo-code, and flowchart for: a) Finding the minimum in a list b) Inserting a card in a sorted list c) Solving the Towers of Hanoi problem
2.	a) Write a Python program to exchange the values of two variables. b) Write a Python program to circulate the values of *n* variables (e.g., rotating [1,2,3,4] to [4,1,2,3]).
3.	Write a Python program to find the GCD of two numbers using: a) Loops b) Recursion
4.	a) Implement Linear Search and Binary Search in Python. b) Implement Bubble Sort and Selection Sort algorithms.
5.	Write a Python function to calculate the square root of a number using the Newton-Raphson method.
6.	a) Write a Python program to count the number of vowels and consonants in a given string. b) Implement a Python program to check if a string is a palindrome.
7.	a) Implement a program to generate and display a **student mark sheet** using lists and dictionaries. b) Implement a **retail bill preparation system** using lists and dictionaries.
8.	a) Write a Python program to copy the contents of one text file into another**.** b) Implement a program to count the number of words in a file**.**
9.	a) Write a Python program to validate voter age using exception handling. b) Implement a program to validate student marks (0-100) using exception handling.
10.	a) Create a **Python module** that includes basic mathematical functions (addition, subtraction, multiplication, division). b) Write a Python program to import and use the module**.**
	Total: 60 Hours

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

CO1: Design algorithmic solutions for fundamental computational problems.
CO2: Implement and execute basic Python programs.
CO3: Utilize conditionals, loops, and functions to develop structured Python programs.
CO4: Apply Python data structures such as lists, tuples, and dictionaries for problem-solving.
CO5: Perform file handling operations for data processing in Python.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	2						2	2	3	2	
CO2	3	3	3	3	2						2	2	3	3	
CO3	3	3	3	3	2						2		3	3	
CO4	2	2			1						1		3	3	
CO5	1	2			1						1		3	3	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
T2.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1stEdition, BCS Learning & Development Limited, 2017.

REFERENCE BOOK(S)	
R1.	Paul Deitel and Harvey Deitel, "PythonforProgrammers",1stEdition, Pearson Education, 2021.
R2.	Venkatesh, G and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
R3.	John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", 3rd Edition, MIT Press, 2021.
R4.	Eric Matthes, "Python Crash Course, A Hands – on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.

Course Code: 24EEC111	**Course Title: Electric Circuit Analysis**
Course Category: PCC	**Credits: 4**

L:T:P (Hours/Week) 3:0:2	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To introduce the basic concepts of DC and AC circuits behavior.
• To provide the different methods of circuit analysis using Network theorems.
• To educate the resonance and coupled circuits.
• To analyze the behavior of transient analysis.
• To understand the concept of port networks.

UNIT I	BASIC CIRCUITS ANALYSIS AND NETWORK TOPOLOGY	9
Fundamentals concepts of R, L and C elements– Kirchhoff 's Laws – D.C Circuits – Resistors in series and parallel circuits – A.C Circuits – Average and RMS Value –Complex Impedance – Phasor diagram – Real and Reactive Power, Power Factor, Energy –Mesh current and node voltage methods of analysis D.C and A.C Circuits– Network reduction: Voltage and Current division, Source transformation – Star to Delta and Delta to Star conversions.		
UNIT II	**NETWORK THEOREMS FOR DC AND AC CIRCUITS**	**9**
Superposition theorem, Theven in theorem, Norton theorem, Reciprocity theorem and Maximum power Transfer theorem– Millman's theorem– D.C and A.C Circuits – Applications of Network theorems		
UNIT III	**RESONANCE AND COUPLED CIRCUITS**	**9**
Series and Parallel resonance – frequency response – Bandwidth – Quality factor – Selectivity –Applications – Self– inductance – Mutual inductance – Coupling Coefficient – Series, Parallel connection of Coupled inductors – Single Tuned Coupled circuits.		
UNIT IV	**TRANSIENT ANALYSIS**	**9**
Introduction – Laplace transforms and inverse Laplace transforms– standard test signals – Natural response – Forced response – Transient response of RL, RC and RLC circuits for exponential, DC and AC (Sinusoidal) excitations using Laplace transformation technique		
UNIT V	**TWO PORT NETWORKS**	**9**
Two port networks, Z parameters, Y parameters, Transmission (ABCD) parameters, Hybrid (H) Parameters, Interconnection of two port networks, Symmetrical properties of T and π networks.		

PRACTICALS	
1.	Verifications of Ohm's law.
2.	Verifications of KVL & KCL.
3.	Verifications of Thevenin's theorem.
4.	Verification of Norton theorem.

5.	Verification of Superposition Theorem.
6.	Verification of maximum power transfer Theorem.
7.	Verification reciprocity theorem.
8.	Transient analysis of RL and RC circuits.
	Total: 60Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the concepts of basic electrical engineering.
CO2: Apply network theorems by using network reduction techniques.
CO3: Compute the concept of resonance and coupled circuits.
CO4: Analyse the transient analysis of RL, RC, and RLC circuits.
CO5: Summarize the characteristics of two port networks.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1				1		1	1	1			
CO2	3	3	2	2				1		1	1	1			
CO3	3	3	3	3				1		1	1	1			
CO4	3	3	3	3				1		1	1	1			
CO5	3	3	2	2				1		1	1	1			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis II", 8thEdition, McGraw Hill Science Engineering, 11th Reprint 2018.
T2.	Joseph Edminister and MahmoodNahvi, "Electric Circuits II, Schaum's Outline Series" , 5th Edition, Tata McGraw Hill Publishing Company, New Delhi, Reprint 2018.
REFERENCE BOOK(S)	
R1.	Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 5thEdition, McGraw Hill, 9th Reprint 2019.
R2.	Bruce Carlson, A., "Cicuits: Engineering Concepts and Analysis of Linear Electric Circuits", 2nd Edition, Cengage Learning, India Indian Reprint 2017.
R3.	Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", 5th Edition, Cengage Learning, 1st Indian Reprint 2013.

Course Code: 24HSM104	**Course Title: Tamils and Technology**	
Course Category: HSMC	**Credits: 1**	
L:T:P (Hours/Week) 1:0:0	**Total Contact Hours: 15**	**Max Marks: 100**

அலகு I	நெசவு மற்றும் பானைத் தொழில்நுட்பம்	3
சங்ககாலத்தில் நெசவுத்தொழில் –பானைத்தொழில்நுட்பம் – கருப்புசிவப்புபாண்டங்கள் –பாண்டங்களில் கீறல் குறியீடுகள்.		
அலகு II	வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:	3
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு –சங்ககாலத்தில் கட்டுமானபொருட்களும் நடுகல்லும் –சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் –மாமல்லபுரச்சிற்பங்களும், கோவில்களும் –சோழர் காலத்துப் பெருங்கோவில்கள் மற்றும் பிறவழிப்பாட்டுத்தலங்கள் –நாயக்கர்காலக் கோயில்கள் –மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரைமீனாட்சி அம்மன்ஆலயம் மற்றும் திருமலைநாயக்கர் மஹால் –செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ்காலத்தில் சென்னையில் இந்தோ –சாரோசெனிக் கட்டிடக்கலை.		
அலகு III	உற்பத்தித் தொழில்நுட்பம்	3
கப்பல் கட்டும்கலை –உலோகவியல் –இரும்புத்தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு –வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் –நாணயங்கள் அச்சடித்தல் –மணி உருவாக்கும் தொழிற்சாலைகள் –கல்மணிகள், கண்ணாடிமணிகள் – சருமம்மணிகள் –சங்குமணிகள் –எலும்புத்துண்டுகள் –தொல்லியல் சான்றுகள் –சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.		
அலகு IV	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம்	3
அணை, ஏரி, குளங்கள், மதகு –சோழர்காலக் குமிழிகள் கூம்பின் முக்கியத்துவம் –கால்நடை பராமரிப்பு –கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் –வேளாண்மை மற்றும் வேளாண்மைச்சார்ந்த செயல்பாடுகள் –கடல்சார் அறிவு –மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் –பெருங்கடல் குறித்த பண்டைய அறிவு –அறிவுசார் சமூகம்.		

அலகு V	அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்	3
அறிவியல்தமிழ்வளர்ச்சி –கணினித்தமிழ்வளர்ச்சி –தமிழ்நூல்களை மின்பதிப்பு செய்தல் –தமிழ் மென்பொருட்கள் உருவாக்கம் –தமிழ் இணையக் கல்விக்கழகம் –தமிழ் மின்நூலகம் –இணையத்தில் தமிழ் அகராதிகள் –சொற்குவைத்திட்டம்.		

UNIT I	WEAVING AND CERAMIC TECHNOLOGY	3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.		
UNIT II	**DESIGN AND CONSTRUCTION TECHNOLOGY**	**3**
Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram– Sculptures and Temples of Mamallapuram– Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple)– ThirumalaiNayakarMahal– Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period.		
UNIT III	**MANUFACTURING TECHNOLOGY**	**3**
Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel – Copper and gold – Coins as source of history – Minting of Coins – Beads making – industries Stone beads – Glass beads – Terracotta beads – Shell beads/ bone beats – Archeological evidences – Gem stone types described in Silappathikaram.		
UNIT IV	**AGRICULTURE AND IRRIGATION TECHNOLOGY**	**3**
Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu of Chola Period, Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society.		
UNIT V	**SCIENTIFIC TAMIL & TAMIL COMPUTING**	**3**
Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.		
		Total: 15Hours

TEXT BOOK(S)

T1.	தமிழகவரலாறு –மக்களும்பண்பாடும் –கே .கே .பிள்ளைவெளிமீது தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்.
T2.	கணினித்தமிழ்– முனைவர்இல .சுந்தரம்விகடன்பிரசுரம்
T3.	பொருநை –ஆற்றங்கரைநாகரிகம்தொல்லியல்துறைவெளியீடு

REFERENCE BOOK(S)	
R1.	Social Life of the Tamils – The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.

Course Code: 24BSC122	**Course Title: Engineering Chemistry Laboratory**	
Course Category: BSC	**Credits: 2**	
L: T:P (Hours/Week): 0:0:4	**Total Contact Hours: 60**	**Max Marks: 100**

COURSE OBJECTIVES
• To gain experimental knowledge of water quality parameters, such as acidity, alkalinity, hardness, DO, chloride and copper.
• To induce the students to familiarize with electro analytical techniques such as, pH metry, potentiometry and conductometry in the determination of ions in aqueous solutions.
• To gain knowledge about the synthesis of Nano particles and to understand the influence of rate of corrosion of materials depending on various factors.
• To infer the quality of some solid and liquid fuels.

LIST OF EXPERIMENTS	
1.	Determination of Total, Permanent and Temporary hardness of water by EDTA method.
2.	Estimation of Chloride content in water by Argentometric method and Determination of strength of given Hydrochloric acid by pH meter
3.	Determination of strength of Acid by Conductometric titration (Strong acid vs Strong base / Strong base vs Mixture of acids).
4.	Preparation of Gold / ZnO Nano particles by Sol– Gel Method
5.	Estimation of ferrous ion content of the given solution using Potentiometer.
6.	Determination of DO content of water sample by Winkler Method.
7.	Determination of Rate of Corrosion of Mild steel by Weight Loss Method.
8.	Determination of Efficiency of Corrosion in Mild steel.
9.	Determination of calorific value of fuel using Bomb Calorimeter.
10.	Determination of viscosity of oil using Redwood Viscometer.
	Total: 60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Analyze the quality of water samples i.e., acidity, alkalinity, chlorine content, hardness, DO and the amount of ions in solutions through volumetric techniques.
CO2: Apply knowledge in designing the engineering materials against corrosion.
CO3: Examine the preparation of Nano particles by sol-gel method.
CO 4: Experimenting the property and characteristics of solid and liquid fuels.
CO5: Analyse the impurities in solution by electro analytical techniques through quantitative method.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1		1	1		1			1	3	3	2
CO2	3	3	1	1		1	1		1			1	3	3	1
CO3	3	3	1			1	1		1			1	3	3	1
CO4	3	3	1			1	1		1			1	3	3	1
CO5	3	3	1	1		1	1		1			1	3	3	1

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Vogel's, "Text Book of Quantitative Chemical Analysis", Pearson Publications, 2014.

REFERENCE BOOK(S)	
R1.	Daniel C. Harris, "Quantitative Chemical Analysis", 7thEdition, W. H. Freeman and Company, New York, 2007.

Course Code: 24ESC121	Course Title: Engineering Practices Laboratory	
Course Category: ESC	Credits: 2	
L:T:P(Hours/Week): 0:0:4	Total Contact Hours: 60	Max Marks : 100

COURSE OBJECTIVES
• To develop practical skills in plumbing, woodwork, welding, machining, and sheet metal work.
• To understand and apply techniques for various household and industrial fittings and connections.
• To study and demonstrate the assembly and operation of common mechanical systems and components.
• To wiring various electrical joints in common household electrical wire work.
• To soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

LIST OF EXPERIMENTS	
	GROUP– A (CIVIL AND MECHANICAL)
1.	**I CIVIL ENGINEERING PRACTICE** **Plumbing Works:** a) Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches. b) Laying pipe connection to the suction & delivery side of a pump – inlet & outlet c) Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances. **Carpentry Works:** a) Sawing, planning and making common joints: T– Joint, Mortise and Tennon joint, Dovetail joint. Study a) Study of joints in door panels, wooden furniture. b) Study of common industrial trusses using models.
	II MECHANICAL ENGINEERING PRACTICE
	Welding: a) Arc welding of butt joints, lap joints, tee joints. b) Gas welding Practice. **Basic Machining:** a) Simple turning, drilling and tapping operations. **Sheet Metal Work:** a) Forming & Bending. b) Model making – Trays, funnels, etc. c) Different type of joints. **Demonstration only:**

	Study and assembling the following: a) Centrifugal pump. b) Submersible pump sets. **Demonstration only:** a) Basics of Smithy operations. b) Foundry operation like mould preparation for grooved pulley. c) Refrigeration and Air– Conditioning System.
	GROUP– B (ELECTRICAL AND ELECTRONICS)
	I ELECTRICAL ENGINEERING PRACTICE Introduction to switches, fuses, indicators and lamps – Basic switch board wiring withlamp, fan and three pin sockets. Staircase wiring. Fluorescent Lamp wiring with introduction to CFL and LED types. Energy meter wiring and related calculations/ calibration. Study of Iron Box wiring and assembly. Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac) Study of emergency lamp wiring/Water heater.
	II ELECTRONICS ENGINEERING PRACTICE **SOLDERING WORK:** a) Soldering simple electronic circuits and checking continuity. **ELECTRONIC ASSEMBLY AND TESTING WORK:** a) Assembling and testing electronic components on a small PCB. **ELECTRONIC EQUIPMENT STUDY:** a) Study an element of smart phone. b) Assembly and dismantle of LED TV. c) Assembly and dismantle of computer/ laptop
	Total: 60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Perform basic plumbing, carpentry, welding, machining, and sheet metal tasks.
: Create and interpret technical sketches for plumbing and carpentry.
: Execute basic electrical and electronics wiring and soldering.
: Analyze and assemble mechanical systems like pumps and HVAC.
CO5: Apply safety protocols in civil, mechanical, electrical, and electronics tasks.

COURSE ARTICULATION MATRIX														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1		1				1	1		2	2	1	
CO2	3	2	1		1				1	1		2	2	1	
CO3	3	2	1		2				2	1		2	2	1	
CO4	3	2	1		1				1	1		2	2	1	
CO5	3	2	1		1				1	1		2	2	1	

(1 – Low, 2 – Medium, 3 – High)

SREE SAKTHI ENGINEERING COLLEGE

(Autonomous)

REGULATION 2024

CHOICE BASED CREDIT SYSTEM

B. E ELECTRICAL AND ELECTRONICS ENGINEERING

SYLLABI

SEMESTER III

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24BSC201	Transforms and Partial Differential Equations	BSC	T	4	3	1	0	4
2	24EEC201	Electromagnetic Theory	PCC	T	4	3	1	0	4
3	24EEC202	Digital Logic Circuits	PCC	T	3	2	1	0	3
4	24EEC211	Electron Devices and Circuits	PCC	TP	5	3	0	2	4
5	24EEC212	Electrical Machines I	PCC	TP	5	3	0	2	4
6	24ESC214	Data Structures and OOPS	ESC	TP	4	2	0	2	3
7	24CDC201	Career Development Skills III	EEC	T	1	1	0	0	1
8	24CDC221	Mini Project I	EEC	P	2	0	0	2	1
9	24MAC***	Mandatory Course I*	MC	T	1	1	0	0	0
Total					**29**	**18**	**3**	**8**	**24**

Course Code: 24BSC201	**Course Title: Transforms and Partial Differential Equations**	
Course Category: BSC	**Credits: 4**	
L: T:P (Hours/Week) 3:1:0	**Total Contact Hours: 60**	**Max Marks: 100**

COURSE OBJECTIVES
• To introduce the foundational concepts of partial differential equations and their solutions for standard types.
• To present Fourier series analysis in different intervals.
• To familiarize students with the use of Fourier series methods for solving wave and heat flow problems in various contexts.
• To provide students with a solid foundation in Laplace and Fourier Transform techniques, • focusing on their mathematical formulation, properties, and applications.
• To develop Z-transform techniques for discrete-time systems.

UNIT I	PARTIAL DIFFERENTIAL EQUATIONS	9+3
Formation of partial differential equations –Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.		
UNIT II	**FOURIER SERIES**	**9+3**
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval's identity – Harmonic analysis.		
UNIT III	**APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**	**9+3**
Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction.		
UNIT IV	**FOURIER AND LAPLACE TRANSFORMS**	**9+3**
Statement of Fourier integral theorem– Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity-Laplace transform- Existence Criterion for the Laplace Transform -Laplace transform of basic functions- Fundamental properties.		
UNIT V	**Z - TRANSFORMS AND DIFFERENCE EQUATIONS**	**9+3**
Z- transforms - Elementary properties – Convergence of Z-transforms – Initial and final value theorems - Inverse Z-transform using partial fraction and convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Recognize and solve higher order partial differential equations.
CO2: Express the given function and data in terms of Fourier series.

CO3: Understand how to solve one- and two-dimensional heat flow issues as well as one-dimensional wave equations by using Fourier series techniques.
CO4: Illustrate Fourier and Laplace transforms to solve engineering problems, including signal analysis and linear differential equations with constant coefficients.
CO5: Possess the knowledge of Z transforms to analyze linear time invariant systems.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	-	2	-	-	1	-	-	-
CO2	3	3	1	1	-	-	-	-	2	-	-	1	-	-	-
CO3	3	3	1	1	-	-	-	-	2	-	-	1	-	-	-
CO4	3	3	1	1	-	-	-	-	2	-	-	1	-	-	-
CO5	3	3	1	1	-	-	-	-	2	-	-	1	-	-	-

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Veerarajan T., “Transforms and Partial Diffrential Equations”, 3rd Reprint published in 2016 by Tata McGraw Hill Education Pvt.Ltd, New Delhi.
T2.	Grewal B.S., “Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi,2018.
T2.	Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, 2018.

REFERENCE BOOK(S)

R1.	Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt. Ltd, 2021.
R2.	James. G., "Advanced Modern Engineering Mathematics", 4thEdition, Pearson Education, New Delhi, 2016.
R3.	Narayanan. S., Manicavachagom Pillay, T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students Vol. II & III ", S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

Course Code: 24EEC201	Course Title: Electromagnetic Theory	
Course Category: PCC	Credits: 4	
L: T:P (Hours/Week) 3:1:0	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To introduce the basic mathematical concepts related to electromagnetic vector field.
• To impart knowledge on the concepts of Electrostatic fields and their applications.
• To gain knowledge on the concepts of Magneto static fields and its applications.
• To know about the different methods of emf generation and Maxwell's equations.
• To gain knowledge on Electromagnetic waves and characterizing parameters.

UNIT I	VECTOR ANALYSIS	9+3
Sources and effects of electromagnetic fields - Coordinate Systems - Differential Elements of Length, Surface and Volume - Vector fields -Gradient of a scalar field - Divergence of a vector field - Curl of a vector filed - Gauss's Divergence Theorem - Stoke's Theorem.		
UNIT II	**STATIC ELECTRIC FIELD**	**9+3**
Coulomb's Law - Electric potential - Electric field and equipotential plots, Uniform and Non-Uniform field, Electric field in free space, conductors - Dielectric polarization -Dielectric strength - Electric field in multiple dielectrics - Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.		
UNIT III	**STATIC MAGNETIC FIELD**	**9+3**
Lorentz force - Biot-Savart's Law - Ampere's Circuit Law - H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) - B in free space, conductor, magnetic materials - Magnetization, Magnetic field in multiple media - Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.		
UNIT IV	**ELECTRODYNAMIC FIELDS**	**9+3**
Magnetic Circuits - Faraday's law - Transformer and motional EMF - Displacement current - Maxwell's equations (differential and integral form) - Relation between field theory and circuit theory - Electromagnetic boundary conditions - Applications of Electrodynamic fields.circuit theory - Electromagnetic boundary conditions - Applications of Electrodynamic fields.		

UNIT V	**ELECTROMAGNETIC WAVES**	**9+3**
Electromagnetic wave generation and equations - Wave parameters; velocity, intrinsic impedance, propagation constant - Waves in free space, loss and lossless dielectrics, conductors - skin depth –Reflection of plane wave by a perfect conductor and dielectric- Poynting vector-Poynting theorem and EM power flow.		
		Total: 60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Apply the basic mathematical concepts related to electromagnetic vector fields.
CO2: Examine the concepts of electrostatic fields and their applications.
CO3: Infer the concepts of magneto static fields and its applications.
CO4: Perform analysis using concepts related to electrostatics, magneto statics and Electrodynamics.
CO5: Understand electromagnetic wave propagation and characterize the parameters.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	3	2	1				3	1				1	3	2	1
CO2	3	2	1				1	1				1	3	2	1
CO3	3	2	1				1	1				1	3	2	1
CO4	3	2	1				1	1				1	3	2	1
CO5	3	2	1				1	1				1	3	2	1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Mathew N. O. Sadiku, S.V. Kulkarni "Principles of Electromagnetics", 6th Edition, Oxford University Press Inc. Asian edition, 2015.
T2.	William H. Hayt and John A. Buck, "Engineering Electromagnetics", McGraw Hill Special Indian edition, 2014.
T3.	Kraus and Fleish, "Electromagnetics with Applications", 5th Edition, McGraw Hill InternationalEditions, 2010.

REFERENCE BOOK(S)

R1.	V.V.Sarwate, "Electromagnetic fields and waves", 2nd Edition, Newage Publishers,2018.

R2.	J.P.Tewari, "Engineering Electromagnetics - Theory, Problems and Applications",2nd Edition, Khanna Publishers 2013.
R3.	Joseph. A.Edminister, "Schaum's Outline of Electromagnetics", 5th Edition (Schaum's Outline Series), McGraw Hill, 2018.
R4.	S.P.Ghosh, Lipika Datta, "Electromagnetic Field Theory", 1st Edition, McGraw Hill Education (India) Private Limited, 2017.
R5.	K A Gangadhar, "Electromagnetic Field Theory", 16th Edition, Khanna Publishers; 2015.

Course Code: 24EEC202	**Course Title: Digital Logic Circuits**	
Course Category: PCC	**Credits: 3**	
L: T:P (Hours/Week) 2:1:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To study various number systems and Digital Logic families.
• To introduce the fundamentals of combinational and sequential digital circuits.
• To study the design of various synchronous circuits.
• To study the design of various asynchronous circuits.
• To introduce programmable logic devices and logic families.

UNIT I	**NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES**	**6+3**
Number system, error detection, corrections & codes conversions, Boolean algebra: De-Morgan‟s theorem, switching functions and minimization using K-maps & Quine McCluskey method.		
UNIT II	**COMBINATIONAL CIRCUITS**	**6+3**
Combinational logic - representation of logic functions-SOP and POS forms - simplification and implementation of combinational logic - multiplexers and de multiplexers - code converters, adders, subtractors, Encoders and Decoders.		
UNIT III	**SYNCHRONOUS SEQUENTIAL CIRCUITS**	**6+3**
Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits - Moore and Mealy models - Counters, state diagram; state reduction; state assignment.		
UNIT IV	**ASYNCHRONOUS SEQUENTIAL CIRCUITS**	**6+3**
Asynchronous sequential logic Circuits - Transition stability, flow stability - race conditions, hazards &errors in digital circuits; analysis of asynchronous sequential logic circuits.		
UNIT V	**PROGRAMMABLE LOGIC DEVICES AND LOGIC FAMILIES**	**6+3**
Introduction to Programmability Logic Devices: PROM - PLA - PAL, CPLD - FPGA. - Digital Logic Families - comparison of RTL, DTL, TTL, ECL and MOS families - operation, characteristics of digital logic family.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Use various number systems and characteristics of digital logic families and apply K- maps and Quine Mc Cluskey methods.
CO2: Design and implement combinational circuit such as multiplexers and demultiplexers - Code converters, adders, subtractors, Encoders and Decoders.
CO3: Design various synchronous circuits using Flip Flops.
CO4: Implement asynchronous sequential circuits.
CO5: Analyse the Programmability Logic Devices and Logical Families.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1				1				1	2		1
CO2	2	2	2	1				1				1	2		1
CO3	2	2	2	1				1				1	1		1
CO4	2	2	2	1				1				1	2		1
CO5	2	3	3	1				1				1	2		1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Morris Mano.M, "Digital Logic and Computer Design", 3rd Edition, Prentice Hall of India, 2005.
T2.	The 2nd Edition (2007, McGraw-Hill US) can also be found via used booksellers and some online retailers.
T3.	Thomas L Floyd, "Digital fundamentals", 11th Edition, Pearson Education Limited, 2018.

REFERENCE BOOK(S)

R1.	Tocci R.J., Neal S. Widmer, "Digital Systems: Principles and Applications", 12th Edition, Pearson Education Asia, 2017.
R2.	The 8th Edition is the newest version of Digital Principles and Applications, published by McGraw Hill Education India in 2014 or 2015.

Course Code: 24EEC211	Course Title: Electron Devices and Circuits	
Course Category: PCC	Credits: 4	
L: T:P (Hours/Week) 3:0:2	Total Contact Hours: 75	Max Marks: 100

COURSE OBJECTIVES
• To understand the structure of basic Semiconductor devices.
• To familiarize the operation and applications of transistor like BJT and FET.
• To explore the characteristics of amplifier, gain and frequency response.
• To gain knowledge on Multistage Amplifiers and Differential Amplifier
• To learn the required functionality of Oscillators, positive and negative feedback systems.

UNIT I	SEMICONDUCTOR DEVICES	9
PN junction diode, Zener diode -structure, operation and I/O characteristics, diffusion and transition capacitance - Clipping & Clamping circuits - LED - Rectifiers - Half Wave and Full Wave Rectifier, Zener as regulator.		
UNIT II	**TRANSISTORS**	9
BJT, JFET, MOSFET, UJT structure, operation, characteristics - Need for Biasing - DC load line analysis of biasing circuits - Operating point - Biasing methods.		
UNIT III	**AMPLIFIERS**	9
BJT small signal model - Analysis of CE, CB, CC amplifiers- Gain and frequency response - MOSFET small signal model - Analysis of CS and Source follower - Gain and frequency response - High frequency analysis.		
UNIT IV	**MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER**	9
Cascade amplifier, Differential amplifier - Common mode and Difference mode analysis - MOSFET input stages - tuned amplifiers - Gain and frequency response - Neutralization methods.		
UNIT V	**FEEDBACK AMPLIFIERS AND OSCILLATORS**	9
Advantages of negative feedback - voltage / current, series, Shunt feedback - positive feedback - Condition for oscillations, phase shift - Wien bridge, Hartley, Colpitts and Crystal oscillators.		

	PRACTICALS
1.	Characteristics of Semiconductor diode, Zener diode.
2.	Characteristics of full wave rectifiers with filters.

3.	Characteristics of NPN Transistor under common emitter configurations.
4.	Characteristics of JFET and draw the equivalent circuit.
5.	Characteristics of UJT and draw the equivalent circuit.
6.	Design and frequency response characteristics of a Common Emitter amplifier.
7.	Simulation of Frequency response of CASCADE amplifier
8.	Simulation of phase shift, Wien Bridge, Hartley and Colpitts oscillators.
	Total: 75 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain the structure and operation of PN junction devices, Clipper, Clamper, Rectifier and Regulator circuits.
CO2: Analyze the structure and characteristics BJT, JFET, MOSFET and UJT.
CO3: Analyze the performance of various configurations of BJT and MOSFET based amplifier.
CO4: Explain the characteristics of MOS based cascade and differential amplifier.
CO5: Explain the operation of various feedback amplifiers and oscillators.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2				1				1	3		1
CO2	2	2	3	2				1				1	3		1
CO3	2	2	3	2				1				1	3		1
CO4	2	2	3	2				1				1	3		1
CO5	2	2	3	2				1				1	3		1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	David A. Bell, "Electronic devices and circuits", 5th Edition, Oxford University higher education, 2008.
T2.	Adel S. Sedra, Kenneth C. Smith, with Tony Chan Carusone & Vincent Gaudet, "Microelectronic circuits", Oxford University Press, November 15, 2019 (print); digital versions in 2020.

REFERENCE BOOK(S)	
R1.	Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits", 2nd Edition, PHI learning private limited, 2014.
R2.	Thomas L. Floyd, "Electronic devices Conventional current version", 10th Edition, Pearson prentice hall, 2017.
R3.	Donald A Neamen, "Electronic Circuit Analysis and Design", 4th Edition, Tata McGraw Hill, September 2009.
R4.	Robert L.Boylestad, "Electronic devices and circuit theory", 14th Edition, Pearson prentice Hall, 2023.
R5.	Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", 2nd Edition, CRC Press, 2012.

Course Code: 24EEC212	Course Title: Electrical Machines-I	
Course Category: PCC	Credits: 4	
L: T:P (Hours/Week) 3:0:2	Total Contact Hours:75	Max Marks: 100

COURSE OBJECTIVES
• To Understand the construction, working principle and characteristics of DC generator.
• To Understand the construction, working principle, characteristics, starting and speed control methods of DC motors.
• To identify the appropriate test to determine the performance parameters of a given DC machine.
• To realize the constructional details, principle of operation of single-phase transformer and Auto transformer. To predict the performance and testing methods of single-phase transformer.
• To know about three phase circuits and three phase transformer connections.

UNIT I	DC GENERATORS	9
Principle of operation, constructional details - Armature windings and its types - EMF equation, wave shape of induced emf - Methods of excitation - Armature reaction - Compensating winding - commutation, methods of improving commutation, interpoles - Characteristics of different types of DC Generators - Parallel operation of DC Generators -Applications of DC Generators.		
UNIT II	**DC MOTORS**	**9**
Principle of operation - Significance of back emf - Torque equations and power developed by armature - Speed control of DC motors - Starting methods of DC motors - Characteristics of DC motors.		
UNIT III	**TESTING OF DC MACHINES**	**9**
Losses and efficiency in DC machine, condition for maximum efficiency. Testing of DC Machines: Brake test - Swinburne's test - Hopkinson's test - Field test -Retardation test - Separation of core losses - applications of DC motors.		
UNIT IV	**TRANSFORMER AND TESTING OF TRANSFORMERS**	**9**
Construction and principle of operation - EMF equation - No load and load conditions - Equivalent circuit - Phasor diagrams - Voltage regulation - Parallel operation of single-phase transformers - Separation of core losses - Applications of single-phase transformer. Losses and efficiency - All day efficiency - Testing - Polarity test, Open circuit and Short circuit tests - Back-to-Back test. Construction and working of Auto transformer - Applications of autotransformer.		
UNIT V	**THREE PHASE CIRCUITS AND THREE PHASE TRANSFORMERS**	**9**

Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced and unbalanced – phasor diagram of voltages and currents – power measurement in three phase circuits– Power Factor Calculations. Three Phase Transformer - Construction - Types of connections - Scott connection - Applications of Scott connection.

PRACTICALS	
1.	Load test on DC shunt motor.
2.	Load test on DC compound motor.
3.	Load test on DC series motor.
4.	Swinburne's test and speed control of DC shunt motor.
5.	Load test on single-phase transformer.
6.	Open circuit and short circuit tests on single phase transformer.
7.	OCC and Load characteristics of Separately excited DC Shunt Generator.
8.	OCC and Load characteristics of Self excited DC Shunt Generator.
	Total: 75 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Apply the principles of magnetic circuits and standards to analyze the constructional features and operation of DC Generator.
CO2: Analyze the principle of operation, back EMF and Torque equation, Starting and Speed control methods of DC motor.
CO3: Analyze the efficiency and performance of DC machines through various testing methods such as Brake test, Swinburne's test and Hopkinson's test.
CO4: Analyze the construction, Principle of operation of Single-phase Transformer and auto transformer. Performance and Equivalent circuits of Single-phase Transformer.
CO5: Describe the working of three phase circuits and working principle of three phase transformer with different types of connections.

COURSE ARTICULATION MATRIX

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	-	-	-	1	-	-	-	1	3	2	2
CO2	3	3	2	2	-	-	-	1	-	-	-	1	3	1	1

CO3	3	3	1	1	-	-	-	1	-	-	-	1	3	1	1
CO4	1	2	1	1	-	-	-	1	-	-	-	1	3	3	2
CO5	1	2	1	1	-	-	-	1	-	-	-	1	3	3	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	J. Nagrath and D. P. Kothari, "Electric Machines", 5th Edition, McGraw Hill Education, 2017
T2.	P. S. Bimbhra, "Electric Machinery", 2nd Edition, Khanna Publishers, 2021.

REFERENCE BOOK(S)	
R1.	A. E. Fitzgerald and C. Kingsley, "Electric Machinery", 16thEdition, New York, McGraw Hill Education, 2017.
R2.	A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2018.
R3.	M. G. Say, "Performance and design of AC machines", 2nd Edition, CBS Publishers, 2018.
R4.	Sahdev S. K., "Electrical Machines", Cambridge University Press, 2018.

Course Code: 24ESC214	Course Title: Data Structures and OOPS	
Course Category: ESC	Credits:3	
L: T:P (Hours/Week) 2:0:2	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To apply the concepts of Linked List in the applications of various linear data structures.
• To demonstrate the understanding of stacks, queues and their applications.
• To apply the concepts of Linked List in the applications of various nonlinear data structures, • various sorting techniques in real time scenarios.
• To understand Object Oriented Programming concepts and basics of Java programming
• To know the principles of packages

UNIT I	LINEAR DATA STRUCTURES - LIST	6
Introduction to Data Structures, abstract data types, Linear list - singly linked list implementation, insertion, deletion and searching operations on linear list, ADT - list ADT - Doubly Linked List - Circular Linked List.		
UNIT II	**STACK AND QUEUE**	**6**
Stack - Operations, Applications of stack - Evaluation of Arithmetic Expressions, Queues-Priority Queues-Application - Enqueue Operation - Dequeue operations.		
UNIT III	**NON-LINEAR DATA STRUCTURE**	**6**
Trees - Binary Trees, Traversals, Binary Search Trees, Insertion and Deletion algorithms, Sorting: Insertion Sort - Heap Sort - Merge Sort - Linear Search - Binary Search.		
UNIT IV	**INTRODUCTION TO OOP AND JAVA**	**6**
Overview of OOP - Object oriented programming paradigms - Features of Object-Oriented Programming - Java Buzzwords - Overview of Java - Data Types, Variables and Arrays - Operators - Control Statements - Programming Structures in Java - Defining classes in Java - Constructors Methods - Access specifiers - Static members - Java Doc comments.		
UNIT V	**INHERITANCE AND PACKAGES**	**6**

Overloading Methods - Objects as Parameters - Returning Objects -Static, Nested and Inner Classes. Inheritance: Basics- Types of Inheritance -Super keyword - Method Overriding - Dynamic Method Dispatch - Abstract Classes - final with Inheritance. Packages: Packages - Packages and Member Access - Importing Packages - Interfaces.

PRACTICALS	
1.	Implementation of Single Linked List (Insertion, Deletion and Display).
2.	Implementation of Doubly Linked List (Insertion, Deletion and Display).
3.	Implementation of Stack using Array and Linked List implementation.
4.	Implementation of Queue using Array and Linked List implementation.
5.	Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection).
6.	Solve problems by using sequential search, binary search, and quadratic sorting algorithms (insertion).
7.	Develop stack and queue data structures using classes and objects.
8.	Develop a java application with an Employee details and generate pay slips for the employees with their gross and net salary.
	Total:60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand and apply the various concepts of Linear data Structures.
CO2: Understand and apply the various concepts of Non-Linear data Structures.
CO3: Understand and apply the various sorting concepts.
CO4: Apply the concepts of classes and objects, inheritance, to solve simple problems.
CO5: Develop programs using packages and interfaces.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	2	1							1	1	1	
CO2	1	1	2	1	1							2	1	1	
CO3	1	1	2	1	1							2	1	1	
CO4	1	1	2	1	1							2	1	1	
CO5	1	1	2	1	1							1	1	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2015.
T2.	V. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education, 2017.
T3.	Herbert Scheldt, "JAVA - The Complete Reference", Tata McGraw Hill, 2019.
T4.	Cay S Horstmann, "Core Java Volume1 - Fundamentals", Pearson Education, 2020.

REFERENCE BOOK(S)	
R1.	Langsam, Augenstein and Tanenbaum, "Data Structures Using C and C++", Pearson Education, 2nd Edition, 2015.
R2.	Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest and Clifford Stein, "Introduction to Algorithms", 4th Edition, Mcgraw Hill/ MIT Press, 2022.
R3.	Harvey M Deitel and Paul J Deitel, "Java How to Program, Early Objects", Pearson Education, 2017.
R4.	Paul Deitel and Harvey Deitel, "Java 9 for Programmers", Pearson Education, 2017.

SREE SAKTHI ENGINEERING COLLEGE
(Autonomous)
REGULATION 2024

CHOICE BASED CREDIT SYSTEM

B. E ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER IV

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24BSC203	Statistics and Numerical Methods	BSC	T	4	3	1	0	4
2	24BSC207	Environmental Science and Sustainability	BSC	T	2	2	0	0	2
3	24EEC203	Measurements and Instrumentation	PCC	T	3	3	0	0	3
4	24EEC213	Microprocessors and Microcontrollers	PCC	TP	5	3	0	2	4
5	24EEC214	Linear Integrated Circuits and Applications	PCC	TP	5	3	0	2	4
6	24EEC215	Electrical Machines - II	PCC	TP	5	3	0	2	4
7	24CDC202	Career Development Skills -IV	EEC	T	1	1	0	0	1
8	24CDC222	Mini Project II	EEC	P	2	0	0	2	1
9	24MAC221	Summer Internship I	MC	P	0	0	0	0	0
Total					**27**	**18**	**1**	**8**	**23**

Course Code: 24BSC203	**Course Title: Statistics and Numerical Methods**	
Course Category: BSC	**Credits: 4**	
L: T:P (Hours/Week) 3:1:0	**Total Contact Hours: 60**	**Max Marks: 100**

COURSE OBJECTIVES
• To explore the knowledge of testing of hypothesis for small and large samples.
• To describe how to design experiments and analyze the data.
• To interpret the basic concepts of solving algebraic and transcendental equations.
• To analyze the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration.

- To acquire the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I	**TESTING OF HYPOTHESIS**	**9+3**
Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.		
UNIT II	**ANALYSIS OF VARIANCE**	**9+3**
One way and two-way classifications – Completely randomized design – Randomized block design– Latin square design.		
UNIT III	**SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**	**9+3**
Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Iterative methods of Gauss Seidal– Eigen values of a matrix by Power method.		
UNIT IV	**INTERPOLATION AND NUMERICAL INTEGRATION**	**9+3**
Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Numerical single integration's using Trapezoidal and Simpson's 1/3 rules.		
UNIT V	**NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**9+3**
Single step methods: Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne's predictor corrector methods for solving first order differential equations.		
		Total: 60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
Apply statistical tests for solving engineering problems involving small and large sample tests
CO2: Illustrate the experimental data with the knowledge of ANOVA.
CO3: Apply various numerical techniques to solve algebraic and transcendental equations.
CO4: Compute intermediate values of given data, numerical derivatives and integral values.
CO5: Obtain the solution of ordinary differential equations by numerical methods.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	-	2	-	2	1	-	-	-
CO2	3	3	1	1	-	-	-	-	2	-	2	1	-	-	-
CO3	3	3	1	1	-	-	-	-	2	-	2	1	-	-	-
CO4	3	3	1	1	-	-	-	-	2	-	2	1	-	-	-
CO5	3	3	1	1	-	-	-	-	2	-	2	1	-	-	-

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", 11th Edition, Khanna Publishers, New Delhi, 2022.
T2.	Johnson, R.A., Miller, I and Freund, J., "Miller and Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education, Asia, 2021.

REFERENCE BOOK(S)

R1.	Gupta, S.C., and Kapoor, V. K., "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand & Sons, New Delhi, 2022.
R2.	Gerald, C.F. and Wheatley. P.O., "Applied Numerical Analysis", 7th Edition, Pearson Education, Asia, New Delhi, 2017.
R3.	Devore, J. L., "Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage Learning, New Delhi, 2016.

Course Code : 24BSC207	Course Title: Environmental Science and Sustainability	
Course Category: BSC	Credits: 2	
L: T: P(Hours/Week): 2: 0: 0	Total Contact Hours: 30	Max Marks: 100

COURSE OBJECTIVES
• To understand and appreciate the unity of life in all its forms, the implications of life style on the environment.
• To understand the various causes for environmental degradation.
• To understand the various energy resources and importance of energy efficiency.
• To understand individual's contribution in the environmental pollution.
• To understand the impact of pollution at the global level and also in the local environment.

UNIT I	ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY	6
Key environmental problems, their basic causes and sustainable solutions-IPAT equation-Ecosystem, earth – life support system and ecosystem components-Food Chain-Food web- Energy flow in ecosystem-Ecological succession-stages involved-Primary and secondary succession-Hydrarch- mesarch- xerarch- Importance-t ypes- mega- biodiversity- Threats due to natural and anthropogenic activities - Conservation methods.		
UNIT II	**SUSTAINING NATURAL RESOURCES AND ENVIRONMENTAL QUALITY**	**6**
Environmental hazards – causes and solutions-Biological hazards – AIDS-Malaria-Chemical hazards- BPA-PCB-Phthalates-Mercury-Nuclear hazards- Risk and evaluation of hazards- Water foot print-virtual water-blue revolution-Water quality management and its conservation-Solid and hazardous waste – types and waste management methods-Sustainable Development Goals (SDG).		
UNIT III	**ENERGY RESOURCES**	**6**
Renewable –Nonrenewable energy resources- Advantages and Disadvantages – Oil-Natural Gas-Coal-Nuclear energy-energy efficiency and renewable energy-Solar Energy-Hydroelectric power-Ocean thermal energy-Wind Energy-Geothermal Energy-Energy from biomass-solar- Hydrogen revolution.		
UNIT IV	**ENVIRONMENTAL IMPACT ASSESSMENT**	**6**

Introduction to environmental impact analysis-EIA guidelines-Notification of Government of India (Environmental Protection Act – Air-water-forest and wild life)-Impact assessment methodologies-Public Awareness-Environmental priorities in India.		
UNIT V	**GLOBAL CLIMATIC CHANGE AND MITIGATION**	**6**
Climate disruption-Greenhouse Effect-Ozone layer depletion-Acid rain-Kyoto protocol- Carbon Credits-Carbon sequestration methods-Montreal Protocol-Role of Information technology in environment-Case Studies-Guest lecture by Industry Experts or R&D organization.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO 1: Understand the interrelationship between living organism and environment.
CO 2: Identify various environmental hazards and waste management techniques.
CO 3: Design various methods for the conservation of resources.
CO 4: Understand the importance of environment by assessing its impact on the human world.
CO 5: Understand the Global climatic changes and its mitigation procedures.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	-	2	-	2	1	-	-	-
CO2	3	3	1	1	-	-	-	-	2	-	2	1	-	-	-
CO3	3	3	1	1	-	-	-	-	2	-	2	1	-	-	-
CO4	3	3	1	1	-	-	-	-	2	-	2	1	-	-	-
CO5	3	3	1	1	-	-	-	-	2	-	2	1	-	-	-

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	T1. G. Tyler Miller and Scott E. Spoolman (2016), Environmental Science, 15th Edition, Cengage learning.
T2.	George Tyler Miller, Jr. and Scott Spoolman (2012), Living in the Environment – Principles, Connections and Solutions, 17th Edition, Brooks/Cole, USA.

REFERENCE BOOK(S)	
R1.	David M. Hassenzahl, Mary Catherine Hager, Linda R. Berg (2011), Visualizing Environmental Science, 4thEdition, John Wiley & Sons, USA.

Course Code: 24EEC203	Course Title: Measurements and Instrumentation	
Course Category: PCC	Credits: 3	
L: T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
To educate the fundamental concepts of measurement and errors.
To impart the knowledge on the functional aspects of measuring instruments.
To infer the importance of various types of bridge circuits
To educate the fundamental working of transducers and their applications.
To summarize the overall measurement and instrumentation with the knowledge on digital instrumentation principles.

UNIT I	CONCEPTS OF MEASUREMENTS	9
Functional Elements of a generalized measurement system - -Errors in measurement, types of errors - Static and dynamic characteristics -Statistical evaluation of measurement data-Standards and calibration, Need for calibration.		
UNIT II	**MEASUREMENT OF PARAMETERS IN ELECTRICAL SYSTEMS**	**9**
Classification of instruments –PMMC instrument - Expression for deflecting and control torques-moving coil and moving iron meters - Dynamometer type watt meter -Single phase induction type and two element energy meter - Megger – Current transformer and Potential transformer-principle of working- ratio and phase angle errors.		
UNIT III	**AC/DC BRIDGES AND INSTRUMENTATION AMPLIFIER**	**9**
Resistance measuring of low resistance by using Kelvin's double bridge, medium resistance by using Whetstone's bridge–Measurement of inductance- Maxwell's bridge, Hay's bridge, Anderson's bridge. Measurement of capacitance –Schering Bridge. Measurement of frequency -Wien's bridge - Errors and compensation in A.C. bridges - Instrumentation Amplifier-three amplifier configuration.		
UNIT IV	**TRANSDUCERS FOR MEASUREMENT OF NON- ELECTRICAL PARAMETERS**	**9**
Classification of transducers - Measurement of pressure, temperature, displacement, flow, angular velocity – Principle and operation of Linear variable Differential Transformer- Digital transducers-Shaft Encoders-Smart Sensors- Proximity Sensors.		

UNIT V	DIGITAL INSTRUMENTATION	9
A/D converters: potentiometric, ramp type, voltage to frequency type, Dual slope integration type, characteristics - D/A converters: Weighted Resistor DAC,2R ladder DAC working and characteristics - Display devices -Cathode ray tube– block schematic – digital storage oscilloscope		

Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the fundamental art of measurement in engineering.
CO2: Classify various measuring instruments used to measure electrical quantities
CO3: Describe the operating principle DC and AC of bridges.
CO4: Explain the various types of transducers and their characteristics.
CO5: Illustrate the concept of digital instruments and display units.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO3
CO1	3	2				2		2				3	3	3	3
CO2	3	2	2	2			2			2		3	3	3	3
CO3	3	2	2			2						3	3	3	3
CO4	3	2	2					2					3	3	3
CO5	3	2	2	2			2			2		3	3	3	3

(1 - Low, 2 - Medium, 3 – High)

TEXT BOOK(S)

T1.	A.K. Sawhney and Puneet Sawhney, “A Course in Electrical and Electronic Measurements & Instrumentation” , Dhanpat Rai and Co, New Delhi, 2016.
T2.	H.S. Kalsi, “Electronic Instrumentation”, Tata McGraw-Hill, New Delhi, 2010.

REFERENCE BOOK(S)

R1.	M.M.S. Anand, “Electronics Instruments and Instrumentation Technology”, Tata McGraw-Hill, New Delhi, 2017.

R2.	E. O. Doebelin and D. N. Manik, "Measurement Systems - Application and Design", 6th Edition, Tata McGraw-Hill, New Delhi, 2017.
R3.	W.Bolton, "Programmable Logic Controllers", 6th Edition, Elseiver, 2015.
R4.	R.B. Northrop, "Introduction to Instrumentation and Measurements", 3rd Edition, Taylor & Francis, New Delhi, 2014.
R5.	J.J. Carr, "Elements of Electronic Instrumentation and Measurement", Pearson Education India, New Delhi, 2011.

Course Code: 24ECC213	Course Title: Microprocessors and Microcontrollers	
Course Category: PCC	Credits: 4	
L: T:P (Hours/Week) 3:0:2	Total Contact Hours: 75	Max Marks: 100

COURSE OBJECTIVES
To study the architecture, addressing modes & instruction set of 8085.
To study the architecture, addressing modes & instruction set of 8051 and to develop skill in simple program writing for 8051.
To explore the **PIC microcontroller architecture** and learn programming methods.
• To gain practical knowledge of the **Arduino platform**, including its architecture, GPIO usage.
• To apply interfacing techniques to connect external devices with **8085 and 8051**, and design embedded systems with modules.

UNIT I	8085 MICROPROCESSOR	9
Overview and comparison of microprocessors and microcontrollers – 8085 Functional block diagram – Timing Diagram – Interrupt structure - Instruction format and addressing modes – Data transfer, data manipulation & control instructions – Simple Programming - Subroutine instructions - Stack.		
UNIT II	**8051 MICROCONTROLLER**	**9**
Functional block diagram - Instruction format and addressing modes – Interrupt structure – Timer – I/O ports – Serial communication, Simple programming - Usage of IDE for assembly language programming.		
UNIT III	**PIC MICROCONTROLLER**	**9**
Architecture of PIC 16F8xx - Memory organization – Addressing modes – Instruction set - Programming techniques – Timers – I/O ports – Interrupt programming.		
UNIT IV	**ARDUINO**	**9**
Arduino platform - Architecture – Programming - The Arduino Boards - Arduino Peripherals - Arduino IDE – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins.		
UNIT V	**INTERFACING OF PROCESSOR AND CONTROLLERS**	**9**
8085: 8255 PPI - 8251USART and 8254 Timer/Counter – 8051: Keyboard and Display		

interface – Temperature control system – Stepper motor control – ESP8266 Wi-Fi module	
PRACTICALS	
PROGRAMMING EXPERIMENTS WITH µP 8085	
1.	Programming with control instructions: Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers, Rotate instructions, Hex / ASCII / BCD code conversions.
2.	Interface Experiments: A/D Interfacing. D/A Interfacing. Traffic light controller
PROGRAMMING EXPERIMENTS WITH µC 8051	
3.	Stepper motor controller interface.
4.	Displaying a moving/ rolling message in the student trainer kit's output device.
SIMULATION WITH PIC MICROCONTROLLER	
5.	Simulate a program to blink an LED connected to a PIC I/O pin.
6.	Simulate to Generate PWM signal to control DC motor speed.
PROGRAMMING EXPERIMENTS WITH ARDUINO	
7.	Interfacing Arduino to GSM module.

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Interpret the architecture, instruction sets and operations of 8085 microprocessor.
CO2: Apply programming skills to develop basic assembly language programs for 8085 and 8051 microcontrollers.
CO3: Develop simple embedded programs using PIC microcontroller with timers, I/O ports, and interrupts.
CO4: Build simple real-time applications using Arduino boards and peripherals
CO5: Design and interface external devices with processors/controllers for automation and control applications.

8.	Interfacing Arduino to Bluetooth Module.
	Total: 75 Hours

TEXT BOOK(S)	
T1.	Ramesh S. Gaonkar, "Microprocessor Architecture Programming and Application", Pen ram International (P)ltd., Mumbai, 6th Education, 2013.
T2.	Muhammad Ali Mazidi & Janice Gilli Mazidi, "The 8051 Micro Controller and Embedded Systems", Pearson Education, Second Edition 2011.
T3.	Muhammad Ali Mazidi & Janice Gilli Mazidi, "The PIC Micro Controller and Embedded Systems", 2016.

COURSE ARTICULATION MATRIX															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**
CO1	3	2	1	1	1							1	3	2	
CO2	3	3	2	1	2					1		1	3	3	
CO3	3	3	3	2	3					1		1	3	3	2
CO4	3	3	3	2	3				1	1		1	3	3	2
CO5	3	3	3	2	3				1	1		1	3	3	3

T4	Simon Monk, "Programming Arduino: Getting Started with Sketches", 2nd Edition, McGraw Hill, 2016.

REFERENCE BOOK(S)	
R1.	Douglas V. Hall, "Micro-processors & Interfacing", Tata McGraw Hill 3rd Edition, 2017.
R2.	Krishna Kant, "Micro-processors & Micro-controllers", Prentice Hall of India, 2007.
R3.	Mike Predko, "8051 Micro-controllers", McGraw Hill, 2009
R4.	Kenneth Ayala, "The 8051 Microcontroller", Thomson, 3rd Edition 2004.
R5.	Massimo Banzi & Michael Shiloh, "Getting Started with Arduino", 3rd Edition, Maker Media, 2015.

Course Code: 24EEC214	Course Title: Linear Integrated Circuits and Applications	
Course Category: PCC	Credits: 4	
L: T:P (Hours/Week) 3:0:2	Total Contact Hours: 75	Max Marks: 100

COURSE OBJECTIVES
To gain knowledge on IC fabrication procedure.
To analyze the AC and DC characteristics of OP-AMPs.
To understand the various applications of OP-AMP.
To acquire knowledge about the Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
To gain knowledge on Instrumentation Amplifier and its application.

UNIT I	FUNDAMENTALS OF IC FABRICATION	9
IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realization of monolithic ICs and packaging. Fabrication of diodes, capacitance, 85 resistances, FETs and PV Cell.		
UNIT II	**OPERATIONAL AMPLIFIER CHARACTERISTICS**	**9**
Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Voltage-shunt feedback and inverting amplifier - Voltage series feedback: and Non-Inverting Amplifier - Basic applications of op-amp, summer, differentiator and Integrator-V/I & I/V converters.		
UNIT III	**ADVANCED APPLICATIONS OF OP-AMPS**	**9**
Instrumentation amplifier and its applications for transducer Bridge, Log and Antilog Amplifiers- Analog multiplier & Divider, first and second order active filters, comparators, multi vibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using OP-AMPs.		

UNIT IV	FUNCTIONAL AND SPECIAL PURPOSE ICS	9
Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage-controlled oscillator IC; 565-phase locked loop IC, AD633 Analog multiplier ICs.		

UNIT V	APPLICATION-SPECIFIC INTEGRATED CIRCUITS	9
AD623 Instrumentation Amplifier and its application as load cell weight measurement - IC voltage regulators - LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variability voltage regulators, switching regulator - SMPS - ICL 8038 function generator IC.		

PRACTICALS	
1.	Design and implement the Boolean Functions.
2.	Construct and test the Adder circuits.
3.	Design and implement Subtractor circuits.
4.	Design logic circuits to convert: Excess-3 to BCD and Binary to Gray code converter.
5.	Design and implement Parity generator and parity checking.
6.	Design inverting and non-inverting amplifier circuits using an operational amplifier.
7.	Simulation using tuned Collector Oscillator
8.	Simulation Using Wein Bridge Oscillator
	Total: 75 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the IC fabrication process and manufacturing techniques of semiconductors.
CO2: Analyze electrical characteristics and design basic operational amplifier
CO3: Illustrate the design, operation, and applications of advanced op-amp circuits.
CO4: Explain the functional blocks, performance characteristics, and applications of key IC components.
CO5: Describe the applications of ICs in analog circuits.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2				1				1	2	1	
CO2	2	2	3	2				1				1	2	1	

CO3	2	2	3	2	1			1				1	2	1	
CO4	2	2	3	2	1			1				1	2	1	
CO5	2	2	3	2				1				1	2	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	David A. Bell, "Op-amp & Linear ICs", Oxford, 4th Edition, 2019
T2.	D. Roy Choudhary, Shail B. Jani, "Linear Integrated Circuits", New Age, 4th Edition, 2020.
T3.	Ramakant A.Gayakward, "Op-amps and Linear Integrated Circuits", 4th Edition, Pearson Education, PHI 2021.

REFERENCE BOOK(S)	
R1.	Fiore, "Opamps and Linear Integrated Circuits Concepts and applications", Cengage, 2010.
R2.	Floyd and Buchla, "Fundamentals of Analog Circuits", Pearson, 4th Edition, 2018.
R3.	Jacob Millman and Christos C.Halkias, "Integrated Electronics - Analog and Digital circuits system", 2nd Edition, McGraw Hill, 2017.
R4.	Robert F.Coughlin and Fredrick F. Driscoll, "Op-amp and Linear ICs", 6th Edition, Pearson, 2012.
R5.	Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuit", 5th Edition, McGraw Hill , 2020.
R6.	Muhammad H. Rashid, "Microelectronic Circuits Analysis and Design", 3rd Edition, Cengage Learning, 2018.

Course Code: 24EEC215	Course Title: Electrical Machines - II	
Course Category: PCC	Credits: 4	
L: T:P (Hours/Week) 3:0:2	Total Contact Hours: 75	Max Marks: 100

COURSE OBJECTIVES
• To educate the Construction, principle of operation and performance of three phase induction machines.
• To impart the knowledge on the Performance and speed control of three-phase induction motors.
• To educate the Construction, principle of operation and performance of single-phase induction motors and special machines.
• To educate the Construction and performance of salient and non - salient type synchronous generators.
• To impart the knowledge on the Principle of operation and performance of synchronous motor.

UNIT I	THREE PHASE INDUCTION MOTOR	9
Types - Construction - MMF in Distributed AC Windings - Rotating Magnetic Field - Principle of Operation - Torque equation - Slip-Torque Characteristics - Equivalent Circuit - Phasor Diagram Losses and efficiency.		
UNIT II	**PERFORMANCE AND CONTROL OF 3-PHASE INDUCTION MOTOR**	**9**
No-Load and Blocked Rotor Tests - Performance prediction by Circle Diagram - Starters - Cogging and Crawling - Speed Control - Braking - Principle of Induction Generators.		
UNIT III	**SINGLE PHASE INDUCTION MOTOR**	**9**
Construction, Principle of Operation - Double Revolving Field Theory - Equivalent Circuit - Methods of Starting - Types: Split phase, Capacitor type, Shaded pole and Universal Motor.		
UNIT IV	**SYNCHRONOUS GENERATOR**	**9**

Construction - types - Winding Factors - EMF Equation - Armature Reaction - Voltage Regulation; EMF, MMF, and ZPF Methods - Parallel Operation - Synchronization - Synchronizing power - Two reaction theory - Slip test - Phasor Diagrams - Voltage Regulation.		
UNIT V	**SYNCHRONOUS MOTOR**	9
Principle of Operation - Methods of Starting - Phasor Diagrams - Power Flow Equations - Effect of Varying load angle and excitation - V and Inverted V Curves - Synchronous Condenser - Hunting and Suppression Techniques.		

PRACTICALS	
1.	Regulation of three phase alternator voltage regulation methods.
2.	Separation of No-load losses of three-phase induction motor.
3.	Regulation of three phase salient pole alternator by slip test.
4.	Load test on three-phase induction motor.
5.	No load and blocked rotor tests on three-phase induction motor (Determination of equivalent circuit parameters).
6.	Load test on single-phase induction motor.
7.	No load and blocked rotor test on single-phase induction motor.
8.	V and Inverted V curves of Three Phase Synchronous Motor.
	Total:75 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
: Apply the principles of operation of three-phase induction motors to solve problems related to torque and power output.
: Analyze various starting and speed control methods of three-phase induction motors to determine their efficiency.
: Evaluate the performance of single-phase induction motors by examining their equivalent circuits and starting methods.
: Design the equivalent circuit and phasor diagram of synchronous generators to predict their regulation and performance.

: Examine the operation and power factor improvement methods of synchronous motors to assess their efficiency in power systems.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3				1					2	1	
CO2	3	3	2	3				1					2	1	
CO3	3	3	1	1				1					2	1	
CO4	3	3	2	3				1					2	1	
CO5	3	3	2	3				1					2	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	D P Kothari, I J Nagrath, “Electric Machines”, McGraw Hill Education (India) Private Limited, New Delhi, 2017.
T2.	K Murugesh Kumar, “Electrical Machines - II”, Vikas Publishing House, New Delhi, 2010.

REFERENCE BOOK(S)	
R1.	Bimbhra P S, “Electrical Machinery”, Khanna Publishers, New Delhi, 2011.
R2.	A E Fitzgerald and Charles Kingsley Jr, Stephen D. Umans, “Electric Machinery”, Tata McGraw-Hill, New Delhi, 2011.
R3.	Ashfaq Husain, “Electric Machines”, Dhanpat Rai & Co., New Delhi, 2011.
R4.	Bhattacharya S K, “Electrical Machines”, Tata McGraw-Hill, New Delhi, 2011.

SREE SAKTHI ENGINEERING COLLEGE

(Autonomous)

REGULATIONS 2024

CHOICE BASED CREDIT SYSTEM

B. E-ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM & SYLLABI

SEMESTER V

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24EEC301	Control Systems	PCC	T	4	3	1	0	4
2	24EEC302	Transmission and Distribution	PCC	T	4	3	0	0	3
3	24EEC311	Power Electronics	PCC	TP	4	2	0	2	3
4	24EEP***	Professional Elective I*	PEC	T/TP	3	3	0	0	3
5	24EEP***	Professional Elective II*	PEC	T/TP	3	3	0	0	3
6	24$$$***	Open Elective I*	PEC	T/TP	3	3	0	0	3
7	24EEC321	Control Systems Laboratory	PCC	P	4	0	0	4	2
8	24CDC301	Career Development Skills - V	EEC	T	1	1	0	0	1
9	24CDC321	Mini Project - III	EEC	P	2	0	0	2	1
10	24MAC***	Mandatory Course II*	MC	T	1	1	0	0	0
Total					**29**	**19**	**1**	**8**	**23**

Course Code: 24EEC301	Course Title: Control Systems	
Course Category: PCC	Credits: 4	
L: T:P (Hours/Week) 3:1:0	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To illustrate the structure and elements of control systems and apply modelling techniques using transfer functions and block diagrams.
• To analyse the time domain behaviour of control systems using standard test signals and performance measures.
• To evaluate system stability using classical methods such as Routh-Hurwitz, Root Locus, and Nyquist criteria.
• To examine frequency-domain characteristics and apply Bode and Nyquist plots for system analysis and compensator interpretation.
• To develop state-space models and assess system controllability and observability for both electrical and mechanical systems.

UNIT I	SYSTEMS AND THEIR REPRESENTATION	9+3
Open and closed loop control system -Transfer function model of Mechanical and Electrical systems- Block diagram reduction techniques - Signal flow graphs-Transfer function of Separately excited DC Generator and Motor- Synchro and servo motor (qualitative approach only)		
UNIT II	**TIME RESPONSE ANALYSIS**	**9+3**
Time response - Types of test input - Response of second order system for step input-Time domain specifications - Error coefficients - Generalized error series - Steady state error - P, PI, PID modes of feedback control.		
UNIT III	**STABILITY OF CONTROL SYSTEM**	**9+3**
Definition of Stability - Location of roots of Characteristics equation in S plane for stability - Routh Hurwitz criterion - Root locus Techniques - Effect of pole, zero addition - Concepts of Nyquist stability criterion-Nyquist plot		

UNIT IV	FREQUENCY RESPONSE ANALYSIS	9+3
Frequency response - Frequency domain specifications - Correlation between frequency domain and time domain specifications - Polar plot - Bode plot –Compensators-lag, lead and lag-lead (qualitative approach only).		
UNIT V	**STATE VARIABLE ANALYSIS**	**9+3**
Concept of State, State Variables, and State Models—Eigen values – Eigen vectors – State Space Representation of Linear Time-Invariant Systems- State variable formulation – State transition matrix State space model of separately excited DC Generator and Motor- Controllability – Observability		
		Total: 60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Develop mathematical models of physical systems using transfer functions and block diagrams.
CO2: Analyse the dynamic behaviour of systems using time-domain methods and specifications.
CO3: Evaluate system stability using root locus and Nyquist criteria.
CO4: Apply frequency-domain techniques for system analysis and compensator evaluation.
CO5: Represent control systems using state-variable approach and interpret controllability and observability.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2								2	3	2	1
CO2	3	3	3	2								2	3	2	1
CO3	3	3	3	2								2	3	2	1
CO4	3	3	2	2								2	3	2	1
CO5	3	3	3	3								2	3	2	1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	I.J. Nagrath and M. Gopal, "Control Systems Engineering", 5th Edition, New Age International Publishers, New Delhi, 2018.
T2.	M. Gopal, "Control Systems, Principles & Design", 4th Edition, Tata McGraw Hill, New Delhi, 2024.

REFERENCE BOOK(S)	
R1.	K. Ogata, "Modern Control Engineering", 5th Edition, Pearson Education, New Delhi, 2010.
R2.	R. Anandha Natarajan and B. Ramesh Babu, "Control System Engineering", 3rd Edition, Scitech Publication, 2009.
R3.	Norman S. Nise, "Control Systems Engineering", 8th Edition, John Wiley and Sons, Inc., 2020.

Course Code: 24EEC302	Course Title: Transmission and Distribution	
Course Category: PCC	Credits: 3	
L: T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To impart knowledge about the configuration of the electrical power systems.
• To study the line parameters and interference with neighboring circuits.
• To understand the mechanical design and performance analysis of transmission lines.
• To learn about different insulators and underground cables.
• To understand and analyze the distribution system.

UNIT I	TRANSMISSION LINE PARAMETERS	9
Structure of electric power system - Resistance, inductance, and capacitance of solid, stranded, and bundled conductors - Typical configuration, conductor types - Symmetrical and unsymmetrical spacing and transposition - application of self and mutual GMD; skin and proximity effects - Effects of earth on the capacitance of the transmission line.		
UNIT II	**MODELLING AND PERFORMANCE OF TRANSMISSION LINES**	**9**
Performance of Transmission lines - short line, medium line - equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance - transmission efficiency and voltage regulation, real and reactive power flow in lines - Ferranti effect - Formation of Corona - Critical Voltages - Effect on line Performance.		
UNIT III	**SAG CALCULATION AND LINE SUPPORTS**	**9**
Mechanical design of overhead lines - Line Supports - Types of towers - Tension and Sag Calculation for different weather conditions - Insulators: Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators.		
UNIT IV	**UNDERGROUND CABLES**	**9**
Underground cables - Types of cables - Construction of single-core and 3-core belted cables - Insulation Resistance - Potential Gradient - Capacitance of single-core and 3-core belted cables - Grading of cables.		

UNIT V	DISTRIBUTION SYSTEMS	9
Distribution Systems - General Aspects - Kelvin's Law - AC and DC distributions - Concentrated and Distributed loading - Techniques of Voltage Control and Power factor improvement - Distribution Loss.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the structure of power system, computation of transmission line parameters for different configurations.
CO2: Simulate transmission lines to evaluate line performance and analyze the impact of the Ferranti effect and corona on transmission efficiency.
CO3: Design and analyse overhead transmission lines under various weather conditions. Evaluate insulator types, voltage distribution, string efficiency, and testing.
CO4: Design and analyse underground cables, including construction, insulation resistance, potential gradient, capacitance, and grading techniques.
CO5: Model and analyse distribution systems, applying voltage control, power factor improvement, and loss reduction. Evaluate modern trends in AC and DC distribution.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1						1					2	2	
CO2	3	2	1	1		1		2					2	1	
CO3	3	2	1	1		1		2					2	2	1
CO4	3	2	1	1		1		2					2	1	
CO5	3	2	1	1		1		2					2	2	2

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)	
T1.	D.P.Kothari and I.J. Nagarath, "Power System Engineering", 3rd Edition, Mc Graw-Hill Publishing Company limited, New Delhi, 2019.
T2.	The 8th Edition is the latest version, released in 2022 by New Age International Pvt Ltd with approximately 958 pages, updated layout, and full-colour diagrams.
T3.	S.N. Singh, "Electric Power Generation, Transmission and Distribution", 2nd Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2008.

REFERENCE BOOK(S)	
R1.	B.R.Gupta, S. Chand, "Power System Analysis and Design", 6th Edition, New Delhi, 2011.
R2.	Arun Ingole, "Power transmission and distribution", 1st Edition, Pearson Education, 2018.
R3.	R.K.Rajput, "A Text Book of Power System Engineering", 2nd Edition, Laxmi Publications (P) Ltd, New Delhi, 2016.
R4.	Hadi Saadat, "Power System Analysis", 3rd Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2015.
R5.	J.Brian Hardy and Colin R.Bayliss "Transmission and Distribution in Electrical Engineering", 4th Edition, Elsevier, 2011.

Course Code: 24EEC311	Course Title: Power Electronics	
Course Category: PCC	Credits: 3	
L: T:P (Hours/Week) 2:0:2	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
To understand the characteristics of power semiconductor devices.
To understand the operation and applications of AC-DC power Converters.
To understand the operation and applications of DC-DC power Converters.
To understand the operation and applications of DC-AC power Converters.
To understand the operation and applications of AC-AC power Converters.

UNIT I	POWER SEMI-CONDUCTOR DEVICES	6
Analysis of switching devices - SCR, TRIAC, GTO, BJT, MOSFET and IGBT, Static characteristics - SCR, MOSFET and IGBT, Introduction to Silicon carbide (SiC) devices, Triggering and commutation circuit for SCR, Introduction to Driver and snubber circuits.		
UNIT II	**PHASE-CONTROLLED CONVERTERS**	**6**
2-pulse, 3-pulse and 6-pulse converters-performance parameters - Effect of source inductance - Firing Schemes for converter-Dual converters, Applications-light dimmer, Excitation system, Solar PV systems.		
UNIT III	**DC TO DC CONVERTERS**	**6**
Control strategy, Step-down and step-up chopper, Types of choppers-A, B, C, D and E - Switched mode regulators-Buck, Boost, Buck-Boost regulator, switching loss calculations. Introduction to Resonant Converters, Applications-Battery operated vehicles.		
UNIT IV	**INVERTERS**	**6**
Single phase and three phase voltage source inverters (both120 mode and 180 mode)-Voltage & harmonic control-PWM techniques: Multiple PWM, Sinusoidal PWM, selective harmonic elimination -Introduction to space vector modulation -Single-phase Current source inverter, Applications-Induction heating, UPS.		
UNIT V	**AC TO AC CONVERTERS**	**6**
Single phase and Three phase AC voltage controllers-Control strategy-Power Factor Control -		

Multistage sequence control -single phase and three phase cyclo converters -Introduction to Matrix converters, Applications -welding.	
PRACTICALS	
1.	Characteristics of SCR and TRIAC.
2.	Characteristics of MOSFET and IGBT.
3.	AC to DC half and fully controlled converter.
4.	Step down and step up MOSFET based choppers.
5.	IGBT based single phase PWM inverter.
6.	IGBT based three phase PWM inverter.
7.	AC Voltage controller.
8.	Simulation of PE circuits (1Φ & 3Φ semi converter, 1Φ & 3Φ full converter, dc-dc converters, ac voltage controllers).
	Total: 60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Describe the characteristics of power semiconductor devices.
CO2: Analyse the operation and performance of phase-controlled rectifiers.
CO3: Examine the operation and control of DC -DC converters.
CO4: Discuss the operation and switching strategies of DC -AC converters.
CO5: Discuss the operation and switching strategies of AC -AC converters.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3			1	1			2	3	2	1	1
CO 2	3	3	3	3	1		1	1			2	3	2	1	1
CO 3	3	3	3	3	1		2	1			3	3	2	1	1
CO 4	3	3	3	3	1			1					2	1	1
CO 5	3	3	3	3	1		1	1			2	3	2	1	1

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)	
T1.	M.H. Rashid, "Power Electronics: Circuits, Devices and Applications", 3rd Edition, Pearson Education, New Delhi, 2004.
T2.	P.S.Bimbra, "Power Electronics", 3rd Edition, Khanna Publishers, 2003.
T3.	Ned Mohan Tore. M. Undel and William. P. Robbins, "Power Electronics: Converters, Applications and Design", 3rd Edition, John Wiley and sons, 2003.

REFERENCE BOOK(S)	
R1.	Ashfaq Ahmed, "Power Electronics for Technology", Pearson Education, 2003.
R2.	Joseph Vithayathil, "Power Electronics, Principles and Applications", 6th Edition, McGraw Hill Series, 2013.
R3.	Philip T. Krein, "Elements of Power Electronics", Oxford University Press, 2004.

Course Code: 24EEC321	Course Title: Control Systems Laboratory	
Course Category: PCC	Credits: 2	
L: T:P (Hours/Week): 0:0:4	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To familiarize the students with various representations of systems.
• To simulate and analyse the behavior of control systems in both time and frequency domains.
• To examine system stability using classical methods such as Root Locus, Bode and Nyquist plots.
• To design and validate compensators and controllers to meet performance specifications.
• To develop linear models mainly state variable model and transfer function model.

LIST OF EXPERIMENTS	
1.	Study of open loop and closed loop control system using a simulation tool.
2.	Design a second order system and analyse effect of damping factor on the unit step response, verify the time domain specifications in simulation platform.
3.	Plot the Bode plot of the given transfer functions and determine Gain margin, phase margin in simulation platform.
4.	Plot the Nyquist plot of the given transfer functions and determine Gain margin, phase margin and comment on stability in simulation platform.
5.	Plot the Root loci of the given transfer function and assess the system's stability in simulation platform.
6.	Design and analyse the gain and phase plots of a lag compensator in simulation platform.
7.	Design and analyse the gain and phase plots of a lead compensator in simulation platform.
8.	Design and analysis of a PID controller for a given system (using SIMULINK/ MATLAB tool boxes.
9.	Conversion of Transfer Function to State Space Model and State Space Model into Transfer Function in simulation platform.
10.	Determine the controllability and observability using simulation.
	Total: 60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Represent physical systems using transfer function and state-space models through simulation tools.
CO2: Simulate and analyze time-domain and frequency-domain responses of control systems.
CO3: Apply classical techniques such as Root Locus, bode plot, and Nyquist plot to assess system stability.
CO4: Design and implement compensators and PID controllers to meet given performance criteria.
CO5: Develop and validate control system models using both transfer function and state-variable approaches.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	3				2	2		2	3	2	1
CO 2	3	3	3	3	3				2	2		2	3	2	1
CO 3	3	3	3	3	3				2	2		2	3	2	1
CO 4	3	3	3	3	3				2	2		2	3	2	1
CO 5	3	3	3	3	3				2	2		2	3	2	1

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	I.J. Nagrath and M. Gopal, "Control Systems Engineering", 5th Edition, New Age International Publishers, New Delhi, 2018.

REFERENCE BOOK(S)	
R1.	K. Ogata, "Modern Control Engineering", 5th Edition, Pearson Education, New Delhi, 2010.

SREE SAKTHI ENGINEERING COLLEGE

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CHOICE BASED CREDIT SYSTEM

B. E-ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM & SYLLABI

Semester VI

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24EEC303	Power System Analysis	PCC	T	3	3	0	0	3
2	24EEC304	Power System Operation Control	PCC	T	4	3	1	0	4
3	24$$$***	Open Elective II*	OEC	T/TP	3	3	0	0	3
4	24EEP***	Professional Elective III*	PEC	T/TP	3	3	0	0	3
5	24EEP***	Professional Elective IV*	PEC	T/TP	3	3	0	0	3
6	24HSM3**	Management Elective*	HSMC	T	2	2	0	0	2
7	24EEC322	Power Systems Laboratory	PCC	P	4	0	0	4	2
8	24CDC302	Career Development Skills - VI	EEC	T	1	1	0	0	1
9	24CDC322	Mini Project IV	EEC	P	2	0	0	2	1
10	24MAC321	Summer Internship - II	MC	P	0	0	0	0	0
11	24MAC***	Mandatory Course III*	MC	T	1	1	0	0	0
Total					**26**	**19**	**1**	**6**	**22**

Course Code: 24EEC303	Course Title: Power System Analysis	
Course Category: PCC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
To impact knowledge on need for operational studies, and to model the power system under steady state operating condition.
To understand and apply iterative techniques for power flow analysis.
To impart knowledge on symmetrical short circuit analysis using Thevenin's theorem and bus impedance matrix, including post-fault voltages, fault levels, and current limiting reactors.
To give insight into sequence impedances and networks for analyzing unsymmetrical faults, including LG, LL, and LLG faults at generator terminals and across the power system.
To study about the various methods for analyzing power system stability.

UNIT I	POWER SYSTEM	9
Need for system planning and operational studies - Power scenario in India - Power system components, Representation - Single line diagram - per unit quantities - p.u. impedance diagram - p.u. reactance diagram, Network graph Theory - Bus incidence matrices, Primitive parameters, Formation of bus admittance matrix – Direct inspection method – Singular Transformation method.		
UNIT II	**POWER FLOW ANALYSIS**	**9**
Bus classification - Formulation of Power Flow problem in polar coordinates - Power flow solution using Gauss Seidel method - Handling of Voltage controlled buses - Power Flow Solution by Newton Raphson method - Flow charts - Comparison of methods.		
UNIT III	**SYMMETRICAL FAULT ANALYSIS**	**9**
Assumptions in short circuit analysis - Symmetrical short circuit analysis using Thevenin's theorem - Bus Impedance matrix building algorithm (without mutual coupling) - Symmetrical fault analysis through bus impedance matrix - Post fault bus voltages - Fault level - Current limiting reactors.		
UNIT IV	**UNSYMMETRICAL FAULT ANALYSIS**	**9**

Unsymmetrical components - Sequence impedances - Sequence networks - Analysis of unsymmetrical faults at generator terminals: LG, LL and LLG - unsymmetrical fault occurring at any point in a power system.		
UNIT V	**STABILITY ANALYSIS**	**9**
Classification of power system stability - Rotor angle stability - Power-Angle equation - Steady state stability - Swing equation - Solution of swing equation by step by step method - Swing curve, Equal area criterion - Critical clearing angle and time, Multi-machine stability analysis - modified Euler method.		

Total Hours : 45

COURSE OUTCOMES
At the end of this course, students will be able to
Develop and analyze power systems under steady-state conditions using per-unit representation, network theory, and bus admittance matrices.
Analyze power flow using Gauss-Seidel and Newton-Raphson methods, incorporating voltage control and method comparison.
CO3: Infer the significance of short circuit studies in designing circuit breakers.
CO4: Ability to analyze the state of the power system for various unsymmetrical faults.
CO5: Analyze the stability of power system using different methods.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	1	1				1				1		2
CO 2	3	3	3	2	1				1				1	1	1
CO 3	3	3	3	2	1				1			1	1	1	1
CO 4	3	2	2	2	2				1			1	1	1	2
CO 5	3	3	2	2	2				1			1	1	1	1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	John J. Grainger and William D. Stevenson, Jr, "Power System Analysis", Mc Graw Hill Education (India) Private Limited, New Delhi, 2017.
T2.	Kothari D.P and Nagrath I.J, "Power System Engineering", 3rd Edition, Tata

	McGraw-HillEducation, 2019.
T3.	Hadi Saadat, “Power System Analysis”, Tata McGraw Hill Education Pvt. Ltd., NewDelhi, 2010.

REFERENCE BOOK(S)	
R1.	Pai M A, “Computer Techniques in Power System Analysis”, 3rd Edition, Tata Mc Graw-HillPublishing Company Ltd., New Delhi, 2019.
R2.	J. Duncan Glover, Mulukutla S.Sarma and Thomas J. Overbye, “Power System Analysis &Design”, 6th Edition, Cengage Learning, 2016.
R3.	P. Venkatesh, B. V. Manikandan, A. Srinivasan and S. Charles Raja, “Electrical Power Systems: Analysis, Security and Deregulation”, 2nd Edition, Prentice Hall India (PHI), 2017.
R4.	Gupta B.R., “Power System - Analysis and Design”, 5th Edition, S. Chand Publishing, 2017.

Course Code: 24EEC304	Course Title: Power System Operation and Control	
Course Category: PCC	Credits: 4	
L: T: P (Hours/Week) 3:1:0	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
To impart knowledge on the significance of power system operation and control.
To understand the real power- frequency interaction and design of power- frequency controller.
To analyze Reactive power- voltage interaction and the compensators for maintaining the voltage profile.
To understand the generation scheduling and economic operation of power system.
To impart knowledge on SCADA and its application for real time operation and control of power systems.

UNIT I	FUNDAMENTALS OF POWER SYSTEM OPERATION AND CONTROL	9+3
Power scenario in Indian grid - National and Regional load dispatching centres - Requirements of good power system - Necessity of voltage and frequency regulation - real power vs frequency and reactive power vs voltage control loops - System load variation, load curves - Load forecasting - Computational methods in load forecasting - Load shedding and Islanding - deregulation - Basics of electrical energy tariff.		
UNIT	**REAL POWER FREQUENCY CONTROL**	**9+3**
Basics of speed governing mechanisms and modelling - Speed regulation of two generators in parallel Load Frequency Control (LFC) of single area system - Static and dynamic analysis - LFC of two area system -Tie line modelling - Block diagram representation of two area system - Static and dynamic analysis - Tie line with frequency bias control - State variable model - Integration of economic dispatch control with LFC.		
UNIT	**REACTIVE POWER - VOLTAGE CONTROL**	**9+3**
Generation and absorption of reactive power - Basics of reactive power control - Automatic Voltage Regulator (AVR) - Brushless AC excitation system - Block diagram		

representation of AVR loop static and dynamic analysis - Stability compensation - Voltage drop in transmission line - Methods of reactive power injection - Tap changing transformer, SVC and STATCOM for voltage control.		
UNIT	**ECONOMIC OPERATION OF POWER SYSTEM**	**9+3**
Statement of economic dispatch problem - Input and output characteristics of thermal plant incremental cost curve - Optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) - Lambda-iteration method - Base point and participation factors method. Statement of Unit Commitment (UC) problem - Constraints on UC problem - Solution of UC problem using priority list - Special aspects of short term and long-term hydrothermal scheduling problems.		
UNIT	**COMPUTER AIDED CONTROL OF POWER SYSTEM**	**9+3**
Need of computer control of power system - Concept of energy control centers and functions - PMU system monitoring, Data acquisition and controls - System hardware configurations - SCADA and EMS functions - State estimation - Measurements and errors - Weighted least square estimation - Various operating states - State transition diagram.		
		Total: 60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the day - to - day operation of power system.
CO2: Evaluate control strategies for real power-frequency regulation.
CO3: Analyze and apply compensators for reactive power and voltage control.
CO4: Optimize day-ahead and real-time generation scheduling.
CO5: Understand the necessity of computer control of power systems.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1						1				2	2		
CO	3	2	1	1		1		2		2		2	2	1	1

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

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Olle. I. Elgerd, "Electric Energy Systems theory - An introduction", 2nd Edition, McGraw Hill Education Pvt.Ltd., New Delhi, 2017.
T2.	Allen J. Wood, Bruce F. Wollenberg, and Gerald B. Sheble "Power Generation, Operation and Control", 3rd edition, JohnWiley & Sons, Inc., 2013.
T3.	Abhijit Chakrabarti and Sunita Halder, "Power System Analysis Operation and Control", 4th Edition, PHIlearning Pvt. Ltd., New Delhi, 2018.

REFERENCE BOOK(S)	
R1.	Kothari D.P. and Nagrath I.J., "Power System Engineering", 2nd Edition, Tata McGraw- Hill Education,Reprint 2018.
R2.	Hadi Saadat, "Power System Analysis", McGraw Hill Education Pvt. Ltd., New Delhi, 2015.
R3.	Kundur P, "Power System Stability and Control", McGraw Hill Education Pvt. Ltd., New Delhi, 2015.
R4.	B.M. Weedy and B.J. Cory et al, "Electric Power systems", 5th Edition, Wiley, 2012.

Course Code: 24EEC322	Course Title: Power Systems Laboratory	
Course Category: PCC	Credits: 2	
L: T:P (Hours/Week): 0:0:4	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To provide a better understanding of modelling of transmission lines in impedance and admittance forms.
• To apply iterative techniques for power flow analysis and to carry out short circuit and stability studies on power system.
• To analyze the load – frequency and voltage controls.
• To analyze optimal dispatch of generators and perform state estimation.
• To understand the operation of relays, characteristics, and applications.

LIST OF EXPERIMENTS	
1.	Computation and modelling of transmission Lines.
2.	Formation of Bus Admittance and Impedance Matrices.
3.	Power Flow Analysis Using Gauss-Seidel Method.
4.	Power Flow Analysis Using Newton Raphson Method.
5.	Symmetric and Unsymmetrical Fault Analysis.
6.	Transient Stability Analysis of SMIB System.
7.	Load – Frequency Dynamics of Single- Area and Two-Area Power Systems.
8.	Economic Dispatch in Power Systems.
9.	State estimation: Weighted least square estimation.
10.	Performance analysis of over current relay.
11.	Performance analysis of impedance relay.
12.	Testing of CT, PT, and Insulator string.
13.	Relay Coordination in Radial Feeder Protection Scheme.
	Total: 60 Hours

COURSE OUTCOMES

On the successful completion of the laboratory, students will be able to:
CO1: Model and analyze the performance of the transmission lines.
CO2: Perform power flow, short circuit, and stability analysis for any power system network.
CO3: Understand, design, and analyze the load frequency control mechanism.
CO4: Perform optimal scheduling of generators and compute the state of the power system.
CO5: Understand, analyze, and apply the relays for power system protection.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	3	-	-	2	1	2	-	3	3	3	3
CO 2	3	3	2	2	3	-	-	2	1	2	-	3	3	3	3
CO 3	3	3	2	2	3	-	-	2	1	2	-	3	3	3	3
CO 4	3	3	2	2	3	-	-	2	1	2	-	3	3	3	3
CO 5	3	3	2	2	3	-	-	2	1	2	-	3	3	3	3

(1 – Low, 2 – Medium, 3 – High)

SREE SAKTHI ENGINEERING COLLEGE

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CHOICE BASED CREDIT SYSTEM

B. E-ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM & SYLLABI

Semester VII

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24EEC401	Industrial Automation using PLC and SCADA	PCC	T	3	3	0	0	3
2	24HSM402	Professional Ethics and Human Values	HSMC	T	2	2	0	0	2
3	24EEP***	Professional Elective V	PEC	T/TP	3	3	0	0	3
3	24$$$***	Open Elective -III	OEC	T/TP	3	3	0	0	3
4	24$$$***	Open Elective -IV	OEC	T/TP	3	3	0	0	3
5	24CDC401	Career Development Skills - VII	EEC	T	1	1	0	0	1
6	24CDC422	Project work Phase I	EEC	P	4	0	0	4	4
Total					19	15	1	4	20

Course Code: 24EEC401	**Course Title:** Industrial Automation using PLC and SCADA	
Course Category: PCC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
Understand basic PLC terminologies digital principles, PLC architecture and operation.

Familiarize different programming language of PLC.
Develop PLC logic for simple applications using ladder logic.
Understand the hardware and software behind PLC and SCADA.
Exposures about communication architecture of PLC/SCADA

UNIT I	**INTRODUCTION TO PLC**	**9**
Introduction to PLC: Microprocessor, I/O Ports, Isolation, Filters, Drivers, Micro controllers/DSP, PLC/DDC- PLC Construction: What is a PLC, PLC Memories, PLC I/O, PLC Special I/O, PLC Types.		
UNIT II	**PLC INSTRUCTIONS**	**9**
PLC Basic Instructions: PLC Ladder Language- Function block Programming- Ladder/Function Block functions- PLC Basic Instructions, Basic Examples (Start Stop Rung, Entry/Reset Rung)- Configuration of Sensors, Switches, Solid State Relays-Interlock examples- Timers, Counters, Examples.		
UNIT III	**PLC PROGRAMMING**	**9**
Different types of PLC program, Basic Ladder logic, logic functions, PLC module addressing, registers basics, basic relay instructions, Latching Relays, arithmetic functions, comparison functions, data handling, data move functions, timer-counter instructions, input-output instructions, sequencer instructions		
UNIT IV	**COMMUNICATION OF PLC AND SCADA**	**9**
Communication Protocol – Modbus, HART, Profibus- Communication facilities SCADA: - Hardware and software, Remote terminal units, Master Station and Communication architectures		
UNIT V	**CASE STUDIES**	**9**
Stepper Motor Control- Elevator Control-CNC Machine Control- conveyor control- Interlocking Problems.		

TOTAL : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Know the basic requirement of a PLC input/output devices and architecture.

CO2: Ability to apply Basics Instruction Sets used for ladder Logic and Function Block Programming.
CO3: Ability to design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function BIock.
CO4: Able to develop a PLC logic for a specific application on real world problem.
CO5: Ability to Understand the Concepts of Communication used for PLC/SCADA.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	1					1		1					
CO 2	3	3	2					1		1	2				2
CO 3	3	3	3	3	1			1		1					
CO 4	3	3		3	3			1		1			3	3	
CO 5	3	3	3	2	1			1		1			3	3	3

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Frank Petruzzula, "Programmable Logic Controllers", 6th Edition, Tata Mc-Graw Hill, 2023.
T2.	John W. Webb and Ronald A. Reis, "Programmable Logic Controllers Principles and Applications", 3rd Edition, PHI publication, 2011.
T3.	Madhuchhanda Mitra and Samarjit Sen Gupta, "Programmable Logic Controllers and Industrial Automation: An Introduction", 2nd Edition, Penram International Publishing Pvt. Ltd, 2017.

Course Code: 24HSM402	**Course Title:** Professional Ethiocs & Human Values	
Course Category: HSMC	**Credits: 2**	
L:T:P (Hours/Week) 2:0:0	**Total Contact Hours: 30**	**Max Marks: 100**

COURSE OBJECTIVES
To learn about morals, values & work ethics and how to live peacefully.

To create awareness about the customs and religions and learn different professional roles.		
To provide depth knowledge on framing of the problem and determining the facts.		
To create awareness about safety, risk & risk benefit analysis.		
To develop knowledge about global issues.		
UNIT I	**HUMAN VALUES**	**6**
Morals, Values and Ethics - Integrity - Work Ethic - Service learning - Civic Virtue - Respect for others - Living Peacefully - Caring - Sharing - Honesty - Courage - Cooperation - Commitment - Empathy - Self Confidence Character - Spirituality - Case Study.		
UNIT II	**ENGINEERING ETHICS**	**6**
Senses of Engineering Ethics-Variety of moral issued - Types of inquiry - Moral dilemmas - Moral autonomy - Kohlberg's theory - Gilligan's theory - Consensus and controversy - Models of professional roles - Theories about right action - Self-interest - Customs and religion - Uses of Ethical theories - Valuing time - Cooperation - Commitment - Case Study.		
UNIT III	**ENGINEERING AS SOCIAL EXPERIMENTATION**	**6**
Engineering as Social Experimentation - Framing the problem - Determining the facts - Codes of Ethics - Clarifying Concepts - Application issues - Common Ground - General Principles - Utilitarian thinking respect for persons - Case study.		
UNIT IV	**ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK**	**6**
Safety and risk - Assessment of safety and risk - Risk benefit analysis and reducing risk - Safety and the Engineer - Designing for the safety - Intellectual Property Rights (IPR).		
UNIT V	**GLOBAL ISSUES**	**6**
Globalization - Cross culture issues - Environmental Ethics - Computer Ethics - Computers as the instrument of Unethical behavior - Computers as the object of Unethical acts - Autonomous Computers-Computer codes of Ethics - Weapons Development - Ethics and Research - Analyzing Ethical Problems in research - Case Study.		
Total: 30 Hours		

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

: Understand and analyze the essentials of human values and skills, self-exploration, happiness and prosperity.
: Recognize the theories and principles of professional ethics.
: Understand various social issues, industrial standards, code of ethics and role of professional ethics in engineering field.
: Analyze Safety and Risk benefit analysis and acquire knowledge on professional rights and responsibilities of an engineer.
: Provide the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively.

COURSE ARTICULATION MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	1					2	1	3	1	1	2	1	1	1	
CO 2	1					3	2	3	2	1	2	1	1	1	
CO 3	1	2	2			3	3	3	2	1	1	1	1	1	
CO 4	1	2	2			3	3	3	2	1	2	1	1	1	
CO 5	1					3	2	3	2	1	1	1	1	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", 4th Edition, McGraw-Hill Education, Delhi, 2005.
T2.	M. Govindarajan, S. Natarajan and V. S. Senthilkumar, "Professional Ethics and Human Values", PHI Learning Private Limited, 2013.

REFERENCE BOOK(S)	
R1.	Jayshree Suresh and B.S. Raghavan, "Human Values and Professional Ethics", 4th Revised Edition, S.Chand & Company Limited, New Delhi, 2012.
R2.	S. B. Gogate, "Human Values and Professional Ethics", First Reprint, Vikas Publishing House Pvt. Ltd., Noida, 2014.

R3.	Charles E. Harris, Michael S. Pritchard, Ray W. James, Michael Jerome Rabins and Elaine E. Englehardt, " Engineering Ethics Concepts and Cases", 5th Edition, Wadsworth Cengage Learning, 2014.

SREE SAKTHI ENGINEERING COLLEGE

(Autonomous)

REGULATIONS 2024

CHOICE BASED CREDIT SYSTEM

B. E-ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM & SYLLABI

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24EEP***	Professional Elective VI*	PEC	T	3	3	0	0	3
2	24CDC423	Project work Phase II	EEC	P	6	0	0	6	6
Total					**9**	**3**	**0**	**6**	**9**

PROFESSIONAL ELECTIVE COURSES

PROFESSIONAL ELECTIVE COURSES I, II, III

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1.	24EEP001	Embedded Control for Electric Drives	PEC	T	3	3	0	0	3
2.	24EEP002	Digital Signal Processing	PEC	T	3	3	0	0	3
3.	24EEP003	VLSI Design	PEC	T	3	3	0	0	3
4.	24EEP004	Protection and Switchgear	PEC	T	3	3	0	0	3
5.	24EEP005	Analysis of Electrical Machines	PEC	T	3	3	0	0	3
6..	24EEP101	Electric Vehicle Design, Mechanics and Control	PEC	TP	4	2	0	2	3
7.	24EEP006	HVDC and FACTS	PEC	T	3	3	0	0	3
8.	24EEP007	Smart System Automation	PEC	T	3	3	0	0	3
9.	24EEP102	Embedded System Design	PEC	TP	4	2	0	2	3
10.	24EEP008	MEMS & NEMS	PEC	T	3	3	0	0	3

11.	24EEP103	Electrical Drives	PEC	TP	4	2	0	2	3
12.	24EEP104	Embedded C programming	PEC	TP	4	2	0	2	3
Total					**40**	**32**	**0**	**8**	**36**

Course Code: 24EEP001	**Course Title: Embedded Control for Electric Drives**	
Course Category: PEC	**Credits: 3**	
L:T:P(Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To provide the control concept for electrical drives.
• To emphasize the need of embedded systems for controlling the electrical drives.
• To provide a comprehensive understanding of speed control methods for three-phase induction motors, including PWM-VSI, fuzzy logic, and embedded control implementations.
• To provide a comprehensive understanding of BLDC motor operation, control, and implementation, including speed control, PWM, and embedded implementations.
• To familiarize the high-performance computing for SRM motor.

UNIT I	**INTRODUCTION TO ELECTRIC DRIVES**	**9**
Electric drives and its classification - Four-quadrant drive - Solid State Controlled Drives - Machine learning and optimization techniques for electrical drives.		
UNIT II	**EMBEDDED SYSTEM FOR MOTOR CONTROL**	**9**
Embedded Processors choice for motor control - Sensors and interface modules for		

Electric drives - IoT for Electrical drives applications		
UNIT III	**INDUCTION MOTOR CONTROL**	**9**
Speed control methods - PWM techniques - VSI fed three-phase induction motor - Fuzzy logic Based speed control for three-phase induction motor - Embedded processor based three phase induction motor speed control.		
UNIT IV	**BLDC MOTOR CONTROL**	**9**
Overview of BLDC Motor - Speed control methods - PWM techniques - Embedded processor based BDLC motor speed control.		
UNIT V	**SRM MOTOR CONTROL**	**9**
Overview of SRM Motor - Speed control methods - PWM techniques - Embedded processor based SRM motor speed control.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Interpret the significance of embedded control of electrical drives.
CO2: Explain the principles of operation and control of various electrical drives, including DC motors, AC motors, and servo motors.
CO3: Apply fuzzy logic control strategies to improve the performance of induction motor drives.
CO4: Explain the operating principles of BLDC motors, commutation methods, and speed-torque characteristics.
CO5: Explain the operating principles of SRMs, magnetic characteristics, and torque production.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1				1			1	1	1	
CO2	2	1	2	2	2				1			1	1	2	
CO3	2	2	2	1	2							2	2		
CO4	2	2	2	1	1							2	1	1	
CO5	1	1	2	2	1							1	1		

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	R.Krishnan, "Electric Motor Drives - Modeling, Analysis and Control", 2nd Edition, Prentice-Hall of India Pvt. Ltd., New Delhi, 2017.
T2.	Steve Kilts, "Advanced FPGA Design: Architecture, Implementation, and Optimization" Wiley, 2nd Edition, 2019.

REFERENCE BOOK(S)	
R1.	Vedam Subramanyam, "Electric Drives - Concepts and Applications", 3rd Edition, Tata McGraw - Hill publishing company Ltd., New Delhi, 2018.
R2.	K.Venkataratnam, "Special Electrical Machines", 2nd Edition, Universities Press, 2021.
R3.	Steve Furber, "ARM system on chip architecture", 3rd Edition, Pearson Education, 2021.

Course Code: 24EEP002	**Course Title: Digital Signal Processing**	
Course Category: PEC	**Credits: 3**	
L:T:P(Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To impart knowledge on the classifications of Systems, Signals & their mathematical representation.
• To impart knowledge on the discrete time systems using Z transforms and discrete time Fourier transforms.
• To give insight into transformation techniques and computation of DFT and FFT.
• To learn the concept of FIR and IIR Filters and their design for digital implementation.
• To learn programmability digital signal processor & quantization effects.

UNIT I	**SIGNALS AND SYSTEMS**	**9**
Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power - mathematical representation of signals - spectral density - sampling techniques, quantization,		

quantization error, Nyquist rate, aliasing effect.		
UNIT II	**DISCRETE TIME SYSTEM ANALYSIS**	**9**
Transform and its properties, inverse z-transforms; difference equation - Solution by z - transform, application to discrete systems - Stability analysis, frequency response - Convolution - Discrete Time Fourier transform , magnitude and phase representation.		
UNIT III	**DISCRETE FOURIER TRANSFORM & COMPUTATION**	**9**
Discrete Fourier Transform - properties, magnitude and phase representation - Computation of DFT using FFT algorithm - DIT & DIF using radix 2 FFT - Butterfly structure.		
UNIT IV	**DESIGN OF DIGITAL FILTERS**	**9**
FIR & IIR filter realization - Parallel & cascade forms. FIR design: Windowing Techniques - Need and choice of windows - Linear phase characteristics. Analog filter design - Butterworth and Chebyshev approximations: IIR Filters, digital design using impulse invariant and bilinear transformation Warping, pre-warping.		
UNIT V	**DIGITAL SIGNAL PROCESSORS**	**9**
Introduction - Architecture - Features - Addressing Formats - Functional modes - Introduction to Commercial DS Processors.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Recognize fundamental concepts of Signals and Systems.
CO2: Understand and analyze the discrete time systems.
CO3: Understand the importance of Fourier transform, digital filters and DS Processors.
CO4: Understand the types of filters and their design for digital implementation.
CO5: Explain the role of quantization in signal processing and DSP implementation.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	1	1					1			1	1	2	
CO2	1	2	1	2					2			1	1	2	
CO3	2	2	2	1					1			2	1	2	
CO4	1	2	2	2					2			2	1	2	
CO5	1	2	2	2					2			1	1	2	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	J.G. Proakis and D.G. Manolakis, "Digital Signal Processing Principles - Algorithms and Applications", 4th Edition, Pearson Education, New Delhi, PHI, 2013.
T2.	S.K. Mitra, "Digital Signal Processing – A Computer Based Approach", 4th Edition, McGraw Hill Edu, 2019.
T3.	Lonnie C. Ludeman, "Fundamentals of Digital Signal Processing", 2nd Edition, Wiley, 2021.

REFERENCE BOOK(S)	
R1.	Robert Schilling and Sandra L. Harris, "Introduction to Digital Signal Processing using MATLAB", 2nd Edition, Cengage Learning, 2018.

Course Code: 24EEP003	Course Title: VLSI Design	
Course Category: PEC	Credits: 3	
L:T:P(Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand the fundamentals of MOS transistors and their characteristics.
• To impart knowledge about the combinational logic circuits and design principles.
• To understand sequential logic circuits and clocking strategies.
• To gain knowledge about the Interconnects and Memory Architecture.
• To design the arithmetic building blocks.

UNIT I	MOS TRANSISTOR PRINCIPLES	9
MOS logic families (NMOS and CMOS), Ideal and Non Ideal IV Characteristics, CMOS devices. MOSFET Transistor DC transfer Characteristics, small signal analysis of		

MOSFET.		
UNIT II	**COMBINATIONAL LOGIC CIRCUITS**	**9**
Propagation Delays, stick diagram, Layout diagrams, Examples of combinational logic design, Elmore's constant, Static Logic Gates, Dynamic Logic Gates, Pass Transistor Logic, PowerDissipation.		
UNIT III	**SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES**	**9**
Static Latches and Registers, Dynamic Latches and Registers, Pipelines, Timing classification of Digital Systems, Synchronous Design, Self-Timed Circuit Design.		
UNIT IV	**INTERCONNECT, MEMORY ARCHITECTURE**	**9**
Interconnect Parameters - Capacitance, Resistance, and Inductance, Logic Implementation using Programmable Devices (ROM, PLA, FPGA), Memory Architecture and Building Blocks.		
UNIT V	**DESIGN OF ARITHMETIC BUILDING BLOCKS**	**9**
Arithmetic Building Blocks: Data Paths, Adders-Ripple Carry Adder, Carry-Bypass Adder, Carry Select Adder, Carry-Look Ahead Adder, Multipliers, Barrel Shifter, power and speed tradeoffs.		
		Total: 45 Hours
COURSE OUTCOMES		
At the end of this course, students will be able to		
CO1: Explain the working principle and characteristics of MOSFET.		
CO2: Design Combinational Logic Circuits.		
CO3: Design Sequential Logic Circuits and Clocking systems.		
CO4: Understand Memory architecture and interconnects.		
CO5: Design of arithmetic building blocks.		

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2							2	3	2		
CO2	2	2	2	2								2	1	2	
CO3	2		3	2							3	2	1	2	1
CO4	2	3	2	2								1		2	1
CO5	2		3	2							1	1	1		1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Jan D Rabaey and Anantha Chandrakasan, "Digital Integrated Circuits: A Design Perspective", 2nd Edition, PHI, 2021.
T2.	Neil H E Weste and Kamran Eshranghian, "Principles of CMOS VLSI Design: A SystemPerspective", 4th Edition, Addison Wesley, 2011.
T3.	M. Bushnell and V. D. Agarwal, "Essentials of Electronic Testing for Digital, Memory andMixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2000.

REFERENCE BOOK(S)	
R1.	D.A. Hodges and H.G. Jackson, "Analysis and Design of Digital Integrated Circuits", 3rd Edition, International Student Edition, McGraw Hill, 2004.
R2.	P. Rashinkar, Paterson and L. Singh, "System-on-a-Chip Verification-Methodology and Techniques", Kluwer Academic Publishers, 2001.
R3.	Samiha Mourad and Yervant Zorian, "Principles of Testing Electronic Systems", Wiley, 2000.

Course Code: 24EEP004	**Course Title: Protection and Switchgear**	
Course Category: PEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the significance of protection, protection schemes and role of earthing.
• To impart knowledge on the operating principles, characteristics, and applications of various relays, including overcurrent, directional, distance, differential, and frequency-based relays.
• To acquire practical knowledge about common faults in power system apparatus andapplying suitable protective schemes.
• To understand the functioning of static relays and numerical protection concepts.

- To understand the problems associated with circuit breaking and to discuss about variouscircuit breakers.

UNIT I	**PROTECTION SCHEMES**	**9**
Significance and need for protective schemes - nature and causes of faults - types of faults Effects of faults - Zones of protection and essential qualities of protection – Types of Protectionschemes - Power system Grounding and Methods of Grounding.		
UNIT II	**BASICS OF RELAYS**	**9**
Operating principles of relays - Universal torque equation - R-X diagram - Electromagnetic Relays - Over current, Directional and non-directional, Distance, Differential, Negative sequence and Under frequency relays.		
UNIT III	**OVERVIEW OF EQUIPMENT PROTECTION**	**9**
Current transformers and Potential transformers and their applications in protection schemes - Protection of transformer, generator, motor, bus bars and transmission line.		
UNIT IV	**STATIC RELAYS AND NUMERICAL PROTECTION**	**9**
Static relays - Phase, Amplitude Comparators - Synthesis of various relays using Static comparators - Block diagram of Numerical relays - Over current protection, transformer differential protection, and distance protection of transmission lines.		
UNIT V	**CIRCUIT BREAKERS**	**9**
Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking - re-striking voltage and recovery voltage - rate of rise of recovery voltage - current chopping - interruption of capacitive current - resistance switching - Types of circuit breakers - air blast, oil, SF6 and vacuum circuit breakers - comparison of different circuit breakers - HVDC Breaker.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand and select proper protective scheme and type of earthing.
CO2: Explain the operating principles of various relays.
CO3: Design and evaluate protection schemes for power system equipment.
CO4: Analyze the importance of static relays and numerical relays in power systemprotection.
CO5: Summarize the merits and demerits and application areas of various circuit breakers.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	2					1		2		2		
CO2	2	1	1	2					1		2		1		
CO3	2	1	1	2					1		2		1		
CO4	2	1	1	2					1		2		2		1
CO5	2	1	1	2					1		2		1		1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Sunil S.Rao, "Switchgear and Protection", 13th Edition, Khanna Publishers, New Delhi, 2023.
T2.	Badri Ram and B.H. Vishwakarma, "Power System Protection and Switchgear", 3rd Edition, McGraw Hill India, 2022.
T3.	B.Rabindranath and N.Chander, "Power System Protection and Switchgear", 2nd Edition, New Age International Pvt. Ltd Publishers, 2018.

REFERENCE BOOK(S)

R1.	Y.G.Paithankar and S.R.Bhide, "Fundamentals of power system protection", 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2013.
R2.	C.L.Wadhwa, "Electrical Power Systems", 8th Edition, New Age International (P) Ltd., 2022.
R3.	Bhavesh Bhalja, R.P. Maheshwari and Nilesh G. Chotani, "Protection and Switchgear", 2nd Edition, Oxford University Press, 2018.
R4.	VK Metha, "Principles of Power Systems", S. Chand, 4th Edition, 2022.

Course Code: 24EEP005	**Course Title: Analysis of Electrical Machines**	
Course Category: PEC	**Credits: 3**	
L:T:P(Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To model & simulate all types of Brushed-DC Electric Machines.
• To develop reference frame equations for various elements.

• To model an induction (three phase and 'n' phase) machine and derive reference frame equations and synchronous machine.
• To model a synchronous (three phase and 'n' phase) machine and derive reference frame equations.
• To study the need and working of multiphase induction and synchronous machine.

UNIT I	**MODELING OF BRUSHED-DC ELECTRIC MACHINERY**	**9**
Fundamentals of Operation - Introduction - Governing equations and modeling of Brushed DC-Motor - Shunt, Series and Compound - State model derivation - Construction of Model of a DC Machine using state equations - Shunt, Series and Compound.		
UNIT II	**REFERENCE FRAME THEORY**	**9**
Historical background - phase transformation and commentator transformation - transformation of variables from stationary to arbitrary reference frame.		
UNIT III	**INDUCTION MACHINES**	**9**
Three phase induction machine - equivalent circuit - free acceleration characteristics - voltage and torque equations in machine variables and arbitrary reference frame variables - Simulation under no - load and load conditions - Machine variable form, arbitrary reference variable form.		
UNIT IV	**SYNCHRONOUS MACHINES**	**9**
Three phase synchronous machine - voltage and torque equations in machine variables and rotor reference frame variables (Park's equations).		
UNIT V	**MULTIPHASE MACHINES CONCEPTS**	**9**
Preliminary Remarks - Necessity of Multiphase Machines - Evolution of Multiphase Machines - Advantages of Multiphase Machines - Working Principle - Multiphase Induction Machine, Multiphase Synchronous Machine - Modeling of 'n' phase machine. Applications of Multiphase Machines.		
Total: 45 Hours		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Find the modeling for a brushed DC-Motor (Shunt, Series, Compound and separatelyexcised motor) and to simulate DC motors using state models.
CO2: Apply reference frame theory for, resistive and reactive elements (three phase).
CO3: Compute the equivalent circuit and torque of three phase induction motor in machine variable arbitrary reference frame variable.
CO4: Compute the equivalent circuit and torque of synchronous motor in machine variable arbitrary reference frame variable.
CO5: Find the need and advantages of multiphase machines and Demonstrate the working of multiphase induction and synchronous machine.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3			2	1		3		2	3	3	3
CO2	3	3	3	3			2	1		3		2	3	3	3
CO3	3	3	3	3			2	1		3		2	3	3	3
CO4	3						2	1		3		2	3	3	3
CO5	3						2	1		3		2	3	3	3

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Stephen D. Umans, "Fitzgerald & Kingsley's Electric Machinery", 7th Edition, Tata McGraw Hill, 2020.
T2.	Bogdan M. Wilamowski and J. David Irwin, "The Industrial Electronics Handbook - Power Electronics and Motor Drives", 2nd Edition,CRC Press, 2011.

T3.	Paul C. Krause, Oleg Wasynczuk, Scott D. Sudhoff and Steven D. Pekarek, "Analysis of Electric Machinery and Drive Systems", 3rd Edition, Wiley-IEEE Press, 2013.

REFERENCE BOOK(S)	
R1.	Krishnan, "Electric Motor & Drives: Modeling, Analysis and Control", 1st Edition, Pearson Education, 2015.
R2.	R.Ramanujam, "Modeling and Analysis of Electrical Machines", I.k.International Publishing HousePvt. Ltd, 2018.
R3.	Chee Mun Ong, "Dynamic Simulation of Electric Machinery using MATLAB", 1st Edition, Prentice Hall.

Course Code: 24EEP101	**Course Title: Electric Vehicle Design, Mechanics and Control**
Course Category: PEC	**Credits: 3**

L:T:P(Hours/Week) 2:0:2	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To learn the basics of internal combustion engines.
• To know the EV architecture and vehicle mechanics.
• To study the energy storage system concepts.
• To learn the control preliminaries for AC Machines.
• To learn the control strategies of AC Machines.

UNIT I	INTERNAL COMBUSTION ENGINES	6
IC Engines, BMEP and BSFC, Vehicle Fuel Economy, Emission Control Systems, Treatment of DieselExhaust Emissions.		
UNIT II	**ELECTRIC VEHICLES AND VEHICLE MECHANICS**	**6**
Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings - Comparisons of EV with internal combustion Engine vehicles - Fundamentals of vehicle mechanics.		
UNIT III	**BATTERY MODELING, TYPES AND CHARGING**	**6**
Batteries in Electric and Hybrid Vehicles - Battery Basics -Battery Parameters. Types - Lead Acid Battery - Nickel - Cadmium Battery - Nickel-Metal-Hydride (NiMH) Battery - Li-Ion Battery - Li-Polymer Battery, Zinc-Air Battery, Sodium - Sulphur Battery, Sodium-Metal-Chloride, Research and Development for Advanced Batteries. Battery Modelling, Electric Circuit Models. Battery Pack Management, Battery Charging.		
UNIT IV	**CONTROL PRELIMINARIES**	**6**
Control Design Preliminaries - Introduction - Transfer Functions - Bode plot analysis for First order and second order systems - Stability - Transient Performance- Power transfer function for boost converter - Gain margin and Phase margin study - open loop mode.		
UNIT V	**CONTROL OF AC MACHINES**	**6**
Introduction - Reference frame theory, basics - modeling of induction and synchronous		

machine in various frames - Vector control - Direct torque control.

PRACTICALS	
1.	Develop a model that could estimate SoC and SoH of Li-Ion Battery.
2.	Modelling and thermal analysis of Li-Ion Battery.
3.	Simulation of boost converter and calculating gain and phase margin from the transferfunction.
4.	Simulation of vector control of induction motor.
	Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain the working principles of different types of internal combustion engines and their components.
CO2: Identify the key components and architecture of Electric Vehicles and Hybrid Electric Vehicles.
CO3: Design battery management strategies for optimizing charging, discharging, and thermal management in electric vehicles.
CO4: Apply control system techniques to assess and improve system stability and response.
CO5: Analyze the dynamic behavior of AC machines under various operating conditions.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3								1	2		2	3		3
CO2	3								1	3		2	3		3
CO3	3						3		1	2		2	3		3
CO4	3						3		1	2		2	3		3
CO5	3						3		1	2		2	3	2	3

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Iqbal Husain, "Electric and Hybrid Vehicles Design Fundamentals", 3rd Edition, CRC Press,2021.
T2.	Teuvo Suntio, Tuomas Messo and Joonas Puukko, "Power Electronic Converters: Dynamics and Control in Conventional and Renewable Energy Applications", 1st Edition, Wiley - VCH, 2017.
T3.	Ali Emadi, Mehrdad Ehsani and John M.Miller, "Vehicular Electric Power Systems", 1st Edition, Marcel dekker, Inc 2003.

REFERENCE BOOK(S)	
R1.	C.C. Chan and K.T. Chau, "Modern Electric Vehicle Technology", 3rd Edition, Oxford University Press,2023.
R2.	Wie Liu, "Hybrid Electric Vehicle System Modeling and Control", 2nd Edition, John Wiley &Sons, 2017.
R3.	Chee Mun Ong, "Dynamic Simulation of Electric Machinery using MATLAB", 1st Edition, Prentice Hall, 1997.
R4.	Atif Iqbal, Shaikh Moinoddin, Bhimireddy Prathap Reddy and Wiley, "Electrical Machine Fundamentals with Numerical Simulation using MATLAB/ SIMULINK", 1st Edition, 2021.

Course Code: 24EEP006	Course Title: HVDC and FACTS	
Course Category: PEC	Credits: 3	
L:T:P(Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To learn the problems in AC, DC transmission systems and types of HVDC transmission systems.
• To gain knowledge about the operation and control of SVC and TCSC.
• To understand the concepts of voltage source converter based FACTS controllers.
• To impart knowledge on the basics of Line Commutated Converter (LCC) based HVDC links.
• To know about the features of voltage source converter based HVDC link.

UNIT I	INTRODUCTION	9
Reactive power control in electrical power transmission lines - load & system compensation, Uncompensated transmission line - shunt and series compensation, Need for HVDC Transmission, Comparison between AC & DC Transmission, Types of HVDC transmission System.		
UNIT II	**COMPONSATING DEVICES IN POWER SYSTEM**	**9**
VI characteristics of FC+TSR, TSC+TSR, Voltage control by SVC - Advantages of slope in dynamic characteristics-Influence of SVC on system voltage - Design of SVC voltage regulator, Thyristor Controlled Series Compensator (TCSC), Concept of TCSC, Operation of the TCSC - Different modes of operation, Applications.		
UNIT III	**VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS**	**9**

Static Synchronous Compensator (STATCOM) - Principle of operation - VI Characteristics, Applications: Steady state power transfer - enhancement of transient stability - prevention of voltage instability, SSSC - operation of SSSC VI characteristics, Enhancement in Power transfer capability - UPSC – Operation Principle Applications.		
UNIT IV	**LINE COMMUTATED HVDC TRASMISSION**	**9**
Operation of Gratz bridge - Effect of delay in Firing Angle – Effect of commutation overlap - Equivalent circuit, Basic concept of HVDC transmission, Model of operations and control of power flow CC and CIA mode of operation.		
UNIT V	**VSC BASED HVDC TRANSMISSION**	**9**
Basic 2 level IGBT inverter operation - 4 Quadrant operations - phase angle control - dq Control - Control of power flow in VSC based HVDC Transmission, Topologies of MTDC system.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Identify and understand the problems in AC transmission systems and HVDC Transmission.
CO2: Understand the operation and control of SVC and TCSC and its applications to enhancethe stability and damping.
CO3: Analyze basic operation and control of voltage source converter based FACTS controllers.
CO4: Understand the basic operation and control of Line Commutated HVDC Transmission.
CO5: Evaluate dq control for VSC-based HVDC power transmission.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	3									2	2	
CO2	2	2	1	2									2	2	
CO3	2	2	1	3									2	1	
CO4	1	2	1	2									2		
CO5	2	2	1	3									2	2	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	R. Mohan Mathur and Rajiv K.Varma, "Thyristor - Based Facts Controllers for Electrical Transmission Systems", 1st Edition, IEEE press and John Wiley & Sons, Inc, 2011.
T2.	Narain G.Hingorani, "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems", 2nd Edition, Standard Publishers Distributors, Delhi, 2018.

REFERENCE BOOK(S)	
R1.	K.R.Padiyar, "FACTS Controllers in Power Transmission and Distribution", 2nd Edition, New Age International (P) Limited, Publishers, New Delhi, 2015.
R2.	A.T.John, "Flexible A.C. Transmission Systems", 1st Edition, Institution of Electrical and Electronic Engineers (IEEE), 1999.
R3.	V.K.Sood, "HVDC and FACTS controllers-Applications of Static Converters in Power System", 1st Edition, Kluwer Academic Publishers, 2004.

Course Code: 24EEP007	Course Title: Smart System Automation	
Course Category: PEC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To introduce the smart system technologies and its role in real time applications.
• To introduce the architecture, components, and design aspects of home automation systems.
• To provide an insight into smart appliances and energy management concepts.
• To familiarize the design and needs of smart wearable devices
• To teach the basics of robotics and its role for automation.

UNIT I	INTRODUCTION	9
Overview of a smart system - Hardware and software selection - Smart sensors and Actuators - Communication protocols used for smart systems.		
UNIT II	**HOME AUTOMATION**	**9**
Home Automation - System Architecture - Essential Components - Design Considerations: ControlUnit, Sensing Requirements, Communication, Data Security.		
UNIT III	**SMART APPLIANCES AND ENERGY MANAGEMENT**	**9**
Significance of smart appliances for energy management - Smart Meters: Significance, Architecture& Energy Measurement Technique - Security Considerations.		
UNIT IV	**SMART WEARABLE DEVICES**	**9**
Body Area Networks - Sensors - communication protocol for Wearable devices -		

Application ofSmart Wearable in Healthcare & Activity Monitoring.		
UNIT V	**EMBEDDED SYSTEMS AND ROBOTICS**	**9**
Fundamental concepts in Robotics - Robots and Controllers components - Embedded processorbased: pick and place robot - Mobile Robot Design - UAV.		
		Total: 45 Hours

COURSE OUTCOMES

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

CO1: Understand the concepts of smart system design and its present developments.

CO2: Illustrate different embedded open-source and cost-effective techniques for developing solution for real time applications.

CO3: Acquire knowledge on different platforms and Infrastructure for Smart system design.

CO4: Infer about smart appliances and energy management concepts.

CO5: Improve Employability and entrepreneurship capacity due to knowledge up gradation on embedded system technologies.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	3	1	3								1	2	2
CO2	3	1	2	2	3								1	1	3
CO3	2	2	3	2	3								2	2	2
CO4	2	2	2	1	3								1	2	2
CO5	3	2	2	2	3				1				2	2	3

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1. Grimm, Christoph, Neumann, Peter, Mahlknech and Stefan, "Embedded Systems for Smart Appliances and Energy Management", 1st Edition, Springer, 2013.

T2.	Kazem Sohraby, Daniel Minoli and TaiebZnati, "Wireless Sensor Networks Technology, Protocols, and Applications", 1st Edition, John Wiley & Sons, 2007.
T3.	Nilanjan Dey and Amartya Mukherjee, "Embedded Systems and Robotics with Open-Source Tools", 1st Edition, CRC press, 2016.

REFERENCE BOOK(S)	
R1.	Karim Yaghmour, "Embedded Android", O'Reilly, 2013.
R2.	Steven Goodwin, "Smart Home Automation with Linux and Raspberry Pi", 2nd Edition, 2013.
R3.	Robert Faludi and O'Reilly "Wireless Sensor Networks", 2011.

Course Code: 24EEP102	Course Title: Embedded System Design	
Course Category: PEC	Credits: 3	
L:T:P (Hours/Week) 2:0:2	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To introduce the Building Blocks of an embedded System and Software Tools.
• To emphasize the role of Input/output interfacing with Bus Communication protocol.
• To illustrate the ISR and scheduling for the multitaskingprocess.
• To explain the basics of a Real-time operating system.
• To analyze the applications based on embedded design approaches.

UNIT I	INTRODUCTION TO EMBEDDED SYSTEMS	6
Introduction to Embedded Systems - Structural units in Embedded processor, selection of processor & memory devices - DMA - Memory management methods - Timer and Counting devices, Real Time Clock, In-circuit emulator, Target Hardware Debugging.		
UNIT II	**EMBEDDED NETWORKING**	**6**
Embedded Networking: Introduction, I/O Device Ports & Buses - Serial Bus communication protocols RS232 standard - RS485 - CAN Bus - Serial Peripheral Interface (SPI) - Inter - Integrated Circuits (I^2C).		

UNIT III	INTERRUPT SERVICE MECHANISM AND DEVICE DRIVER	6
Programmed - I/O busy - wait approach without interrupt service mechanism - ISR concept-interrupt sources - multiple interrupts - context and periods for context switching, interrupt latency and deadline - Introduction to Device Drivers.		
UNIT IV	**RTOS-BASED EMBEDDED SYSTEM DESIGN**	**6**
Introduction to basic concepts of RTOS - Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication - shared memory, message passing - Interprocess Communication- Introduction to process synchronization using semaphores.		
UNIT V	**EMBEDDED SYSTEM APPLICATION DEVELOPMENT**	**6**
Embedded Product Development Life Cycle - Case Study: Precision Agriculture - Autonomous car.		

PRACTICALS	
1.	Configure timer block for signal generation (with given frequency).
2.	Interrupts programming example using GPIO.
3.	I^2C communication with peripherals.
4.	Master-slave communication between processors using SPI.
5.	Networking of processor using Wi-Fi.
6.	Basic RTOS concept and programming.
	Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the hardware functional and software strategies required to develop variousEmbedded systems.

CO2: Understand the basic differences between various Bus communication standards.
CO3: Understand the incorporation of the interface as Interrupt services.
CO4: Understand the various scheduling algorithms through a Real-time operating system.
CO5: Understand the various embedded concepts for developing automation applications.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	1								2	2	3
CO2	3	2	3	2	1								2	1	1
CO3	3	3	2	3	1								2	1	2
CO4	3	2	2	2	1								1	2	3
CO5	3	2	1	2	1				1				3	1	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Rajkamal, "Embedded system-Architecture, Programming, Design", 3rd Edition, McGraw-Hill Edu, 2017.
T2.	Peckol, "Embedded system Design", 2nd Edition, John Wiley & Sons, 2019.

REFERENCE BOOK(S)

R1.	Shibu. K.V, "Introduction to Embedded Systems", 2nd Edition, TataMcgraw Hill, 2017.

R2.	Tammy Noergaard, "Embedded Systems Architecture", 2nd Edition, Newnes, 2013.
R3.	Lya B.Das, "Embedded Systems", 1st Edition, Pearson Education, 2012.
R4.	Parag H.Dave and Himanshu B.Dave, "Embedded Systems-Concepts, Design and Programming", 1st Edition, Pearson Education, 2015.

Course Code: 24EEP103	**Course Title: Electrical Drives**	
Course Category: PEC	**Credits: 3**	
L:T:P (Hours/Week) 2:0:2	**Total Contact Hours: 60**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand steady state operation and transient dynamics of a motor load system.
• To study and analyze the operation of the converter / chopper fed dc drive, both qualitatively and quantitatively.
• To study and understand the operation and performance of AC Induction motor drives.
• To study and understand the operation and performance of AC Synchronous motor drives.
• To analyze and design the current and speed controllers for a closed loop solid state DC motor drives.

UNIT I	**DRIVE CHARACTERISTICS**	**6**

Electric drive - Equations governing motor load dynamics - steady state stability - multi quadrant Dynamics: acceleration, deceleration, starting & stopping - typical load torque characteristics - Selection of motor.		
UNIT II	**CONVERTER / CHOPPER FED DC MOTOR DRIVE**	**6**
Steady state analysis of the single and three phase converter fed separately excited DC motor drive - continuous and discontinuous conduction - Time ratio and current limit control - 4 quadrant operations of converter / chopper fed drive.		
UNIT III	**INDUCTION MOTOR DRIVES**	**6**
Stator voltage control - energy efficient drive - v/f control - constant air gap flux - field weakening mode - voltage / current fed inverter - closed loop control.		
UNIT IV	**SYNCHRONOUS MOTOR DRIVES**	**6**
V/f control and self-control of synchronous motor: Margin angle control and power factor control - permanent magnet synchronous motor.		
UNIT V	**DESIGN OF CONTROLLERS FOR DRIVES**	**6**
Transfer function for DC motor / load and converter - closed loop control with current and speed feedback - armature voltage control and field weakening mode - design of controllers; current controller and speed controller - converter selection and characteristics.		

PRACTICALS	
1.	Simulation of converter fed DC drive
2.	Simulation of chopper fed DC drive
3.	Simulation of closed loop operation of stator voltage control of induction motor drive
4.	Simulation of closed loop operation of v/f control of induction motor drive
5.	Simulation of synchronous motor drive
	Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the basic requirements of motor selection for different load profiles.
CO2: Analyse the steady state behavior and stability aspects of drive systems.
CO3: Analyse the dynamic performance of the DC drive using converter and chopper control.
CO4: Simulate the AC drive.
CO5: Design the controller for electrical drives.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	-	-	1	-	-	-	2	3	3	2
CO2	3	2	2	3	3	-	-	1	-	-	-	2	3	3	2
CO3	3	2	2	3	3	-	-	1	-	-	-	2	3	3	3
CO4	3	2	2	3	3	-	-	1	-	-	-	2	3	3	3
CO5	3	2	2	3	3	-	-	1	-	-	-	2	3	3	3

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Gopal K. Dubey, "Fundamentals of Electrical Drives", 2nd Edition, Narosa Publishing House,January 2010.
T2.	Bimal K. Bose. "Modern Power Electronics and AC Drives", 1st Edition, Pearson Education, 2002.
T3.	R.Krishnan, "Electric Motor & Drives: Modeling, Analysis and Control", 1st Edition, Prentice hall of India,2001.

REFERENCE BOOK(S)	
R1.	S.K.Pillai, "A First course on Electrical Drives", 4th Edition, Wiley Eastern Limited, 2022.
R2.	Murphy J.M.D and Turnbull, "Thyristor Control of AC Motor", 1st Edition,

	Pergamon Press, Oxford, 1988.
R3.	Gopal K. Dubey, "Power semiconductor controlled Drives", 1st Edition, Prentice Hall Inc., New Jersey, 1989.

Course Code: 24EEP104	**Course Title: Embedded C Programing**	
Course Category: PEC	**Credits: 3**	
L:T:P (Hours/Week) 2:0:2	**Total Contact Hours: 60**	**Max Marks: 100**

COURSE OBJECTIVES
• To expose the students to the fundamentals of embedded Programming
• To Introduce the GNU C Programming Tool Chain.
• To study the basic concepts of embedded C.
• To teach the basics of 8051 Programming
• To involve Discussions/ Practice/Exercise in revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

UNIT I	BASIC C PROGRAMMING	6
Typical C Program Development Environment - Introduction to C Programming - Structured Program Development in C - Data Types and Operators - C Program Control - C Functions - Introduction to Arrays.		
UNIT II	**EMBEDDED C**	**6**
Adding Structure to 'C' Code: Object-oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts.		
UNIT III	**8051 PROGRAMMING IN C**	**6**
Data types and time delay in 8051, I/O programming in 8051, Logic operations in 8051, Data conversion program in 8051 Accessing code ROM space in 8051, Data serialization using 8051		
UNIT IV	**8051 SERIAL PORT AND INTERRUPT PROGRAMMING IN C**	**6**
Basics of serial communication, 8051 interface to RS232- serial port programming in 8051. 8051 interrupts and programming, Programming for timer configuration.		
UNIT V	**8051 INTERFACING**	**6**
8051: ADC interfacing , DAC interfacing, Sensor interfacing, LCD interfacing, Stepper motor interfacing.		

PRACTICALS	
1.	Laboratory exercise: Use 8051 microcontroller/Embedded processor/IDE/open source platform to give hands-on training on Embedded C- programming. a. Introduction to IDE (like code blocks, vscode ,etc)and Programming Environment (like Keililu vision, Proteus) b. Configuring an I/O port using bitwise programming. c. Configuring timer for generating hardware delay. d. Flashing an LED using an interrupt e. Serial communication using UART port of 8051 f. Interfacing an ADC with 8051 g. Interfacing an analog sensor with 8051 h. Interfacing 16x2 LCD with 8051 i. configuring timer for generating PWM signal

	j. Interfacing a stepper motor with 8051
2.	Assignment: Introduction to Arduino IDE, Raspberry Pi
3.	Embedded C-Programming -based Mini project
	Total: 60 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Deliver insight into embedded C programming and its salient features for embedded systems.
CO2: Illustrate the software and hardware architecture for distributed computing in embedded systems
CO3: Develop a solution for problems by using the conceptlearnednt in programming using the embedded controllers
CO4: Develop simple applications with 8051 by using its various features and interfacing with various external hardware.
CO5: Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded programming skills.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	3	1	-	-	-	-	-	-	-	1	2	2
CO2	1	1	2	2	1	-	-	-	-	-	-	-	1	3	2
CO3	2	2	3	2	3	-	-	-	-	-	-	-	2	3	3
CO4	3	2	3	2	3	-	-	-	-	-	-	-	1	1	1
CO5	3	2	1	2	1	-	-	-	1	-	-	-	2	3	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Paul Deitel and Harvey Deitel, “C How to Program”, 9th Edition, Pearson Education Limited, 2022, 1st edition.
T2.	Michael J Pont, "Embedded C", Addison-Wesley, An imprint of Pearson Education, 2002.

T3.	William von Hagen, "The Definitive Guide to GCC", 2nd Edition, Apress Inc., 2006.
T4.	Gowrishankar S and Veena A, "Introduction to Python Programming", CRC Press, Taylor & Francis Group, 2019.

REFERENCE BOOK(S)	
R1.	Noel Kalicharan, "Learn to Program with C", Apress Inc., 2015, 1st edition.
R2.	Steve Oualline, "Practical C programming", O'Reilly Media, 1997, 3rd edition.
R3.	Muhammad Ali Mazidi, Janice G. Mazidi and Rolin D. McKinlay, 'The 8051 Microcontroller and Embedded Systems' Prentice Hall, 2nd Edition 2007.
R4.	Myke Predko, "Programming and customizing the 8051 microcontrollers",McGraww Hill 2000, 1st edition.

PROFESSIONAL ELECTIVE COURSES

PROFESSIONAL ELECTIVE COURSES IV, V, VI

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1.	24EEP009	Power System Transients	PEC	T	3	3	0	0	3
2.	24EEP010	IoT Concepts and Applications	PEC	T	3	3	0	0	3

3.	24EEP011	Power Electronics for Renewable Energy Systems	PEC	T	3	3	0	0	3
4.	24EEP012	Smart Grid	PEC	T	3	3	0	0	3
5.	24EEP106	Control of Power Electronic Circuits	PEC	TP	4	2	0	2	3
6.	24EEP013	Intelligent control of Electric Vehicles	PEC	T	3	3	0	0	3
7.	24EEP014	Under Ground Cable Engineering	PEC	T	3	3	0	0	3
8.	24EEP015	Special Electrical Machines	PEC	T	3	3	0	0	3
9.	24EEP016	EHVAC Transmission	PEC	T	3	3	0	0	3
10.	24EEP107	Design of Motor and Power Converters for Electric Vehicles	PEC	TP	4	2	0	2	3
11.	24EEP017	Principles of Robotics	PEC	T	3	3	0	0	3
12.	24EEP018	High Voltage Engineering	PEC	T	3	3	0	0	3
Total					**38**	**34**	**0**	**4**	**36**

Course Code: 24EEP009	**Course Title: Power System Transients**	
Course Category: PEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES

• To study the generation of switching transients and their control using circuit – theoretical concept.
• To study the mechanism of lighting strokes and the production of lighting surges.
• To study the propagation, reflection and refraction of travelling waves.
• To study the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system..

UNIT I	**INTRODUCTION AND SURVEY**	**9**
Sources of different types of transients - RL circuit transient with sine wave excitation - double frequency transients - basic transforms of the RLC circuit transients - study of transients in system planning - Importance of grounding.		
UNIT II	**SWITCHING TRANSIENTS**	**9**
Basic concept of switching transients - resistance switching and equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - normal and abnormal switching transients Current suppression - current chopping - effective equivalent circuit - capacitance switching with a restrike, with multiple restrikes - ferro resonance.		
UNIT III	**LIGHTNING TRANSIENTS**	**9**
Theories of cloud formation - mechanism of lightning discharges and characteristics of lightning strokes – model for lightning stroke - factors contributing to good line design - protection using ground wires - tower footing resistance - Interaction between lightning and power system.		
UNIT IV	**TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS**	**9**
Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewely's lattice diagram - standing waves and natural frequencies - reflection and refraction of travelling		

waves. Computation of overvoltage using EMTP.		
UNIT V	**TRANSIENTS IN INTEGRATED POWER SYSTEM**	**9**
The short line and kilometric fault - distribution of voltages in a power system - Line dropping and load rejection - voltage transients on closing and reclosing lines - overvoltage induced by faults switching surges on integrated system Qualitative application of EMTP for transient computation.		
		Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain the principles of transients and its concepts.
CO2: Know the different types of switching transients and the way to draw the necessary equivalent circuit.
CO3: Explain the concepts behind lighting and the way to protect the same.
CO4: Compute the transient behavior in transmission line.
CO5: Explain the behavior of the Circuit during switching and to learn the simulation tool.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	2	-	-	-	-	3	3	3	3
CO2	3	3	3	3	2	-	2	-	-	-	-	3	3	3	3

CO3	3	3	3	3	2	-	2	-	-	-	-	3	3	3	3
CO4	3	3	3	3	2	-	2	-	-	-	-	3	3	3	3
CO5	3	3	3	3	2	-	2	-	-	-	-	3	3	3	3

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter Science, New York, 2nd Edition, 1991.
T2.	Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., Second Edition, 2009.

REFERENCE BOOK(S)	
R1.	M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', 6th Edition, Tata McGraw Hill, 2020.
R2.	R.D. Begamudre, 'Extra High Voltage AC Transmission Engineering', 4th Edition, • New Age International Pvt. Ltd, 2018.
R3.	Y.Hase, Handbook of Power System Engineering," 1st Edition , Wiley India, 2012.
R4.	J.L.Kirtley, "Electric Power Principles, Sources, Conversion, Distribution and use," 2nd Edition , Wiley, 2020.

Course Code: 24EEP010	**Course Title: IoT Concepts and Applications**
Course Category: PEC	**Credits: 3**

L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To apprise students with basic knowledge of IoT that paves a platform to understand physical and logical design of IOT
• To teach a student how to analyze requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms.
• To introduce the technologies behind Internet of Things (IoT).
• To explain the students how to code for an IoT application using Arduino/Raspberry Pi open platform.
• To apply the concept of Internet of Things in real world scenario

UNIT I	INTRODUCTION TO INTERNET OF THINGS	9
Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT		
UNIT II	**COMPONENTS IN INTERNET OF THINGS**	**9**
Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee, Wifi, GPS, GSM Modules)		
UNIT III	**PROTOCOLS AND TECHNOLOGIES BEHIND IOT**	**9**
IOT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, Big Data Analytics, Cloud Computing, Embedded Systems.		
UNIT IV	**OPEN PLATFORMS AND PROGRAMMING**	**9**
IOT deployment for Raspberry Pi /Arduino platform-Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins –		

Connecting to the Cloud.		
UNIT V	**IOT APPLICATIONS**	**9**
Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain the concept of IoT.
CO2: Understand the communication models and various protocols for IoT.
CO3: Design portable IoT using Arduino/Raspberry Pi /open platform.
CO4: Apply data analytics and use cloud offerings related to IoT.
CO5: Analyze applications of IoT in real time scenario.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1				1				1	2		2
CO2	2	2	3	2				1				1	3		1
CO3	2	2	3	2				1				1	3		1
CO4	2	2	3	2				1				1	3		1
CO5	2	2	3	2				1				1	3		1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
T2.	Samuel Greengard, The Internet of Things, The MIT Press, 2015.

REFERENCE BOOK(S)	
R1.	Perry Lea, "Internet of things for architects", 2nd Edition, Packt, 2020
R2.	Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", 2nd Edition, Wiley, 2012
R3.	IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.
R4.	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
R5.	ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015

Course Code: 24EEP011	Course Title: Power Electronics for Renewable Energy Systems	
Course Category: PEC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To learn the various types of renewable sources of energy.
• To understand the electrical machines to be used for wind energy conversion systems.
• To learn the principles of power converters used in solar PV system.
• To study the principle of power converters used in Wind system.
• To simulate the AC-DC, AC-AC Converters, Matrix Converters and PWM Inverters.

UNIT I	INTRODUCTION TO RENEWABLE ENERGY SYSTEMS	6
Classification of Energy Sources – Importance of Non-conventional energy sources – Advantages and disadvantages of conventional energy sources - Environmental aspects of energy - Impacts of renewable energy generation on the environment - Qualitative study of renewable energy resources: Ocean energy, Biomass energy, Hydrogen energy, - Solar Photovoltaic (PV), Fuel cells: Operating principles and characteristics, Wind Energy: Nature of wind, Types, control strategy, operating area.		
UNIT II	**ELECTRICAL MACHINES FOR WIND ENERGY CONVERSION SYSTEMS (WECS)**	**6**
Construction, Principle of operation and analysis: Squirrel Cage Induction Generator (SCIG), Doubly Fed Induction Generator (DFIG) - Permanent Magnet Synchronous Generator (PMSG).		
UNIT III	**POWER CONVERTERS AND ANALYSIS OF SOLAR PV**	**6**

	SYSTEMS	
Power Converters: Line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing. Simulation of line commutated converters, buck/boost converters. Analysis: Block diagram of the solar PV systems - Types of Solar PV systems: Stand-alone PV systems, Grid integrated solar PV Systems - Grid Connection Issues.		
UNIT IV	**POWER CONVERTERS FOR WIND SYSTEMS**	**6**
Power Converters: Three-phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid-Interactive Inverters - Matrix converter.		
UNIT V	**HYBRID RENEWABLE ENERGY SYSTEMS**	**6**
Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Diesel-PV, Wind PV, Micro hydel-PV, Biomass-Diesel systems - Maximum Power Point Tracking (MPPT).		
		Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Examine the available renewable energy sources.
CO2: Demonstrate the working principles of electrical machines and power converters used for wind energy conversion system
CO3: Demonstrate the principles of power converters used for solar PV systems
CO4: Examine the available hybrid renewable energy systems.
CO5: Simulate AC-DC converters, buck/boost converters, AC-AC converters and PWM inverters.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	3	-	-	-	-	-	-	2	-	2	3	3	3
CO2	3	-	3	-	-	-	-	-	-	2	-	2	3	3	3
CO3	3	-	3	-	-	-	-	-	-	2	-	2	3	3	3
CO4	3	-	3	-	-	-	-	-	-	2	-	2	3	3	3
CO5	3	3	2.25	3	3	-	-	3	-	2	-	3	3	3	3

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	S.N.Bhadra, D. Kastha, & S. Banerjee "Wind Electrical Systems", Oxford University Press, 2009, 7th impression.
T2.	Rashid .M. H "Power electronics Hand book", Academic press,2nd Edition, 2006 4th Edition, 2017

REFERENCE BOOK(S)	
R1.	Rai. G.D, "Non-conventional energy sources", Khanna publishers, 6th Edition, 2017. 145
R2.	Rai. G.D," Solar energy utilization", Khanna publishers, 5th Edition, 2008.
R3.	Gray, L. Johnson, "Wind energy system", prentice hall of india, 2nd Edition, 2006.
R4.	H.Khan "Non-conventional Energy sources ",Tata McGraw-hill Publishing Company, New Delhi, 2017, 3rd Edition.

Course Code: 24EEP012	Course Title: Smart Grid	
Course Category: PEC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To understand the evolution of Smart and Interconnected energysystems.
• To understand the various challenges and benefits of smart grid and the national and international initiatives taken
• To understand the concepts related with transmission and distribution in smart grid technologies.
• To get an insight of the various smart measurement technologies.
• To understand the various computing technologies for Smart Operation of the Grid.

UNIT I	INTRODUCTION	9
Evolution of Energy Systems, Concept, Definitions and Need, Difference between Conventional & Smart Grid, Drivers, structures, functions, opportunities, challenges and benefits of Smart Grid, Basics of Micro grid, National and International Initiatives in Smart Grid.		
UNIT II	**SMART METERING**	**9**
Introduction to Advanced Metering infrastructure (AMI) - drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Real time management and control, Phasor Measurement Unit (PMU).		
UNIT III	**SMART GRID TECHNOLOGIES (Transmission)**	**9**
Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, Wide area Monitoring, Protection and		

control.		
UNIT IV	**SMART GRID TECHNOLOGIES (Distribution)**	**9**
DMS, Volt/VAr control, Fault Detection, Isolation and service restoration, Outage management, High- Efficiency Distribution Transformers, Phase Shifting Transformers, Electric Vehicles.		
UNIT V	**HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS**	**9**
Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Computing technologies for Smart Grid applications (Web Service to CLOUD Computing), Role of big data and IoT, Cyber Security for Smart Grid.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: To be able to understand the importance and objectives of Power System Grid.
CO2: To be able to know and understand the concept of a smart grid;
CO3: To identify and discuss smart metering devices and associated technologies.
CO4: To be able to get an overview of Microgrid and Electric Vehicle Technology.
CO5: To be able to have an up to date knowledge on the various computing technologies; to understand the role of Big Data and IoT for effective and efficient operation of Smart Grid.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	-	-	1	-	-	-	2	3	3	-
CO2	3	3	2	3	3	-	-	1	-	-	-	2	3	3	-

CO3	3	3	2	3	3	-	-	1	-	-	-	2	3	3	-
CO4	3	3	2	3	3	-	-	1	-	-	-	2	3	3	-
CO5	3	3	2	3	3	-	-	1	-	-	-	2	3	3	-

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Smart Grids Advanced Technologies and Solutions, Second Edition, Edited by Stuart Borlase,CRC, 2018.
T2.	Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, John Wiley,2012
T3.	James Momoh ,Smart Grid Fundamentals of Design and Analysis, IEEE press 2012.

REFERENCE BOOK(S)	
R1.	Ahmed F. Zobaa, Trevor J. Bihl, Big data analytics in future power systems, 1st Edition, CRC press 2018.
R2.	C. Gungor et al., "Smart Grid Technologies: Communication Technologies and Standards," in IEEE Transactions on Industrial Informatics, vol. 7, no. 4, pp. 529-539, Nov. 2011.doi: 10.1109/TII.2011.2166794.
R3.	X. Fang, S. Misra, G. Xue and D. Yang, "Smart Grid — The New and Improved Power Grid: A Survey," in IEEE Communications Surveys & Tutorials, vol. 14, no. 4, pp. 944-980, Fourth Quarter 2012. doi: 10.1109/SURV.2011.101911.00087.
R4.	Stuart Borlase “Smart Grid : Infrastructure, Technology and Solutions”, CRC Press 2012.

Course Code: 24EEP105	Course Title: Control of Power Electronics Circuits	
Course Category: PEC	Credits: 3	
L:T:P(Hours/Week) 2:0:2	Total Contact Hours: 60	Max Marks: 100

COURSE OBJECTIVES
• To learn the basics of control system simulation.
• To do symbolic calculation.
• To study the principles of sliding mode control and the way of apply SMC for buck converter.
• To learn the concept of power factor correction.
• To design simulate SMPS for buck converter and power factor correction circuit with controller.

UNIT I	SIMULATION BASICS IN CONTROL SYSTEMS	6
Transfer Function - How to build transfer function, identify Poles, zeros, draw time response plots, bode plot (Bode Plots for Multiplication Factors, Constant, Single and Double Integration Functions, Single and Double Differentiation Functions, Single Pole and Single Zero Functions, RHP Pole and RHP Zero Functions), state space modelling - transfer function from state space Model.		
UNIT II	**SYMBOLIC CALCULATIONS**	**6**
Symbolic Variables - Symbolic Vector Variables, Commands for Handling Polynomial Expressions - Extracting Parts of a Polynomial - Factorization and Roots of Polynomials, Symbolic Matrix Algebra - Operations with Symbolic Matrices - Other Symbolic Matrix Operations.		

UNIT III	SLIDING MODE CONTROL BASICS	6
Introduction - Sliding-Mode Control - Basics of Sliding-Mode Theory - Application of Sliding - Mode Control to DC - DC Converters - Principle - Sliding mode control of buck converter.		
UNIT IV	**POWER FACTOR CORRECTION CIRCUITS**	**6**
Introduction, Operating Principle of Single-Phase PFCs, Control of boost converter based PFCs, Designing the Inner Average - Current - Control Loop, Designing the Outer Voltage-Control Loop, Example of Single - Phase PFC Systems.		
UNIT V	**CONTROLLER DESIGN FOR PFC CIRCUITS**	**6**
Power factor correction circuit using other SMPS topologies: Cuk and SEPIC converter - PFCcircuits employing bridgeless topologies.		

PRACTICALS	
1.	Simulation of zero, first and second order basic blocks.
2.	Simulation of symbolic calculations.
3.	Simulation of Sliding mode control based buck converter.
4.	Simulation of Single-Phase PFC circuit employing boost converter.
5.	Simulation of Single-Phase PFC circuit employing Cuk converters.
	Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the basic functions of control system.
CO2: Apply commands for Handling Polynomial Expressions.
CO3: Explain the basics of Sliding-Mode Theory.
CO4: Explain the operating Principle of Single-Phase Power Factor correction circuits.

CO5: Design controller for power factor correction circuits.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	2	2							2	1	2	1
CO2	2	2	1	2	2							1	1	2	
CO3	1	1	1		2							1	2	1	
CO4	2	1	2	2	2							2	1	1	
CO5	2	2	2	2	2							2	2	2	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Dean Frederick and Joe Chow, "Feedback Control problems using MATLAB and the Control system tool box", 1st Edition, Cengage Learning, 2000.
T2.	Ned Mohan, "Power Electronics: A First Course", 2nd Edition, John Wiley, 2022.
T3.	Marian K. Kazimierczuk and Agasthya Ayachit, "Laboratory Manual for Pulse-WidthModulated DC-DC Power Converters, 1st Edition, Wiley, 2016.

REFERENCE BOOK(S)

R1.	Slew-Chong Tan, Yuk Ming Lai and Chi-Kong Tse, "Sliding mode control for Switching Power Converters, Techniques and Implementation", 1st Edition, CRC Press, 2017.
R2.	Andre Kislovski, "Dynamic Analysis of Switching-Mode DC/DC Converters", Springer, 1991.

R3.	Lopez Cesar, “MATLAB Symbolic Algebra and Calculus Tools”, Apress, 2014.

-Course Code: 24EEP013	**Course Title: Intelligent Control of Electric Vehicles**	
Course Category: PEC	**Credits: 3**	
L:T:P(Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To design and drive the mathematical model of a BLDC motor and its characteristics.
• To impart knowledge on various control schemes, including PID, anti-windup, intelligent and vector control, for speed regulation of electric drives, with a focus on BLDC motors.
• To study the basics of fuzzy logic.
• To study the FPGA & VHDL basics.
• To implement fuzzy logic control of BLDC motor in real time.

UNIT I	**MATHEMATICAL MODEL AND CHARACTERISTICS ANALYSIS OF THE BLDC MOTOR**	**9**
Structure and Drive Modes - Basic Structure, General Design Method, Drive Modes. Mathematical Model, Differential Equations, Transfer Functions, State-Space Equations. Characteristics Analysis, Starting Characteristics, Steady-State Operation, Dynamic Characteristics, Load Matching Commutation Transients.		
UNIT II	**SPEED CONTROL FOR ELECTRIC DRIVES**	**9**
Introduction - PID Control Principle, Anti windup Controller, Intelligent Controller,		

Vector Control - Control applied to BLDC motor.		
UNIT III	**FUZZY LOGIC**	**9**
Membership functions: features, fuzzification, methods of membership value assignments Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness - fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning - fuzzy inference systems, overview of fuzzy expert system - fuzzy decision making.		
UNIT IV	**FPGA AND VHDL BASICS**	**9**
Introduction – FPGA Architecture - Advantages - Review of FPGA family processors - Spartan 3, Spartan 6 and Spartan 7. VHDL Basics - Fundamentals - Instruction set - data type - conditional statements - programs like arithmetic, sorting, PWM generation, Speed detection.		
UNIT V	**REAL TIME IMPLEMENTATION**	**9**
Inverter design, identifying rotor position via hall effect sensors, open loop and fuzzy logic control of48 V BLDC motor using FPGA**.**		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Design the mathematical model of a BLDC motor and to discuss about its characteristics.
CO2: Understand the PID control, ant windup controller, Intelligent Controller and Vector Control.
CO3: Illustrate the basics of fuzzy logic system
CO4: Describe the basics of VHDL & FPGA applied to control of EVs.
CO5: Design and implement of fuzzy logic control scheme for BLDC motor using FPGA

in realtime.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1		1					1				1	1	
CO2	2	1	1	2									2	1	
CO3	2	1	2	2	1								2	2	
CO4	2	2	2	2	1				1				2	2	
CO5	2	1	2	2					2				2	2	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	John G. Hayes, G. Abas Goodarzi, "Electric Powertrain Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles", 1st Edition, Wiley, 2018.
T2.	Jayaram Bhasker, "VHDL Primer A", 3rd Edition, Prentice Hall, 2015.
T3.	Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals", 3rd Edition, CRCPress, Taylor & Francis Group, 2021.

REFERENCE BOOK(S)

R1.	Chang-liang, "Permanent Magnet Brushless DC Motor Drives and Controls", 1st Edition, Xia Wiley, 2012.
R2.	Wei Liu, "Hybrid Electric Vehicle System Modeling and Control", 2nd Edition, Wiley, 2017.
R3.	Emanuele Crisostomi, Robert Shorten, Sonja Studli and Fabian Wirth, "Electric and Plug-in Hybrid Vehicle Networks Optimization and Control", 1st Edition, CRC Press, 2018.

Course Code: 24EEP014	Course Title: Underground Cable Engineering	
Course Category: PEC	Credits: 3	
L:T:P(Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To understand Power Cable Characteristics and Applications.
• To gain knowledge on Cable Architecture, Dielectric theory and Cable characteristics.
• To impart knowledge on Installation of distribution systems and cables.
• To impart knowledge on Installation of Transmission systems and cables.
• To perform the various testing and maintenance of Underground cable system.

UNIT I	INTRODUCTION TO ELECTRICAL POWER CABLES	9
Development of Underground Cables - Electric Lighting - Distribution of Energy for Lighting - Paper Insulated Cables - Underground Residential Distribution Systems - Underground Residential Distribution Systems - Medium Voltage Cable Development.		
UNIT II	CABLE ARCHITECHTURE, DIELECTRIC THEORY AND CABLE CHARACTERISTICS	9

Architecture of Underground Cabling System - Basic Dielectric Theory of Cable – Conductors - Armour and Protective Finishes - Cable Characteristics: Electrical - Fundamentals of Electrical Insulation Materials - Electrical Properties of Cable Insulating Materials - Cable Standards and Quality Assurance - Cable design parameters - Current Carrying Capacity - Short-circuit Ratings.		
UNIT III	**SUPPLY DISTRIBUTION SYSTEMS AND CABLES**	**9**
Supply Distribution Systems - Distribution Cable Types, Design and Applications - Paper Insulated Distribution Cables - PVC Insulated Cables - Polymeric Insulated Distribution Cables for 6-30 kV - Manufacture of Distribution Cables - Joints and Terminations for Distribution Cables - Testing of Distribution Cables.		
UNIT IV	**TRANSMISSION SYSTEMS AND CABLES**	**9**
Basic Cable Types for A.C. Transmission - Self-contained Fluid-filled Cables - Gas Pressure Cables - High Pressure Fluid-filled Pipe Cables - Polymeric Insulated Cables for Transmission Voltages - Techniques for Increasing Current Carrying Capacity - Transmission Cable Accessories and Jointing for Pressure-assisted and Polymeric Cables.		
UNIT V	**CABLE INSTALLATION, TESTING, MAINTENANCE**	**9**
Installation of Transmission Cables - Splicing, Terminating, and Accessories - Sheath Bonding and Grounding - Testing of Transmission Cable Systems - Underground System Fault Locating - Field Assessment of Power Cable Systems - Condition monitoring tests – PD measurements.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the fundamental of electric cable system.
CO2: Gain knowledge on the architecture of UG cable and physical and electrical

characteristics of the UG cable.
CO3: Understand different types of cable used in distribution system.
CO4: Acquire knowledge on Underground cables used in transmission system.
CO5: Understand the theory / methodology of cable fault detection and rectification, testing and maintenance.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2					2	1			2		2	1	
CO2	2	2					2	1			2		1		1
CO3	2	2					2	1			2		2		
CO4	1	2					2	1			2		2	1	
CO5	2	2	3				2	1			2		2	2	1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	William Thue, "Electrical Power Cable Engineering", 3rd Edition, CRC Press Taylor & Francis Group, 2011.
T2.	G. F. Moore, "Electric Cables Handbook", 3rd Edition, Blackwell Science Ltd, Oxford, January 2017.

REFERENCE BOOK(S)

R1.	Leonard L. Grigsby, "Electrical Power Cable Engineering", 3rd Edition, CRC Press,

	Marcel Dekker, 2012.
R2.	Christian Flytkjaer Jensen, "Online Location of Faults on AC Cables in Underground Transmission Systems", Springer, 2014.

Course Code: 24EEP015	**Course Title: Special Electrical Machines**	
Course Category: PEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Maximum Marks : 100**

COURSE OBJECTIVES
• To understand the working of special machines like stepper motor, switched reluctance motor, BLDC motor & PMSM
• To derive torque equation and study the characteristics of special machines.
• To design the controller for special machines.
• To study the working principle of synchronous reluctance motor
• To simulate closed loop operation of BLDC motor

UNIT I	**STEPPER MOTORS**	**9**
Constructional features –Principle of operation –Types – Torque predictions – Linear and Non-linear analysis – Characteristics – Drive circuits – Closed loop control –Applications		
UNIT II	**SWITCHED RELUCTANCE MOTORS**	**9**
Constructional features –Principle of operation- Torque prediction–Characteristics-Power		

controllers – Control of SRM drive- Speed control-current control-design procedures- Sensor less operation of SRM – Current sensing-rotor position measurement and estimation methods- sensor less rotor position estimation-inductance based estimation –applications.		
UNIT III	**PERMANENT MAGNET BRUSHLESS DC MOTORS**	**9**
Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis EMF and Torque equations- Characteristics- Controller design-Transfer function – Machine, Load and Inverter-Current and Speed Controller.		
UNIT IV	**PERMANENT MAGNET SYNCHROUNOUS MOTORS**	**9**
Permanent Magnet ac Machines, Machine Configurations, PMSM - Principle of operation – EMF and Torque equations - Phasor diagram - Torque speed characteristics –evaluation of control characteristics- design of current and speed controllers- Constructional features, operating principle and characteristics of synchronous reluctance motor.		
UNIT V	**STUDY OF OTHER SPECIAL ELECTRICAL MACHINES**	**9**
Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear motor – Applications.		
		Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Ability to model and analyze power electronic systems and equipment using computational software.
CO2: Ability to optimally design magnetics required in special machines based drive systems using FEM based software tools.
CO3: Ability to analyse the dynamic performance of special electrical machines.
CO4: Ability to understand the operation and characteristics of other special electrical machines.
CO5: Ability to design and conduct experiments towards research.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	2	-	-	-	-	3	3	3	3

Course Code: 24EEP016	Course Title: EHVAC Transmission	
Course Category: PEC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

CO2	3	3	3	3	-	-	2	-	-	-	-	3	3	3	3
CO3	3	3	3	3	-	-	2	-	-	-	-	3	3	3	3
CO4	3	3	3	3	-	-	2	-	-	-	-	3	3	3	3
CO5	3	3	3	3	-	-	2	-	-	-	-	3	3	3	3

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	R. Krishnan - Switched Reluctance Motor Drives Modeling, Simulation, Analysis, Design, and Applications - 1st Edition, CRC Press 2017.
T2.	Ramu Krishnan - Permanent Magnet Synchronous and Brushless DC Motor Drives - 1st Edition, CRC Press, 2016

REFERENCE BOOK(S)	
R1.	T.Kenjo, ' Stepping motors and their microprocessor controls', Oxford University press, New Delhi,2009.
R2.	T.J.E. Miller, 'Brushless magnet and Reluctance motor drives', Clarendon press, London, 2010.

COURSE OBJECTIVES
• To impart knowledge on the preliminary aspect EHVAC Transmission lines.
• To impart knowledge on the Electrostatic field of AC lines.
• To give insight into Electrostatic induction.
• To learn the concept of Corona in E.H.V. lines and Radio Interference.
• To design EHV lines based on steady state and transient limits.

UNIT I	**INTRODUCTION**	**9**
EHVAC Transmission line trends and preliminary aspect - standard transmission voltages - Estimation at line and ground parameters - Bundle conductors: Properties - Inductance and		

Capacitance of EHV lines - Positive, negative and zero sequence impedance - Line Parameters for Modes of Propagation.		
UNIT II	**ELECTROSTATIC FIELDS**	**9**
Electrostatic field and voltage gradients - Calculations of electrostatic field of AC lines - Effect of high electrostatic field on biological organisms and human beings - Surface voltage gradients and Maximum gradients of actual transmission lines - Voltage gradients on sub conductor.		
UNIT III	**POWER CONTROL**	**9**
Electrostatic induction in un energized lines - Measurement of field and voltage gradients for three phase single and double circuit lines - Un energized lines. Power Frequency Voltage control and overvoltage in EHV lines: No load voltage - Charging currents at power frequency - Voltage control – Shunt and Series compensation - Static VAR compensation.		
UNIT IV	**CORONA EFFECTS AND RADIO INTERFERENCE**	**9**
Corona in EHV lines – Corona loss formulae - Charge voltage diagram - Attenuation of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits. Measurements of audio noise radio interference due to Corona - properties of radio noise – Frequency spectrum of RI fields – Measurements of RI and RIV.		
UNIT V	**STEADY STATE AND TRANSIENT LIMITS**	**9**
Design of EHV lines based on steady state and transient limits - EHV cables and their characteristics - Introduction six phase transmission – UHV.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the principles and types of EHVAC system.

CO2: Analyze the electrostatic field of AC lines.
CO3: Explain the principles of electrostatic induction in un energized transmission lines.
CO4: Analyze the attenuation of traveling waves in transmission lines due to corona discharge.
CO5: Analyze the steady state and transient limits.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	3			1				2	2	1	
CO2	3	2	2	3	3			1				2	2	1	
CO3	3	2	2	3	3			1				2	2	1	
CO4	3	2	2	3	3			1				2	2	1	
CO5	3	2	2	3	3			1				2	2	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Rokosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", 5th Edition, New Age International Publishers, Wiley Eastern Ltd., 2023.
T2.	S. Rao, "EHV-AC and HVDC Transmission, Engineering and Practice", 3rd Edition , Khanna Publisher, Delhi, 2009.

REFERENCE BOOK(S)

R1.	Subir Ray, "An Introduction to High Voltage Engineering", 2nd Edition Prentice

	Hall of India Private Limited, 2013.
R2.	R D Begamudre, "Extra High Voltage AC Transmission Engineering", 5th Edition, New Academic Science Ltd, 2023.

Course Code: 24EEP106	**Course Title: Design of Motor and Power Converters for Electric Vehicles**	
Course Category: PEC	**Credits: 3**	
L:T:P(Hours/Week) 2:0:2	**Total Contact Hours: 60**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the drive cycle characteristics required for Electric Vehicles.
• To know the working of motors used in Electric Vehicle.
• To learn the simulation basics of control systems.
• To analyze and model the DC-DC converter operation and to design the same.
• To derive transfer functions for DC-DC converters.

UNIT I	**ELECTRIC VEHICLE DYNAMICS**	**6**
Standard drive cycles - Dynamics of Electric Vehicles - Tractive force - Maximum speed, torque, power, energy requirements of EVs.		
UNIT II	**MOTORS FOR ELECTRIC VEHICLES**	**6**

Introduction - Speed And Torque control of above and below rated speed - Speed control of EV in the constant power region of electric motors. DC Motors, Induction Motor, Permanent Magnet Synchronous Motors (PMSM), Brushless DC Motors, Switched Reluctance Motors (SRMs), Synchronous Reluctance Machines - Choice of electric machines for EVs.		
UNIT III	**ESSENTIALS OF CONTROL SYSTEM SIMULATION**	**6**
Transfer Function - determine - Time domain response plot (Impulse, Step and Ramp) - Frequency domain response plot (Bode plot) which covers multiplication of factors and the behavior of constant, integration, differentiation, single/double pole/zero, and RHP pole/zero functions, state space modelling - transfer function from state space Model.		
UNIT IV	**MODELING OF DC-DC CONVERTERS**	**6**
Overview of PWM Converter Modelling - Power Stage Modelling - PWM Block Modelling - Voltage Feedback Circuit and Small-Signal Model of PWM Converter - Averaging Power Stage Dynamics - Average Models for buck/boost Converter - Small - Signal Model of Converter Power Stage - Frequency Response of Converter.		
UNIT V	**POWER STAGE TRANSFER FUNCTIONS OF DC - DC CONVERTERS**	**6**
Power Stage Transfer Functions of buck-boost Converter in CCM Operation, Input-to-Output Transfer Function, Duty Ratio-to-Output Transfer Function, Load Current-to-Output Transfer Function.		

PRACTICALS	
1.	Simple simulation exercises of basic control systems.
2.	Bode plots and calculation of Gain margin and Phase margin for power stage transfer function via simulation.
3.	Simulation of buck converter.
4.	Simulation of boost converter.

5.	Simulation of buck boost converter-open loop.
	Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Select appropriate electric machine for electric vehicle application based on characteristics.
CO2: Select appropriate electric machine for electric vehicle application based on applications.
CO3: Compute transfer function from state models.
CO4: Design buck, boost and buck-boost DC-DC converter.
CO5: Compute a power stage transfer functions for DC-DC converters.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1					1				2		
CO2	2	1		1					1			1	2		
CO3	1	2	2	2	2				2			2	1	2	
CO4	2	2	2	1	1				1			2	1	2	
CO5	2	2	2	1					2			2	1	2	1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Teuvo Suntio, Tuomas Messo and Joonas Puukko, "Power Electronic Converters", 1st Edition, 2017.
T2.	Randall Shaffer, "Fundamentals of Power Electronics with MATLAB", 2nd Edition, Lakshmipublications, 2013.

T3.	Dean Frederick and Joe Cho, "Feedback Control problems using MATLAB and the Control system tool box", 1st Edition, Cengage learning, 2000.

REFERENCE BOOK(S)	
R1.	Atif Iqbal, Shaikh Moinoddin and Bhimireddy Prathap Reddy, "Electrical Machine Fundamentals with Numerical Simulation using MATLAB/SIMULINK", 1st Edition, Wiley, 2021.
R2.	Md. Rabiul Islam,Md. Rakibuzzaman Shah and Mohd. Hasan Ali, "Emerging Power Converters for Renewable Energy and Electric Vehicles Modeling, Design, and Control", 1st Edition, CRC Press, 2021.
R3.	Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals", 3rd Edition, CRC Press, Taylor & Francis Group, 2021.

Course Code: 24EEP017	**Course Title: Principles of Robotics**	
Course Category: PEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks : 100**

COURSE OBJECTIVES
• To introduce the functional elements of Robotics.
• To impart knowledge on the direct and inverse kinematics.
• To introduce the manipulator differential motion and control.
• To educate on various path planning techniques.
• To introduce the dynamics and control of manipulators.

UNIT I	**BASIC CONCEPTS**	**9**

Brief history - Types of Robot - Technology - Robot classifications and specifications - Design and control issues - Various manipulators – Sensors - work cell - Programming languages.		
UNIT II	**DIRECT AND INVERSE KINEMATICS**	**9**
Mathematical representation of Robots - Position and orientation - Homogeneous transformation - Various joints - Representation using the Denavit Hattenberg parameters - Degrees of freedom - Direct kinematics - Inverse kinematics - SCARA robots - Solvability - Solution methods - Closed form solution.		
UNIT III	**MANIPULATOR DIFFERENTIAL MOTION AND STATICS**	**9**
Linear and angular velocities - Manipulator Jacobian - Prismatic and rotary joints - Inverse - Wrist and arm singularity - Static analysis - Force and moment Balance.		
UNIT IV	**PATH PLANNING**	**9**
Definition - Joint space technique - Use of p-degree polynomial - Cubic polynomial - Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.		
UNIT V	**DYNAMICS AND CONTROL**	**9**
Lagrangian mechanics - 2DOF Manipulator - Lagrange Euler formulation - Dynamic model - Manipulator control problem - Linear control schemes - PID control scheme - Force control of robotic manipulator.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand basic concept of robotics.
CO2: Analyze Instrumentation systems and their applications.
CO3: Understand the mathematical modeling of differential motion and static equilibrium in robotics.
CO4: Explain how path-planning algorithms are applied in real-world scenarios.

CO5: Understand the mathematical modeling of robotic dynamics and control mechanisms.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1					1		1					
CO2	3	3	2					1		1	2				2
CO3	3	3	3	3	1			1		1					
CO4	3	3		3	3			1		1			3	3	
CO5	3	3	3	2	1			1		1			3	3	3

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	R.K.Mittal and I.J.Nagrath, "Robotics and Control", 4th Edition, Tata McGraw Hill, New Delhi, 2005.
T2.	JohnJ.Craig, "Introduction to Robotics Mechanics and Control", 4th Edition, Pearson Education, 2022.
T3.	S.Ghoshal, "Embedded Systems & Robotics - Projects using the 8051 Microcontroller", 1st Edition, Cengage Learning, 2009.

REFERENCE BOOK(S)

R1.	Ashitava Ghoshal, "Robotics - Fundamental Concepts and Analysis", 1st Edition, Oxford University Press, 2006.
R2.	R.D.Klafter, T.A.Chimielewski and M.Negin, "Robotic Engineering - An Integrated Approach", Prentice Hall of India, New Delhi, 1989.
R3.	B.K.Ghosh, "Control in Robotics and Automation: Sensor Based Integration", 1st Edition, Allied Publishers, Chennai, 2011.

Course Code: 24EEP018	**Course Title: High Voltage Engineering**	
Course Category: PEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks : 100**

COURSE OBJECTIVES
• To gain knowledge about the various types of over voltages in power system and protection methods.
• To understand the properties of Dielectric breakdown.
• To impart knowledge on Generation and Measurement of over voltages and currents.
• To perform the testing of power apparatus and insulation coordination.

- To gain knowledge about the applications of high voltage engineering in Industries.

UNIT I	OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS	9
Over voltages - Causes and its effects on power system - Lightning, switching surges and temporary over voltages – Reflection and Refraction of Travelling waves - protection against over voltages - Insulation Coordination.		
UNIT II	**DIELECTRIC BREAKDOWN**	**9**
Properties of Dielectric materials - Gaseous breakdown in uniform and non-uniform fields -Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality - Breakdown mechanisms in solid and composite dielectrics - Applications of insulating materials in electrical equipment.		
UNIT III	**GENERATION AND MEASUREMENTS OF HIGH VOLTAGES AND HIGH CURRENTS**	**9**
Generation of High DC, AC, impulse voltages and currents - Analysis of DC/AC and Impulse generator circuits - Tripping and control of impulse generators, Measurement of High voltages and High currents - High Resistance with series ammeter - Dividers - Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters, Electrostatic Voltmeters - Sphere Gaps, High current shunts - Digital techniques in high voltage measurement.		
UNIT IV	**HIGH VOLTAGE TESTING & INSULATION COORDINATION**	**9**
High voltage testing of electrical power apparatus - International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers - Insulation Coordination.		
UNIT V	**APPLICATION IN INDUSTRY**	**9**
Introduction - electrostatic applications - electrostatic precipitation, separation, painting / coating, spraying, imaging, printing, Transport of materials - manufacturing of sand paper - Smoke particle detector - Electrostatic spinning, pumping, propulsion - Ozone		

generation - Biomedical applications.
TOTAL: 45 HOURS

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain various over voltages and its effects on power systems.
CO2: Understand the Dielectric breakdown phenomena in different medium under uniform and non- uniform fields.
CO3: Explain the methods of generating and measuring High DC, AC, Impulse voltage and currents.
CO4: Apply suitable HV testing of Electrical power apparatus as per Standards.
CO5: Explain the Industrial Applications of Electrostatic Fields.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2											3	2	
CO2	3	2		1									3		
CO3	2	2	3	1							2	3	3	2	
CO4	1	2	3	1				1	1			3	3	2	
CO5	2	2	1			2					2		3		2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	M.S.Naidu and V. Kamaraju, "High Voltage Engineering", 6th Edition, Tata McGraw Hill, 2020.
T2.	E. Kuffel and W.S. Zaengl, J.Kuffel, "High voltage Engineering fundamentals", 2nd Edition, Newnes, Elsevier, New Delhi, 2000.
T3.	C.L. Wadhwa, "High voltage Engineering", 4th Edition, New Age International Publishers, 2021.
REFERENCE BOOK(S)	
R1.	L.L.Alston, "High Voltage Technology", 1st Edition, Oxford University Press, 2006.
R2.	C.L.Wadhwa, "High voltage Engineering", 4th Edition, New Age International Publishers, 2021.
R3.	Mazen Abdel - Salam, Hussein Anis, Ahdab A-Morshedy and Roshday Radwan, "High Voltage Engineering - Theory & Practice", 2nd Edition, Taylor & Francis Gourp, 2019.

OPEN ELECTIVE COURSES

OPEN ELECTIVES OFFERED BY THE PARENT (EEE) DEPARTMENT:

Course Code: 24EEO001	**Course Title: Sustainable and Environmental Friendly HV Insulation system**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To know about the products related with sustainable application.
• To learn about Green Gaseous insulators and its hazardous effects.
• To learn about Green liquid insulators and its hazardous effects.
• To learn about Green solid insulators and its hazardous effects.
• To understand the standards and testing of green insulation systems.

UNIT I	**SUSTAINABLE AND ENVIRONMENTAL ENERGY AND PRODUCTS**	**9**
Carbon print, global warming potential, environment requirement for any product and system.		
UNIT II	**ALTERNATE GREEN GASEOUS INSULATORS**	**9**
SF6 gas and its hazardous environmental effects, alternate gases, gaseous mixtures and othersources and its properties.		
UNIT III	**ALTERNATE GREEN LIQUID INSULATORS**	**9**
Hazardous effects of existing liquid dielectric materials (such as organic oil), alternate sources of environmental friendly liquid such as ester oil, vegetable oils dielectric and its properties.		
UNIT IV	**ALTERNATE GREEN SOLID INSULATORS**	**9**
Hazardous effects of existing solid dielectric materials, alternate sources of environmental friendlysolid dielectric and its properties.		
UNIT V	**EVOLVING STANDARDS FOR GREEN INSULATION SYSTEMS**	**9**
Requirements, evolving standards of management, testing, usage and disposal of alternateinsulation systems, Major applications and standards.		
		Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand sustainable and environmental energy and products.
CO2: Understand the alternate green gaseous insulators.
CO3: Understand the alternate green liquid insulators.
CO4: Understand the alternate green solid insulators.
CO5: Understand the standards and testing of Green insulation systems.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1			1		1	1						1		
CO2	2					2	2						2		
CO3	2					2	2						2		
CO4	2					2	2						2		
CO5	2					2	2						2		

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	R. Arora and H.C.W Mosch, "High Voltage Insulation Engineering", 2nd Edition, New Age International Publishers, 2021.
T2.	Chandra Swaroop Meena, Ashwani Kumar and Varun Pratap Singh, "Sustainable Technologies for Energy Efficient Building", 2nd Edition, CRC Press, 2021.
T3.	U.Mohan Rao and Ramanujam Sarathi, "Alternative Liquid Dielectrics for High Voltage Transformer Insulation Systems: Performance Analysis and Applications", 2nd Edition, Wiley- IEEE press, 2021.

REFERENCE BOOK(S)	
R1.	M.H. Fulekar, Bhawana Pathak and R.K. Kale, "Environment and Sustainable Development", Springer, 2020.
R2.	P. Muthukumar and Dilip Kumar Sakar, "Innovations in Sustainable Energy and

	Technology", Springer, 2020.

Course Code: 24EEO002	**Course Title: Smart Grids**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks : 100**

COURSE OBJECTIVES
• To acquire knowledge about the evolution of Smart and Interconnected energy systems.
• To gain knowledge about the various challenges and benefits of smart grid and the national andinternational initiatives taken.
• To acquire knowledge on the concepts related with transmission in smart grid technologies.
• To get an insight into smart grid technologies applied to distribution systems.
• To gain knowledge about various computing technologies for Smart Operation of the Grid.

UNIT I	SMART GRID	9
Evolution of Energy Systems, Concept, Definitions and Need, Difference between Conventional & Smart Grid, Drivers, structures, functions, opportunities, challenges and benefits of Smart Grid, Basics of Micro grid, National and International Initiatives in Smart Grid.		
UNIT II	**SMART METERING**	**9**
Introduction to Advanced Metering infrastructure (AMI) - drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Real time management and control, Phasor Measurement Unit (PMU).		
UNIT III	**SMART GRID TECHNOLOGIES (Transmission)**	**9**
Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, Wide area Monitoring, Protection and control.		
UNIT IV	**SMART GRID TECHNOLOGIES (Distribution)**	**9**
DMS, Volt/VAr control, Fault Detection, Isolation and service restoration, Outage management, High- Efficiency Distribution Transformers, Phase Shifting Transformers, Electric Vehicles.		
UNIT V	**HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS**	**9**
Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Computing technologies for Smart Grid applications (Web Service to CLOUD Computing), Role of big data and IoT, Cyber Security for Smart Grid.		
		Total : 45 Hours

COURSE OUTCOMES

At the end of this course, students will be able to
CO1: Understand the importance and objectives of Power System Grid.
CO2: Understand the concept of a smart grid.
CO3: Identify and discuss smart metering devices and associated technologies on Transmission Sector.
CO4: Deliver an overview of Micro grid and Electric Vehicle Technology on Distribution Sector.
CO5: Interpret the various computing technologies to understand the role of Cloud computing and IoT for effective and efficient operation of Smart Grid.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2			1		1	1		1			1	2		
CO2	2		2	1		1	1		2			1	2		
CO3	2	2	2	2		2	1		1			2	2	2	
CO4	2	1	2	2		2	1		2			2	2	2	
CO5	2	1	2	2		2	1		2			2	2		

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Stuart Borlase, "Smart Grids Advanced Technologies and Solutions", 2nd Edition, CRC, 2018.
T2.	Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu and Akihiko

	Yokoyama, “Smart Grid:Technology and Applications”, John Wiley, 2012.
T3.	James Momoh, “Smart Grid Fundamentals of Design and Analysis”, IEEE press, 2012.

REFERENCE BOOK(S)	
R1.	Ahmed F. Zobaa and Trevor J. Bihl, “Big data analytics in future power systems”, 1st Edition, CRC press, 2018.
R2.	Stuart Borlase, “Smart Grid: Infrastructure, Technology and Solutions”, CRC Press, 2012.
R3.	Janaka B. Ekanayake , “Smart Grid: Technology and Applications”, 1st Edition, Wiley Publications, 2021.

Course Code: 24EEO003	**Course Title: Hybrid Energy Technology**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To acquire knowledge about different types of hybrid energy systems.
• To know about the various electrical Generators used for the Wind Energy Conversion Systems.
• To design the power converters used in SPV Systems.
• To gain knowledge about the various power converters used in hybrid energy systems.
• To get knowledge about the performance of the various hybrid Renewable energy systems.

UNIT I	**HYBRID ENERGY SYSTEMS**	**9**
Hybrid Energy Systems - Need for Hybrid Energy Systems - Solar - Wind - Fuel Cell - Diesel, Wind - Biomass - Diesel, Micro - Hydel - PV, Ocean and geyser energy - Classification of Hybrid Energy systems - Importance of Hybrid Energy systems - Advantages and Disadvantages - Environmental aspects of renewable energy - Impacts of renewable energy generation on the environment - Present Indian and international energy scenario of conventional and RE sources - Ocean energy, Hydel Energy - Wind Energy, Biomass energy, Hydrogen energy - Solar Photovoltaic (PV) and Fuel cells: Operating principles and characteristics.		
UNIT II	**ELECTRICAL MACHINES FOR WIND ENERGY CONVERSION SYSTEMS**	**9**
Review of reference theory fundamentals - Construction, Principle of operation and analysis: Squirrel Cage Induction Generator (SCIG), Doubly Fed Induction Generator (DFIG) - Permanent Magnet Synchronous Generator (PMSG).		
UNIT III	**POWER CONVERTERS AND ANALYSIS OF SOLAR PV SYSTEMS**	**9**
Power Converters for SPV Systems - Line commutated converters (inversion-mode) - Boost and buck- boost converters - selection of inverter, battery sizing, array sizing - Analysis of SPV Systems - Block diagram of the solar PV systems - Types of Solar PV systems: Stand-alone PV systems.		
UNIT IV	**ANALYSIS OF POWER CONVERTERS FOR HYBRID ENERGY SYSTEMS**	**9**
Introduction to Power Converters - Stand-alone Converters - AC - DC - AC converters: uncontrolled rectifiers, PWM Inverters - Bi-Directional Converters - Grid-Interactive Inverters - Matrix converter - Merits and Limitations.		
UNIT V	**CASE STUDIES FOR HYBRID RENEWABLE ENERGY SYSTEMS**	**9**
Hybrid Systems - Range and type of Hybrid systems – Performance Analysis – Cost Analysis - Case studies of Diesel - PV, Wind - PV - Fuel - cell, Micro - hydel - PV,		

Biomass-Diesel - Fuel - cell systems.
Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Analyze the impacts of hybrid energy technologies on the environment and demonstrate them to harness electrical power.
CO2: Select a suitable Electrical machine for Wind Energy Conversion Systems and simulatewind energy conversion system.
CO3: Design the power converters such as AC-DC, DC-DC, and AC-AC converters for SPV systems.
CO4: Analyze the power converters such as AC-DC, DC-DC, and AC-AC converters for Hybrid energy systems.
CO5: Interpret the hybrid renewable energy systems.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		2	1		1	1		1			1	2	1	
CO2	2	1	2	1		1	1		1			1	2	2	
CO3	2	2	2	1		1	1		1				2	2	
CO4	2	2	1	2		1	1		1				2	2	
CO5	2	2	2	2		1	1		1			1	1	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Bahman Zohuri, "Hybrid Energy Systems", Springer, 1st Edition, 2018.

T2.	S.M. Muyeen, "Wind Energy Conversion Systems", 1st Edition, Springer, 2012.
T3.	Md. Rabiul Islam, Md. Rakibuzzaman Shah and Mohd Hasan Ali, "Emerging Power Converters for Renewable Energy and Electric Vehicles", 1st Edition, CRC Press, 2021.

REFERENCE BOOK(S)	
R1.	Ernst Joshua, "Wind Energy Technology", 3rd Edition, PHI, India, 2018.
R2.	Rashid.M. H, "Power electronics Hand book", 4th Edition, Academic press, 2018.
R3.	Rai. G.D, "Non-conventional energy sources", 6th Edition, Khanna publishers, 2017.

Course Code:	**Course Title: RENEWABLE ENERGY SYSTEM**	
Course Category: BSC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	

COURSE OBJECTIVES
• To Provide knowledge about various renewable energy technologies.
• To enable students to understand and design a PV system.
• To provide knowledge about wind energy system.
• To gain knowledge about application of various renewable energy technologies.

UNIT I	**INTRODUCTION**	**9**
Primary energy sources, renewable vs. non-renewable primary energy sources, renewable energy resources in India, Current usage of renewable energy sources in India, future potential		

of renewable energy in power production and development of renewable energy technologies.		
UNIT II	**SOLAR ENERGY**	**9**
Solar Radiation and its measurements, Solar Thermal Energy Conversion from plate Solar Collectors, Concentrating Collectors and its Types, Efficiency and performance of collectors, Direct Solar Electricity Conversion from Photovoltaic, types of solar cells and its application of battery charger, domestic lighting, street lighting, and water pumping, power generation schemes. Recent Advances in PV Applications: Building Integrated PV, Grid Connected PV Systems.		
UNIT III	**WIND ENERGY**	**9**
Wind energy principles, wind site and its resource assessment, wind assessment, Factors influencing wind, wind turbine components, wind energy conversion systems (WECS), Classification of WECS devices, wind electric generating and control systems, characteristics and applications.		
UNIT IV	**BIO-ENERGY**	**9**
Energy from biomass, Principle of biomass conversion technologies/process andtheir classification, Bio gas generation, types of biogas plants, selection of site for biogas plant, classification of biogas plants, Advantage and disadvantages of biogas generation, thermal gasification of biomass, biomass gasifies, Application of biomass and biogas plants and their economics.		
UNIT V	**OTHER TYPES OF ENERGY**	**9**
Energy conversion from Hydrogen and Fuel cells, Geo thermal energy Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants and their economics.		
		Total : 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Attained knowledge about various renewable energy technologies.
CO2: Ability to understand and design a PV system.

CO3: Understand the concept of various wind energy system.
CO4: Gained knowledge about various possible hybrid energy systems.
CO5: Attained knowledge about various application of renewable energy technologies.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	2	-	2	-	-	-	-	3	3	3	3
CO2	3	3	3	3	2	-	2	-	-	-	-	3	3	3	3
CO3	3	3	3	3	2	-	2	-	-	-	-	3	3	3	3
CO4	3	3	3	3	2	-	2	-	-	-	-	3	3	3	3
CO5	3	3	3	3	2	-	2	-	-	-	-	3	3	3	3

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	D.P.Kothari, K.C.Singhal,'Renewable energy sources and emerging technologies', P.H.I.
T2.	D.S.Chauhan, S.K. Srivastava, 'Non – Conventional Energy Resources', New Age Publishers, 2006.

REFERENCE BOOK(S)	
R1.	Twidell & Wier,'Renewable Energy Resources' CRC Press(Taylor & Francis).
R2.	Tiwari and Ghosal/ Narosa,'Renewable energy resources'.
R3.	B.H.Khan, 'Non – Conventional Energy Resources', Tata Mc Graw Hill, 2006.

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Course Code: 24EEO005	**Course Title: Flexible AC Transmission Systems**	
Course Category: OEC	**Credits: 3**	
L:T:P(Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To know about the Power control in Electrical Transmission lines.
• To impart knowledge about static VAR Compensator and its applications.
• To gain knowledge on Thyristor Controlled Series Capacitor and its applications.
• To understand the performance of power systems with FACTS controllers.
• To acquire knowledge about advanced FACTS controllers.

UNIT I	**REAL AND REACTIVE POWER COMPENSATION**	**9**
Real and reactive power control in electrical power transmission lines - loads & system compensation - Uncompensated transmission line - shunt and series compensation.		
UNIT II	**STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS**	**9**
Voltage control by SVC - Advantages of slope in dynamic characteristics - Influence of SVC on system voltage - Design of SVC voltage regulator - TCR - FC - TCR - Modeling of SVC for power flow and fast transient stability- Applications: Enhancement of transient stability - Steady state power transfer - Enhancement of power system damping.		
UNIT III	**THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS**	**9**
Operation of the TCSC - Different modes of operation - Modelling of TCSC, Variability reactance model - Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit - Enhancement of system damping.		
UNIT IV	**VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS**	**9**
Static Synchronous Compensator (STATCOM) - Principle of operation - VI Characteristics. Applications: Steady state power transfer - enhancement of transient stability - prevention of voltage instability. SSSC - operation of SSSC and the control of power flow - modelling of SSSC in load flow and transient stability studies - Dynamic voltage restorer (DVR).		
UNIT V	**ADVANCED FACTS CONTROLLERS**	**9**
Interline DVR(IDVR) - Unified Power flow controller (UPFC) - Interline power flow controller (IPFC) - Unified Power quality conditioner (UPQC).		
		Total : 45 Hours

COURSE OUTCOMES

At the end of this course, students will be able to
CO1: Explain Power control in Electrical Transmission lines.
CO2: Analyze and develop Static VAR Compensator (SVC) for Steady state power transfer.
CO3: Analyze and develop Thyristor Controlled Series Capacitor (TCSC) for system stability.
CO4: Analyze the performance of steady state and dynamics of facts controllers.
CO5: Explain about advanced FACTS controllers.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2					2				2		
CO2	2	1	2	1					2				2		1
CO3	2	2		2					2				2		
CO4	2	2	1	1					2				2		
CO5	2	1	2	2					2				2		1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	R.Mohan Mathur and Rajiv K.Varma, "Thyristor-Based Facts Controllers for Electrical Transmission Systems", IEEE press and JohnWiley &Sons, Inc, 2002.

T2.	NarainG. Hingorani, "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors, 2011.

REFERENCE BOOK(S)	
R1.	K.R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Limited, Publishers, New Delhi, 2008.
R2.	V.K.Sood, "HVDC and FACTS controllers-Applications of Static Converters in Power System", Kluwer Academic Publishers, April 2004.

OPEN ELECTIVES OFFERED BY ECE DEPARTMENT

Course Code: 24ECO001	**Course Title: Introduction to Control Engineering**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To introduce the control system components and transfer function model with their graphical representation
• To understand the analysis of system in time domain along with steady state error.
• To introduce frequency response analysis of systems.

• To accord basic knowledge in design of compensators.
• To introduce the state space models.

UNIT I	**MATHEMATICAL MODELLING**	**9**
Introduction – transfer function – simple electrical, mechanical, pneumatic, hydraulic and thermal systems–analogies		
UNIT II	**FEEDBACK CONTROL SYSTEMS**	**9**
Control system components - Block diagram representation of control systems, Reduction of block diagrams, Signal flow graphs, Output to input ratios		
UNIT III	**TIME DOMAIN ANALYSIS**	**9**
Response of systems to different inputs viz., Step impulse, pulse, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.		
UNIT IV	**STABILITY ANALYSIS**	**9**
Necessary and sufficient conditions, Routh - Hurwitz criteria of stability, Root locus and Bode techniques ,Concept and construction, frequency response.		
UNIT V	**STATE SPACE TECHNIQUE**	**9**
State vectors–state space models-Digital Controllers–design aspects.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Represent and develop systems in different forms using the knowledge gained.
CO2: Analyses the system in time and frequency domain and the stability of physical systems.
CO3: Ability to Derive Transfer function Model of Electrical and Mechanical Systems.
CO4: Ability to Obtain the transfer Function by the Reduction of Block diagram & Signal

flow graph.
CO5: Acquire and analyze knowledge in State variable model for MIMO systems.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3				1		1		1			
CO2	3	3	3	2				1		1		1			
CO3	2	1	2	1				1		1		1			
CO4	3	3	3	3				1		1		1			
CO5	3	3	3	2				1		1		1			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Nagarath, I.J. and Gopal, M., "Control Systems Engineering", New Age International Publishers, 2017.
T2.	Benjamin C. Kuo, "Automatic Control Systems", Wiley, 2014

REFERENCE BOOK(S)

R1.	Katsuhiko Ogata, "Modern Control Engineering", Pearson, 2015.
R2.	John J.D., Azzo Constantine, H. and HoupisSttuart, N Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor& Francis Reprint 2009.
R3.	Rames C.Panda and T. Thyagarajan, "An Introduction to Process Modelling Identification and Control of Engineers", Narosa Publishing House, 2017.

Course Code: 24ECO002	**Course Title: SEMICONDUCTOR MANUFACTURING**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand basic semiconductor manufacturing technology
• To know Integrated Circuit Fabrication
• To introduce the basic semiconductor manufacturing processes
• To familiarize with steps involved in CMOS IC chip fabrication
• To explain major processing technology used IC manufacturing.

UNIT I	**INTRODUCTION TO SEMICONDUCTOR MANUFACTURING**	**9**

Historical perspective, processing overview, semiconductor materials, semiconductor devices, process technology, fabrication steps.		
UNIT II	**MANUFACTURING PROCESS: CRYSTAL GROWTH, SILICON OXIDATION, PHOTOLITHOGRAPHY**	**9**
Silicon crystal growth, material characterization, thermal oxidation process, impurity redistribution, masking properties of silicon dioxide, oxidation thickness characteristics.		
UNIT III	**MANUFACTURING PROCESS: ETCHING, DIFFUSION, ION IMPLANTATION, FILM DEPOSITION**	**9**
Wet chemical etching, Dry etching, basic diffusion process, extrinsic diffusion, lateral diffusion, Photolithography, Ion Implantation, implanted damage and annealing, epitaxial growth techniques, structures and defects, dielectric deposition, metallization.		
UNIT IV	**PROCESS INTEGRATION**	**9**
Passive components, bipolar technology, MOSFET Technology, MESFET Technology, MEMS Technology.		
UNIT V	**IC MANUFACTURING**	**9**
Electrical testing, packing, statistical process control, computer integrated manufacturing, challenges for integration, system-on-a-chip.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Relate technology changes from semiconductor manufacturing industry.
CO2: Explain steps for making silicon wafers from sand.
CO3: Apply various technology involved in manufacturing.
CO4: Analyze the integration of steps in CMOS IC chip fabrication.
CO5: Build CMOS-based used in the electronics industry.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1	1									1	2	
CO2	1	1	2	1										2	
CO3	1	2	1	1										2	
CO4	2	1	2	2									1	1	
CO5		2	2	1									1		

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	G. S. May and S. M. Sze, "Fundamentals of Semiconductor Fabrication", Wiley India, 2004.
T2.	Hong Xiao, "Introduction to Semiconductor Manufacturing Technology", 2nd Edition, SPIE Press, 2012.

REFERENCE BOOK(S)	
R1.	W. R. Runyan and K. E. Bean, "Semiconductor Integrated Circuit Processing Technology", Addison Wesley Publishing Company, 2010.
R2.	S. A. Campbell, "The Science and Engineering of Microelectronic Fabrication", Oxford University Press, 2012.
R3.	M. J. Madou, "Fundamentals of Micro fabrication", CRC Press, 2nd Edition, 2011.
R4.	S. M. Sze, "Semiconductor Devices: Physics and Technology", 2nd Edition., Wiley India, 2011.

Course Code: 24ECO003	**Course Title: Mechatronics**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To illustrate the selecting the sensors to develop mechatronics systems.
• To explain the architecture and timing diagram of microprocessor, and also interpret and develop programs.
• To design appropriate interfacing circuits to connect I/O devices with microprocessor.
• To apply PLC as a controller in mechatronics system.
• To design and develop the apt mechatronics system for an application.

UNIT I	INTRODUCTION AND SENSORS	9
Introduction to Mechatronics – Systems – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and Dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance Sensors – Strain Gauges – Eddy Current Sensor – Hall Effect Sensor –Temperature Sensors – Light Sensors.		
UNIT II	**8085 MICROPROCESSOR**	**9**
Introduction – Pin Configuration - Architecture of 8085 – Addressing Modes – Instruction set, Timing diagram of 8085.		
UNIT III	**PROGRAMMABLE PERIPHERAL INTERFACE**	**9**
Introduction – Architecture of 8255, Keyboard Interfacing, LED display – Interfacing, ADC and DAC Interface, Temperature Control – Stepper Motor Control – Traffic Control Interface.		
UNIT IV	**PROGRAMMABLE LOGIC CONTROLLER**	**9**
Introduction – Architecture – Input / Output Processing – Programming with Timers, Counters and Internal relays – Data Handling – Selection of PLC.		
UNIT V	**ACTUATORS AND MECHATRONICS SYSTEM DESIGN**	**9**
Types of Stepper and Servo motors – Construction – Working Principle – Characteristics, Stages of Mechatronics Design Process – Comparison of Traditional and Mechatronics Design Concepts with Examples – Case studies of Mechatronics Systems – Pick and Place Robot – Engine Management system – Automatic Car Park Barrier.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Select sensors to develop mechatronics systems.
CO2: Explain the architecture and timing diagram of microprocessor, and also interpret and

develop programs.
CO3: Design appropriate interfacing circuits to connect I/O devices with microprocessor.
CO4: Apply PLC as a controller in mechatronics system.
CO5: Design and develop the apt mechatronics system for an application.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1								2			
CO2	1	2	1	1								2			
CO3	1	2	1	1								2			
CO4	1	2	1	1								2			
CO5	2	2	1	1								2			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Bolton W., "Mechatronics", 6th Edition, Pearson Education, 2015.
T2.	Ramesh S Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", 6th Edition, Penram International Publishing Private Limited, 2013.

REFERENCE BOOK(S)

R1.	Bradley D.A., Dawson D., Buru N.C. and Loader A.J., "Mechatronics", Chapman and Hall, 2012.
R2.	Davis G. Alciatore and Michael B. Histand, "Introduction to Mechatronics and Measurement systems", McGraw Hill Education, 2011.

R3.	Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", Cengage Learning, 2010.

Course Code: 24ECO004	**Course Title: Sensors and Actuators**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To illustrate the fundamental concepts of Instrument types and its Sensors
• To analyze the variable resistance and the Inductance Sensors
• To study about the Variable Sensors and the Special Sensors.
• To understand about the Automotive Actuators
• To study about the Automatic Temperature Control Actuators .

UNIT I	**INTRODUCTION TO MEASUREMENTS AND SENSORS**	**9**

Sensors: Functions- Classifications- Main technical requirement and trends Units and standards-Calibration methods- Classification of errors- Error analysis- Limiting error- Probable error-Propagation of error- Odds and uncertainty- principle of transduction- Classification. Static characteristics- mathematical model of transducers- Zero, First and Second order transducers-Dynamic characteristics of first and second order transducers for standard test inputs.		
UNIT II	**VARIABLE RESISTANCE AND INDUTANCE SENSORS**	**9**
Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezo resistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pick up and LVDT		
UNIT III	**VARIABLE AND OTHER SPECIAL SENSORS**	**9**
Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers- Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.		
UNIT IV	**AUTOMOTIVE ACTUATORS**	**9**
Electromechanical actuators- Fluid-mechanical actuators- Electrical machines- Direct-current machines- Three-phase machines- Single-phase alternating-current Machines - Duty-type ratings for electrical machines. Working principles, construction and location of actuators viz. Solenoid, relay, stepper motor etc.		
UNIT V	**AUTOMATIC TEMPERATURE CONTROL ACTUATORS**	**9**
Different types of actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system.		

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

CO1: List common types of sensor and actuators used in vehicles.
CO2: Design measuring equipment's for the measurement of pressure force, temperature and flow.
CO3: Generate new ideas in designing the sensors and actuators for automotive application
CO4: Understand the operation of the sensors, actuators and electronic control.
CO5: Design temperature control actuators for vehicles.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2										1			
CO2	3	2		2	1										
CO3	3	2		2	1										
CO4	3	2		2	1										
CO5	3	2		2	1		2					1			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Doebelin, Ernest O. Doebelin Dhanesh N. Manik, " Measurement Systems", 7th Edition, McGraw Hill Publishers, 2019.
T2.	Robert Brandy, "Automotive Electronics and Computer System", Prentice Hall, 2001.
T3.	Bosch, "Automotive Electrics, Automotive Electronics Systems and Components, Networking and Hybrid Drive", 5th Edition, McGraw Hill Publishers, 2007.

REFERENCE BOOK(S)

R1.	James D Halderman, " Automotive Electrical and Electronics", Prentice Hall, USA, 2013.
R2.	Tom Denton, "Automotive Electrical and Electronics Systems," 3rd Edition, SAE

	International, 2004.
R3.	William Ribbens, "Understanding Automotive Electronics -An Engineering Perspective," 7th Edition, Elsevier Butterworth-Heinemann Publishers, 2012.

Course Code: 24ECO005	**Course Title: Wireless Networks**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the concept about Wireless networks, protocol stack and standards
• To understand and analyze the network layer solutions for Wireless networks
• To study about fundamentals of 3G Services, its protocols and applications
• To have in depth knowledge on internetworking of WLAN and WWAN
• To learn about evolution of 4G Networks, its architecture and applications

UNIT I	WIRELESS LAN	9
Introduction-WLAN technologies: - IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, WirelessHART.		
UNIT II	**MOBILE NETWORK LAYER**	**9**
Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing: Destination Sequence distance vector, IoT: CoAP.		
UNIT III	**3G OVERVIEW**	**9**
Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA.		
UNIT IV	**INTERNETWORKING BETWEEN WLANS AND WWANS**	**9**
Internetworking objectives and requirements, Schemes to connect WLANS and 3G Networks, Session Mobility, Internetworking Architecture for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System		
UNIT V	**4G & BEYOND**	**9**
Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Identify and choose wireless transmission standard, physical layer protocol and MAC layer protocol on the basis of various network applications.

CO2: Understand and explain mobile IP and data routing using it. Classify ad hoc network protocols
CO3: Understand the TCP protocol for wireless networks and able to do congestion free transmission over wireless networks.
CO4: Understand the major concepts involved in wireless wide-area networks and its architecture.
CO5: Have knowledge of 4G technologies and analyze various smart antenna techniques, modulation and coding techniques used in 4G technology.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3													
CO2	3	3													
CO3	3	3													
CO4	2	3													
CO5	2														

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Jochen Schiller, ”Mobile Communications”, 2nd Edition, Pearson Education 2012.
T2.	Vijay Garg, “Wireless Communications and Networking”, 1st Edition, Elsevier 2007.

REFERENCE BOOK(S)

R1.	Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband”, 2nd Edition, Academic Press, 2008.
R2.	Anurag Kumar, D.Manjunath, Joy kuri, “Wireless Networking”, 1st Edition, Elsevier 2011.

R3.	Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", 1st Edition, Pearson Education 2013

OPEN ELECTIVES OFFERED BY MECHANICAL DEPARTMENT

Course Code: 24MEO001	**Course Title: Drone Technologies**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the basics of drone technology concepts.
• To learn and understand the fundamental of design, fabrication and programming of drone.
• To impart the knowledge of a flying and operation of drone.
• To know about the various applications of drone.
• To understand the safety risks and guidelines of fly safely.

UNIT I	INTRODUCTION TO DRONE TECHNOLOGY	9
Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability.		
UNIT II	**DRONE DESIGN, FABRICATION AND PROGRAMMING**	**9**
Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program - Install program on computer-Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection.		
UNIT III	**DRONE FLYING AND OPERATION**	**9**
Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity -Removable storage devices- Linked mobile devices and applications.		
UNIT IV	**DRONE COMMERCIAL APPLICATIONS**	**9**
Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcel sand other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing.		
UNIT V	**FUTURE DRONES AND SAFETY**	**9**
The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone License-Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms.		
Total: 45 Hours		

COURSE OUTCOMES
At the end of this course, students will be able to
CO 1: Understand the various types of drone technology, drone fabrication and programming.
CO 2: Apply the suitable operating procedures for functioning a drone.

CO 3: Understand appropriate sensors and actuators for Drones.
CO 4: Apply the drone mechanism for specific applications.
CO 5: Create the programs for various drones.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	1					2			1		1	
CO2	3	3	1	1					2			1		1	
CO3	3	3	1	1					2			1		1	
CO4	3	3	1	1					2			1		1	
CO5	3	3	1	1					2			1		1	

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)	
T1.	Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and construction a Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", John Wiley & Sons, Inc, 2021.
T2.	Terry Kilby and Belinda Kilby, "Make: Getting Started with Drones", Maker Media, Inc, 2016.

REFERENCE BOOK(S)	
R1.	John Baichtal, "Building Your Own Drones: A Beginners Guide to Drones, UAVs, and ROVs", Que Publishing, 2020.

Course Code: 24MEO002	**Course Title: Introduction to Six Sigma**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the core concepts of Six Sigma, including its history, philosophy, and principles.
• To explore various tools and techniques used in Six Sigma for defining, measuring, analysing, improving, and controlling processes.
• To learn Six Sigma methodologies like DFSS and FMEA for designing and optimizing processes.
• To comprehend the strategies for effective implementation of Six Sigma and the challenges faced during its deployment.
• To examine evaluation strategies and continuous improvement techniques, focusing on

lean manufacturing and waste reduction.

UNIT I	**SIX SIGMA BACKGROUND AND FUNDAMENTALS**	**9**
Historical Overview -Definition of quality -What is six sigma -TQM and Six sigma - lean manufacturing and six sigma- six sigma and process tolerance -Six sigma and cultural changes -six sigma capability -six sigma need assessments - implications of quality levels, Cost of Poor Quality (COPQ), Cost of Doing Nothing -assessment questions.		
UNIT II	**THE SCOPE OF TOOLS AND TECHNIQUES**	**9**
Tools for definition -IPO diagram, SIPOC diagram, Flow diagram, CTQ Tree, Project Charter -Tools for measurement -Check sheets, Histograms, Run Charts, Scatter Diagrams, Cause and effect diagram, Pareto charts, Control charts, Flow process charts, Process Capability Measurement, Tools for analysis -Process Mapping, Regression analysis, RU/CS analysis, SWOT, PESTLE, Five Whys, interrelationship diagram, overall equipment effectiveness, TRIZ innovative problem solving -Tools for improvement -Affinity diagram, Normal group technique, SMED, 5S, mistake proofing, Value stream Mapping, forced field analysis -Tools for control -Radar chart, PDCA cycle, Milestone tracker diagram, Earned value management.		
UNIT III	**SIX SIGMA METHODOLOGIES**	**9**
Design For Six Sigma (DFSS), Design for Six Sigma Method - Failure Mode Effect Analysis (FMEA), FMEA process - Risk Priority Number (RPN) - Six Sigma and Leadership, committed leadership -Change Acceleration Process (CAP) - Developing communication plan -Stakeholder.		
UNIT IV	**SIX SIGMA IMPLEMENTATION AND CHALLENGES**	**9**
Tools for implementation -Supplier Input Process Output Customer (SIPOC) -Quality Function Deployment or House of Quality (QFD) -alternative approach –implementation - leadership training, close communication system, project selection -project management and team -champion training -customer quality index -challenges -program failure, CPQ vs six sigma, structure the deployment of six sigma -cultural challenge -customer/internal metrics.		
UNIT V	**EVALUATION AND CONTINUOUS IMPROVEMENT METHODS**	**9**

Evaluation strategy -the economics of six sigma quality, return on six Sigma (ROSS), ROI, poor project estimates -continuous improvement -lean manufacturing -value, customer focus, Perfection, focus on waste, overproduction -waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people -Kaizen -5S.
Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the concepts of Six Sigma and various tools.
CO2: Analyze the solutions and corrective actions to improve process performance and reduce defects using tools like DOE and mistake-proofing.
CO3: Evaluate and develop the control plans and monitor key performance indicators (KPIs) to ensure sustained improvement in processes.
CO4: Create the process documentation, Standard Operating Procedures (SOPs), and regular reviews to maintain improvements over time.
CO5: Understand about the Gain leadership and team management skills for leading Six Sigma projects, including project planning, execution, and resource management.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1					2			1			
CO2	3	3	1	1					2			1			
CO3	3	3	1	1					2			1			
CO4	3	3	1	1					2			1			
CO5	3	3	1	1					2			1			

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)	
T1.	Thomas Pyzdek and Paul A. Keller, “The Six Sigma Handbook”, McGraw-Hill, 2018.
T2.	Mikel Harry and Richard Schroeder, “Six Sigma the Breakthrough Management Strategy Revolutionizing the World's Top Corporations”, double day, 2006.

REFERENCE BOOK(S)	
R1.	Michael George, David Rowlands, and Bill Kastle, "What is Lean Six Sigma", McGraw -Hill 2003.
R2.	Thomas Pyzdek, "The Six Sigma Handbook", McGraw-Hill, 2000.
R3.	Fred Soleimannejed, "Six Sigma, Basic Steps and Implementation", Author House, 2004.
R4.	Forrest W. Breyfogle, III and James M. Cupello, Becki Meadows, "Managing Six Sigma a Practical Guide to Understanding, Assessing, and Implementing the Strategy That Yields Bottom-Line Success", John Wiley & Sons, 2000.

Course Code: 24MEO003	**Course Title: Sustainable Engineering**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To be acquainted with sustainability in engineering and its evaluation.
• To provide knowledge in environment and social sustainability.
• To provide the student with the knowledge of strategy to achieve sustainability.
• To familiarize with trends in sustainable operations.
• To create awareness in current sustainable practices in manufacturing industry.

UNIT I	ECONOMIC SUSTAINABILITY	9
Industrial Revolution-Economic sustainability: globalization and international issues Sustainability status - Emerging issues- Innovative products- Reconfiguration manufacturing enterprises - Competitive manufacturing strategies - Performance evaluation- Management for sustainability -Assessments of economic sustainability.		
UNIT II	**SOCIAL AND ENVIRONMENTAL SUSTAINABILITY**	**9**
Social sustainability -Introduction-Work management -Human rights - Societal Commitment-Customers -Business practices -Modelling and assessing social sustainability. Environmental issues pertaining to the manufacturing sector: Pollution - Use of resources - Pressure to reduce costs - Environmental management: Processes that minimize negative environmental impacts - environmental legislation and energy costs - need to reduce the carbon footprint of manufacturing Operations-Modelling and assessing environmental sustainability.		
UNIT III	**SUSTAINABILITY PRACTICES**	**9**
Sustainability awareness - Measuring Industry Awareness-Drivers and barriers -Availability of sustainability indicators -Analysis of sustainability practicing -Modeling and assessment of sustainable practicing -Sustainability awareness -Sustainability drivers and barriers - Availability of sustainability indicators- Designing questionnaires- Optimizing Sustainability Indexes-Elements –Cost and time model.		
UNIT IV	**MANUFACTURING STRATEGY FOR SUSTAINABILITY**	**9**
Concepts of competitive strategy and manufacturing strategies and development of a strategic improvement programme - Manufacturing strategy in business success strategy formation and formulation - Structured strategy formulation - Sustainable manufacturing system design options - Approaches to strategy formulation - Realization of new strategies/system designs.		
UNIT V	**TRENDS IN SUSTAINABLE OPERATIONS**	**9**
Principles of sustainable operations - Life cycle assessment manufacturing and service activities - Influence of product design on operations - Process analysis -Capacity management - Quality management -Inventory management - Just-In-Time systems -Resource efficient design - Consumerism and sustainable well-being.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO 1: Apply the importance of economic sustainability.
CO 2: Understand the importance of sustainable practices.
CO 3: Analyze the drivers and barriers for the given conditions.
CO 4: Apply strategy in sustainable manufacturing.
CO 5: Create the plan for sustainable operation of industry with environmental, cost consciousness.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1					2			1	1	2	
CO2	3	3	1	1					2			1	1	2	
CO3	3	3	1	1					2			1	1	2	
CO4	3	3	1	1					2			1	1	2	
CO5	3	3	1	1					2			1	1	2	

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)	
T1.	Davim J.P., "Sustainable Manufacturing", John Wiley & Sons., United States, 2019.
T2.	Ibrahim Garbie, "Sustainability in Manufacturing Enterprises Concepts, Analyses and Assessments for Industry 4.0", Springer International Publishing., United States, 2021.

REFERENCE BOOK(S)	
R1.	Jovane F., Ęmper, W.E. and Williams, D.J., "The Manufuture Road towards Competitive and Sustainable High-Adding-Value Manufacturing", Springer, United States, 2019.
R2.	Kutz M., "Environmentally Conscious Mechanical Design", John Wiley & Sons., United States, 2021

R3.	Seliger G., "Sustainable Manufacturing: Shaping Global Value Creation", Springer, United States, 2020.

Course Code: 24MEO004	**Course Title: Foundation Skills in Integrated Product Development**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks : 100**

COURSE OBJECTIVES
• To understand the fundamentals of product development, including global trends and product decision-making.
• To explore requirement engineering, system design, and modelling for effective product

development.
• To learn various design, testing, and prototyping techniques for product development.
• To understand the concepts of sustenance engineering, product validation, and end-of-life (EoL) support.
• To comprehend the business dynamics of the engineering services industry.

UNIT I	**FUNDAMENTALS OF PRODUCT DEVELOPMENT**	**9**
Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economic Trends -Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle - Product Development Planning and Management.		
UNIT II	**REQUIREMENTS AND SYSTEM DESIGN**	**9**
Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis -Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization -System Specification - Sub-System Design - Interface Design.		
UNIT III	**DESIGN AND TESTING**	**9**
Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques –Challenges in Integration of Engineering Disciplines -Concept Screening & Evaluation - Detailed Design -Component Design and Verification -Mechanical, Electronics and Software Subsystems - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing -Prototyping - Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation		
UNIT IV	**SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT**	**9**
Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation- Sustenance -Maintenance and Repair -Enhancements - Product EoL -Obsolescence		

Management -Configuration Management - EOL Disposal.		
UNIT V	**BUSINESS DYNAMICS -ENGINEERING SERVICES INDUSTRY**	**9**
The Industry - Engineering Services Industry - Product Development in Industry versus Academia -The IPD Essentials - Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems - Product Development Trade-offs -Intellectual Property Rights and Confidentiality -Security and Configuration Management.		
		Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1. Apply product life cycle concepts to plan and manage product development effectively.
CO2. Analyse system design and optimization techniques for subsystem and interface design.
CO3. Understand the concepts using concept generation techniques.
CO4. Formulate the strategies for product maintenance, repair, and enhancements.
CO5. Evaluate the integration of mechanical, embedded, and software systems in product manufacturing and assembly.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1					2			1	2	1	
CO2	3	3	1	1					2			1	2	1	
CO3	3	3	1	1					2			1	2	1	
CO4	3	3	1	1					2			1	2	1	
CO5	3	3	1	1					2			1	2	1	

(1 -Low, 2 -Medium, 3 -High)

TEXT BOOK(S)	
T1.	Ulrich, Karl T.; Eppinger, Steven D.; Yang, Maria C.; *Product Design and Development*; 7th Edition; McGraw-Hill Education; 2020.
T2.	Pugh, Stuart; *Total Design: Integrated Methods for Successful Product Engineering*; 1st Edition; Addison-Wesley Publishing; 1990.

REFERENCE BOOK(S)	
R1.	Cross, Nigel*; Engineering Design Methods: Strategies for Product Design*; 4th Edition; John Wiley & Sons; 2008.
R2.	Otto, " *Product Design: Techniques in Reverse Engineering and New Product Development"* 1st Edition; Pearson Education; 2000.

Course Code: 24MEO005	**Course Title: Maintenance Engineering**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks : 100**

COURSE OBJECTIVES
• To understand the principles, objectives and importance of maintenance adopted in industry for successful progress.

• To introduce different maintenance categories, its merits and types of lubrication.
• To expose the idea of condition monitoring, methods and instruments used for allied measurements.
• To learn about failure analysis and repair methods for few mechanical elements.
• To promote computerization in maintenance and inventory management.

UNIT I	**PRINCIPLES OF MAINTENANCE PLANNING**	**9**
Basic principles of maintenance planning - Objectives and principles of planned maintenance activity - Importance and benefits of sound maintenance systems - Maintenance organization - Maintenance economics.		
UNIT II	**MAINTENANCE CATEGORIES AND LUBRICATION**	**9**
Maintenance categories - Comparative merits of each category - Preventive maintenance, Maintenance schedules, Repair cycle - Total Productive Maintenance - Principles and methods of lubrication.		
UNIT III	**CONDITION MONITORING**	**9**
Condition based maintenance - Cost comparison with and without Condition Monitoring - Methods and instruments for condition monitoring - Noise, vibration, wear and temperature measurement.		
UNIT IV	**FAILURE ANALYSIS AND REPAIR METHODS**	**9**
Failure analysis - Failures and their development - Role of Non Destructive Testing in failure analysis - Repair methods for bearings, cylinder block, fuel pump, shaft.		
UNIT V	**COMPUTER AIDED MAINTENANCE MANAGEMENT**	**9**
Approach towards Computerization in maintenance - computer-aided maintenance management system (CAMMS) - Advantages of CAMMS - spare parts and inventory centre performance reporting.		
Total: 45 Hours		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain the principles, objectives and importance of maintenance adopted in industry.

CO2: Select the suitable maintenance category and lubrication type.
CO3: Apply the appropriate methods and instruments for condition monitoring.
CO4: Analyze the failures of mechanical systems and select suitable repair methods.
CO5: Utilize computers in maintenance and inventory management.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	1					2			1	2	1	
CO2	3	3	1	1					2			1	2	1	
CO3	3	3	1	1					2			1	2	1	
CO4	3	3	1	1					2			1	2	1	
CO5	3	3	1	1					2			1	2	1	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)	
T1.	Srivastava S.K, "Maintenance Engineering", S Chand and Company, 2010.
T2.	Mishra R.C, Pathak K, "Maintenance Engineering and Management", Second edition, Prentice Hall India Learning Pvt. Ltd., 2012.

REFERENCE BOOK(S)	
R1.	Keith Mobley R, Lindley R. Higgins and Darrin J. Wikoff, "Maintenance Engineering" , Seventh edition, McGraw-Hill Professional, 2008.
R2.	Davies A, "Handbook of Condition Monitoring: Techniques and Methodology", Springer, 2012.
R3.	Otegui Jose Luis, "Failure Analysis, Fundamentals and Applications in Mechanical Components", Nineteenth edition, Springer, 2014.

OPEN ELECTIVE OFFERED BY CIVIL DEPARTMENT

Course Code: 24CEO001	**Course Title: Environment and Agriculture**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the environmental basis of agriculture and the impact of globalization on agro-ecosystems.
• To analyze the environmental impacts of irrigation, mechanized agriculture, and urbanization on land and water resources.
• To study the effects of climate change, global warming, and water cycle disruptions on agricultural systems
• To examine the relationship between ecological diversity, agricultural biotechnology, and sustainable farming practices.
• To explore emerging agricultural environmental concerns, including global policies, alternative farming methods, and sustainable agricultural solutions.

UNIT I	ENVIRONMENTAL CONCERNS	9
Environmental basis for agriculture and food - land use and landscape changes - water quality issues - changing social structure and economic focus - globalization and its impacts - agro ecosystems.		
UNIT II	**ENVIRONMENTAL IMPACTS**	**9**
Irrigation development and watersheds - mechanized agriculture and soil cover impacts - erosion and problems of deposition in irrigation systems - agricultural drainage and downstream impacts - agriculture versus urban impacts.		
UNIT III	**CLIMATE CHANGE**	**9**
Global warming and changing environment - ecosystem changes - changing blue – green - grey water cycles - water scarcity and water shortages - desertification.		
UNIT IV	**ECOLOGICAL DIVERSITY AND AGRICULTURE**	**9+3**
Ecological diversity, wild life and agriculture - GM crops and their impacts on the environment - insets and agriculture - pollination crisis - ecological farming principles - forest fragmentation and agriculture - agricultural biotechnology concerns.		

UNIT V	EMERGING ISSUES	9+3
Global environmental governance - alternate culture systems - mega farms and vertical farms - virtual water trade and its impacts on local environment - agricultural environment policies and its impacts - sustainable agriculture distributed GIS.		
		Total: 45 Hours

COURSE OUTCOMES

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

CO1: Understand the environmental basis of agriculture, land use changes, and the impact of globalization on agro-ecosystems.

CO2: Analyze the environmental impacts of irrigation, mechanized agriculture, soil erosion, and urbanization on land and water resources.

CO3: Evaluate the effects of climate change, global warming, and water cycle disruptions on agricultural sustainability.

CO4: Assess the role of ecological diversity, GM crops, and agricultural biotechnology in sustainable farming practices.

CO5: Explore emerging environmental challenges in agriculture and assess policies, alternative farming methods, and sustainable agricultural solutions.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1				2	2						2	1	1
CO2	2	2	1	2	2	2	2					1	2	2	2
CO3	2	2	2	2	1	2	2					1			
CO4	2	2	2	2	2	2	2	1				2	2		
CO5	2	2	2	2	2	2	2	1				2	2		

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	M.Lakshmi Narasaiah, Environment and Agriculture, Discovery Pub. House, 2006.
T2.	Arvind Kumar, Environment and Agriculture, ABH Publications, New Delhi, 2005.

REFERENCE BOOK(S)	
R1.	T.C. Byerly, Environment and Agriculture, United States. Dept. of Agriculture. Economic Research Service, 2006.
R2.	Environment and agriculture: environmental problems affecting agriculture in the Asia and Pacific region; World Food Day Symposium, Bangkok, Thailand. 1989

Course Code: 24CEO002	**Course Title: Green Building Design**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the environmental implications of buildings, including energy use, carbon emissions, water consumption, and waste disposal

• To analyze the impact of building technologies and materials, considering embodied energy, resource utilization, and sustainable alternatives.
• To evaluate thermal comfort in buildings by examining heat transfer characteristics and the effects of geographical location.
• To explore the role of solar energy in buildings, focusing on solar passive cooling and heating techniques through case studies
• To apply green building principles by implementing efficient water management, waste disposal, and urban sustainability practices.

UNIT I	**ENVIRONMENTAL IMPLICATIONS OF BUILDINGS**	**9**
Energy use - carbon emissions - water use, waste disposal; building materials: sources, methods of production and environmental implications - embodied energy in building materials: transportation energy for building materials; maintenance energy for buildings.		
UNIT II	**IMPLICATIONS OF BUILDING TECHNOLOGIES EMBODIED ENERGY OF BUILDINGS**	**9**
Framed construction - masonry construction - resources for building materials, alternative concepts - recycling of industrial and buildings wastes - biomass resources for buildings.		
UNIT III	**COMFORTS IN BUILDING**	**9**
Thermal comfort in buildings issues; heat transfer - characteristic of building materials and building techniques - incidence of solar heat on buildings - implications of geographical locations.		
UNIT IV	**UTILITY OF SOLAR ENERGY IN BUILDINGS**	**9**
Utility of solar energy in buildings - concepts of solar passive cooling and heating of buildings - low energy cooling - case studies of solar passive cooled and heated buildings.		
UNIT V	**GREEN COMPOSITES FOR BUILDINGS**	**9**
Concepts of green composites - water utilisation in buildings - low energy approaches to water management - management of solid wastes - management of sullage water and sewage.		

urban environment and green buildings - green cover and built environment.
Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain the environmental implications of buildings, including energy use, carbon emissions, and waste disposal.
CO2: Examine the impact of building technologies and construction materials on sustainability and embodied energy.
CO3: Assess thermal comfort in buildings and determine the influence of heat transfer characteristics of materials.
CO4: Demonstrate the utility of solar energy in buildings and implement solar passive cooling and heating techniques.
CO5: Develop green building solutions incorporating water management, solid waste disposal, and urban environmental sustainability strategies.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1			2	2	1				1	2	1	2
CO2	2	2	2	2	1	2	2	1		1	1	1	2		
CO3	1	1	2	1		2	2			1		1	2		
CO4	2	2	2	2	1	2	2	1		1	1	2	2		
CO5	2	1	1	1		2	2	1					2	1	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.

T2.	Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.
T3.	Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

REFERENCE BOOK(S)	
R1.	Osman Attmann, "Green Architecture Advanced Technologies and Materials", McGraw. Hill, 2010.
R2.	Jerry Yudelson, McGraw Hil "Green building Through Integrated Design". 2009.

Course Code: 24CEO003	**Course Title: Geographical Information System**	
Course Category: OEC	**Credits: 3**	
L:T:P (Hours/Week) 3:0:0	**Total Contact Hours: 45**	**Max Marks: 100**

COURSE OBJECTIVES
• To understand the basic concepts and significance of GIS.
• To understand different database structures, including relational and object-oriented

models
• To understand different methods of spatial data input, including scanning and digitization.
• To understand the importance of metadata in GIS.
• To explore various data management functions and their significance.

UNIT I	**FUNDAMENTALS OF GIS**	**9**
Introduction to GIS - basic spatial concepts - coordinate systems - GIS and information systems - definitions - history of GIS - components of a GIS - hardware, software, data, people, methods - proprietary and open source software - types of data - spatial, attribute data- types of attributes - scales/ levels of measurements.		
UNIT II	**SPATIAL DATA MODELS**	**9**
Database structures - relational, object oriented - entities - ER diagram - data models - conceptual, logical and physical models - spatial data models - raster data structures - raster data compression - vector data structures - raster vs vector models- tin and grid data models.		
UNIT III	**DATA INPUT AND TOPOLOGY**	**9**
Scanner - raster data input - raster data file formats - geo referencing - vector data input - digitizer - datum projection and reprojection -coordinate transformation - topology - adjacency, connectivity and containment - topological consistency - non topological file formats - attribute data linking - linking external databases - GPS data integration.		
UNIT IV	**DATA QUALITY AND STANDARDS**	**9+3**
Data quality - basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage - metadata - GIS standards –interoperability - OGC - spatial data infrastructure		
UNIT V	**DATA MANAGEMENT AND OUTPUT**	**9+3**
Import/Export - data management functions- raster to vector and vector to raster conversion - data output - map compilation - chart/graphs - multimedia - enterprise vs desktop GIS - distributed GIS.		

Total: 45 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the fundamental principles and components of a Geographic Information System (GIS).
CO2: Analyze differentiate between raster and vector data models and analyze their suitability for specific applications.
CO3: Apply data input techniques to create and manage spatial data, including establishing topological relationships.
CO4: Evaluate spatial data quality based on established standards and recommend appropriate data sharing practices.
CO5: Create design and produce effective GIS outputs, including maps and reports, to communicate spatial information.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		1									1	1	1	1
CO2	2		2	1	1							1	1		
CO3	2		2	1	1							1	1		
CO4	2	1	2	2	1							1			
CO5	2	1	2	2	2							1	1	1	1

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition, 2011.
T2.	Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction Geographical Information Systems, Pearson Education, 2nd Edition, 2007.

REFERENCE BOOK(S)	
R1.	Lo. C. P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 2006.

Course Code: 24CEO004	Course Title: Climate Change and its Impacts	
Course Category: OEC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To explore key climate parameters such as temperature, rainfall, humidity, and wind
• To identify greenhouse gases and their impact on climate change.
• To assess the effects of climate change on human health, malnutrition, and migration.
• To identify various adaptation options for mitigating climate change effects.
• To understand the importance of conducting an energy audit to improve energy efficiency.

UNIT I	ENVIRONMENTAL IMPLICATIONS OF BUILDINGS	9
Energy use - carbon emissions - water use - waste disposal; Building materials: sources, methods of production and environmental Implications - Embodied Energy in Building Materials: Transportation Energy for Building Materials - Maintenance Energy for Buildings.		
UNIT II	**IMPLICATIONS OF BUILDING TECHNOLOGIES EMBODIED ENERGY OF BUILDINGS**	**9**
Framed Construction - Masonry Construction - Resources for Building Materials - Alternative concepts - Recycling of Industrial and Buildings Wastes - Biomass Resources for buildings.		
UNIT III	**COMFORTS IN BUILDING**	**9**
Thermal Comfort in Buildings - Issues; Heat Transfer Characteristic of Building Materials and Building Techniques - Incidence of Solar Heat on Buildings - Implications of Geographical Locations.		
UNIT IV	**UTILITY OF SOLAR ENERGY IN BUILDINGS**	**9**
Utility of Solar energy in buildings - concepts of Solar Passive Cooling and Heating of Buildings - Low Energy Cooling - Case studies of Solar Passive Cooled and Heated		

Buildings.		
UNIT V	**GREEN COMPOSITES FOR BUILDINGS**	**9**
Concepts of Green Composites - Water Utilisation in Buildings - Low Energy Approaches to Water Management - Management of Solid Wastes - Management of Sullage Water and Sewage - Urban Environment and Green Buildings - Green Cover and Built Environment.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the environmental implications of buildings, including energy use, carbon emissions, and waste disposal.
CO2: Analyze the impact of building technologies and construction materials on sustainability and embodied energy
CO3: Evaluate thermal comfort in buildings and the influence of heat transfer characteristics of materials.
CO4: Assess the utility of solar energy in buildings and explore solar passive cooling and heating techniques.
CO5: Apply green building concepts, including water management, solid waste disposal, and urban environmental sustainability.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1			2	2	1					2	1	2
CO2	2	2	2	1	1	2	2			1	1	1	2		
CO3	1	1	2			2	2	1		1		1	1		
CO4	2	2	2	1	1	2	2	1			1	2			
CO5	2	1	1			2	2	1				1	2	1	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
T2.	Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.
T3.	Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

REFERENCE BOOK(S)	
R1.	Osman Attmann Green Architecture Advanced Technologies and Materials. McGraw Hill, 2010.
R2.	Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
R3.	Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke.

Course Code: 24CEO005	Course Title: Disaster Management	
Course Category: OEC	Credits: 3	
L:T:P (Hours/Week) 3:0:0	Total Contact Hours: 45	Max Marks: 100

COURSE OBJECTIVES
• To provide students an exposure to disasters, their significance and types.
• To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
• To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR).
• To enhance awareness of institutional processes in the country.
• To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

UNIT I	INTRODUCTION TO DISASTERS	9
Definition: disaster, hazard, vulnerability, resilience, risks - disasters: types of disasters - earthquake, landslide, flood, drought, fire etc - classification, causes, impacts including social, economic, political, environmental, health, psychosocial, etc.- differential impacts- in terms of caste, class, gender, age, location, disability - global trends in disasters: urban disasters, pandemics, complex emergencies, climate change- dos and don'ts during various types of disasters.		
UNIT II	**APPROACHES TO DISASTER RISK REDUCTION (DRR)**	**9**
Disaster cycle - phases, culture of safety, prevention, mitigation and preparedness community based DRR, structural- non-structural measures, roles and responsibilities of- community, panchayat raj institutions/urban local bodies(PRIS/ULBS), states, centre, and other stakeholders- institutional processes and framework at state and central level- state disaster management authority(SDMA) - early warning system - advisories from appropriate agencies.		
UNIT III	**INTER-RELATIONSHIP BETWEEN DISASTERS AND**	**9**

	DEVELOPMENT	
Factors affecting vulnerabilities, differential impacts, impact of development projects such as dams, embankments, changes in land-use etc. - climate change adaptation- IPCC scenario and scenarios in the context of India - relevance of indigenous knowledge, appropriate technology and local resources.		
UNIT IV	**DISASTER RISK MANAGEMENT IN INDIA**	**9**
Hazard and vulnerability profile of India, components of disaster relief: water, food, sanitation, shelter, health, waste management, institutional arrangements (mitigation, response and preparedness, disaster management act and policy - other related policies, plans, programmes and legislation - role of GIS and information technology components in preparedness, risk assessment, response and recovery phases of disaster - disaster damage assessment		
UNIT V	**DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS**	**9**
Landslide hazard zonation: case studies, earthquake vulnerability assessment of buildings and infrastructure: case studies, drought assessment: case studies, coastal flooding: storm surge assessment, floods: fluvial and pluvial flooding: case studies; forest fire: case studies, man-made disasters: case studies, space based inputs for disaster mitigation and management and field works related to disaster management.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain key concepts related to disasters, including hazard, vulnerability, resilience, and risk.
CO2: Understand disaster risk reduction (DRR) strategies, including structural and non-structural measures.
CO3: Analyze factors affecting vulnerabilities and their differential impacts on different communities.
CO4: Assess India's hazard and vulnerability profile.
CO5: Assess the vulnerabilities of buildings and infrastructure to earthquakes and other hazards.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1				2	2					2	2	1	1
CO2	2	2	1			2	2	1				2	2		
CO3	1	2	2		1	2	2						2		
CO4	1	1	2	1	1	2	2					1	2		
CO5	1			1		2	2						1	1	2

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-938038642
T2.	Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-12590073
T3.	Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
T4.	Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCE BOOK(S)	
R1.	Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005.
R2.	Government of India, National Disaster Management Policy, 2009.

MANDATORY COURSE

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1	24MAC001	Constitution of India	MC	T	1	1	0	0	0
2	24MAC002	Industrial Safety	MC	T	1	1	0	0	0
3	24MAC003	Entrepreneurship	MC	T	1	1	0	0	0
4	24MAC004	Film Appreciation	MC	T	1	1	0	0	0
5	24MAC005	Well Being with Traditional Practices - Yoga, Ayurveda and Siddha	MC	T	1	1	0	0	0
6	24MAC006	Introduction to Women and Gender Studies	MC	T	1	1	0	0	0
7	24MAC007	Elements of Literature	MC	T	1	1	0	0	0
Total					**7**	**7**	**0**	**0**	**0**

Course Code: 24MAC001	Course Title: Constitution of India	
Course Category: MC	Credits: 0	
L:T:P (Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks: 100

COURSE OBJECTIVES
• To understand evolution of Indian Constitution.
• To analyze the fundamental rights.
• To understand the composition of Parliament.
• To study constitution amendment procedure.
• To know about the powers of High Court and Supreme Court.

UNIT I	INTRODUCTION	2
Evolution of Indian Constitution, Significance of Constitution, Composition, Preamble and its Philosophy.		
UNIT II	**RIGHTS, DUTIES AND DIRECTIVE PRINCIPLES**	**3**
Fundamental Rights - Writs and Duties, Directive Principles of State Policy.		
UNIT III	**COMPOSITION OF PARLIAMENT AND FEDERALISM**	**4**
Union Government, President and Vice President, Houses of the Parliament and their functions, Composition of State Legislature, Powers, Functions and Position of Governor, Function of Chief Ministers, Council of Ministers, The Indian Federal System, Administrative Relationship between Union and States.		
UNIT IV	**BILLS AND CONSTITUTION AMENDMENT PROCEDURE**	**3**
Types of Bills, Stages of passing of Bill into an Act, Veto Power, Constitution Amendment Procedure, Various Amendments made and their significance for India.		
UNIT V	**JUDICIARY**	**3**
Supreme Court and High Court, Functions and powers, Judicial Review.		

TEXT BOOK(S)	
T1.	Subash C. Kashyap, "Our Constitution", 5th Edition, NBT, India, New Delhi, 2015.
T2.	Basu D D, "Introduction to the Constitution of India", 20th Edition, Prentice Hall of India, New Delhi, 2011.

REFERENCE BOOK(S)	
R1.	Briji Kishore Sharma, "Introduction to the Constitution of India", 8th Edition, Prentice Hall of India, New Delhi, 2017.
R2.	Hoshiar Singh, "Indian Administration", 1st Edition, Pearson Education, New Delhi, 2011.
R3.	Jain M C, "The Constitution of India", 5th Edition, State Mutual Book & Periodical Service, Limited, New Delhi, 1988.
R4.	Shukla V N, "Constitution of India", 13th Edition, Eastern Book Company Limited, New Delhi, 2017.

Course Code: 24MAC002	Course Name: Industrial Safety	
Course Category: MC	Credits: 0	
L:T:P(Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks: 100

COURSE OBJECTIVES
• To understand the Introduction and basic terminologies of safety.
• To learn about the Important Statutory Regulations and standards.
• To conduct and participate the various safety activities in the Industry.
• To have knowledge about Workplace Exposures and Hazards.
• To assess the various Hazards and consequences through various Risk Assessment Techniques.

UNIT I	SAFETY TERMINOLOGIES	3
Hazard - Types of Hazard - Risk - Hierarchy of Hazards Control Measures - Lead indicators - lag Indicators - Flammability - Toxicity Time-weighted Average (TWA) - Personnel Protective Equipment - Health and Safety Policy - Material Safety Data Sheet MSDS.		
UNIT II	**STANDARDS AND REGULATIONS**	**3**
Indian Factories Act - 1948 - Health - Safety - Hazardous materials and Welfare - ISO 45001:2018 occupational health and safety (OH&S).		
UNIT III	**SAFETY ACTIVITIES**	**3**
Mock Drills - On-site Emergency Action Plan - Off-site Emergency Action Plan - Safety poster and Display - Human Error Assessment.		
UNIT IV	**WORKPLACE HEALTH AND SAFETY**	**3**
Noise hazard - Particulate matter - musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA.		
UNIT V	**HAZARD IDENTIFICATION TECHNIQUES**	**3**
Job Safety Analysis - Preliminary Hazard Analysis - Failure mode and Effects Analysis - Hazard and Operability - Fault Tree Analysis - Event Tree Analysis Qualitative and		

Quantitative Risk Assessment.

TEXT BOOK(S)	
T1.	R.K. Jain and Prof. Sunil S. Rao "Industrial Safety, Health and Environment Management Systems", Khanna Publisher, 2012.
T2.	L. M. Deshmukh, "Industrial Safety Management: Hazard Identification and Risk Control", McGraw-Hill Education, 2015.

REFERENCE BOOK(S)	
R1.	Frank Lees, "Loss Prevention in Process Industries", 4th Edition, Butterworth-Heinemann Publications, UK, 2012.
R2.	John Ridley and John Channing, "Safety at Work: Routledge", 7th Edition, McGraw-Hill Education, 2015.
R3.	Dan Petersen, "Techniques of Safety Management: A System Approach", Khanna Publisher, 2012.

Course Code: 24MAC003	**Course Title: Entrepreneurship**
Course Category: MC	**Credits: 0**

L:T:P (Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks: 100

COURSE OBJECTIVES
• To develop and strengthen the entrepreneurial quality and motivation of learners.
• To impart the entrepreneurial skills and traits essential to become successful entrepreneurs.
• To apply the principles and theories of entrepreneurship and management in Technology oriented businesses.
• To empower the learners to run a Technology driven business efficiently and effectively
• To understand the emerging trends in Entrepreneurship.

UNIT I	INTRODUCTION TO ENTREPRENEURSHIP	3
Entrepreneurship- Definition, Need, Scope - Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur; Classification of entrepreneurs, Types of entrepreneurs - Factors affecting entrepreneurial development - Achievement Motivation - Contributions of Entrepreneurship to Economic Development.		
UNIT II	**BUSINESS OWNERSHIP & ENVRIONMENT**	**3**
Types of Business Ownership - Business Environmental Factors - Political-Economic-Sociological - Technological - Environmental - Legal aspects - Human Resources Mobilization - Basics of Managing Finance - Essentials of Marketing Management - Production and Operations Planning - Systems Management and Administration.		
UNIT III	**FUNDAMENTALS OF TECHNOPRENEURSHIP**	**3**
Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts-Principles - Characteristics of a technopreneur - Impacts of Technopreneurship on Society - Economy - Job Opportunities in Technopreneurship - Recent trends		
UNIT IV	**APPLICATIONS OF TECHNOPRENEURSHIP**	**3**
Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and		

Technology interactions, Networking of entrepreneurial activities - Launching - Managing Technology based Product / Service entrepreneurship - Success Stories of Technopreneurs - Case Studies.		
UNIT V	**EMERGING TRENDS IN ENTREPRENERUSHIP**	**3**
Effective Business Management Strategies For Franchising - Sub-Contracting- Leasing- Technopreneurs - Agripreneurs - Netpreneurs - Portfolio entrepreneurship - NGO Entrepreneurship - Recent Entrepreneurial Developments - Local - National - Global perspectives.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Learn the basics of Entrepreneurship.
CO2: Understand the business ownership patterns and environment.
CO3: Understand the Job opportunities in Industries relating to Technopreneurship.
CO4: Learn about applications of Tehnopreneurship and to become a successful Technopreneurs.
CO5: Acquaint with the recent and emerging trends in entrepreneurship.

TEXT BOOK(S)	
T1.	S.S.Khanka, "Entrepreneurial Development", S.Chand & Co. Ltd., Ram Nagar New Delhi, 2021.
T2.	Donal F Kuratko, "Entrepreneurship Theory, Process, Practice", 11th Edition, Cengage Learning, 2019.
T3.	Daniel Mankani, "Technopreneurship: The successful Entrepreneur in the new Economy", Prentice Hall, 2012.

REFERENCE BOOK(S)	
R1.	Edward Elgar, "Entrepreneurship, Cooperation and the Firm: The Emergence and Survival of High-Technology Ventures in Europe", Wiley Publication, 2010.
R2.	S.S.Khanka, "Entrepreneurial Development", S.Chand & Co. Ltd. Ram Nagar New Delhi, 2021.

Course Code: 24MAC004	Course Title: Film Appreciation	
Course Category: MC	Credits: 0	
L:T:P (Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks:100

COURSE OBJECTIVES
• To understand the historical development of film as an art and entertainment form.
• To learn the language of cinema and its evolution over a century.
• To develop the ability to read a film critically and appreciate its various nuances.
• To cultivate an appreciation for film as a text, exploring its narrative, themes, and stylistic elements.
• To foster a joyful and engaging approach to studying films.

UNIT I	THEME - A: THE COMPONENT OF FILMS	3
A-1: The material and equipment A-2: The story, screenplay and script A-3: The actors, crew members, and the director A-4: The process of film making… structure of a film		
UNIT II	**THEME - B: EVOLUTION OF FILM LANGUAGE**	**3**
B-1: Film language, form, movement etc. B-2: Early cinema… **silent film** (Particularly French) B-3: The emergence of feature films: **Birth of a Nation** B-4: Talkies		
UNIT III	**THEME - C: FILM THEORIES AND CRITICISM/APPRECIATION**	**3**
C-1: Realist theory; Autarkists C-2: Psychoanalytic, Ideological, Feminists C-3: How to read films?		

C-4: Film Criticism / Appreciation		
UNIT IV	**THEME - D: DEVELOPMENT OF FILMS**	**3**
D-1: Representative Soviet films D-2: Representative Japanese films D-3: Representative Italian films D-4: Representative Hollywood film and the studio system		
UNIT V	**THEME - E: INDIAN FILMS**	**3**
E-1: The early era E-2: The important films made by the directors E-3: The regional films E-4: The documentaries in India		

COURSE OUTCOMES
At the end of this course, students will be able to:
CO1: Understand the historical development of film as an art and entertainment form.
CO2: Learn the language of cinema and its evolution over a century.
CO3: Develop the ability to read a film critically and appreciate its various nuances.
CO4: Cultivate an appreciation for film as a text, exploring its narrative, themes, and stylistic Elements.
CO5: Foster a joyful and engaging approach to studying films.

READING:

A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.

Course Code: 24MAC005	Course Title: Well Being with Traditional Practices - Yoga, Ayurveda and Siddha	
Course Category: MC	Credits: 0	
L:T:P (Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks: 100

COURSE OBJECTIVES
• To enjoy life happily with fun filled new style activities that help to maintain health.
• To adapt a few lifestyle changes that will prevent many health disorders.
• To be cool and handbill every emotion very smoothly in every walk of life.
• To learn to eat cost effective but healthy foods those are rich in essential nutrients.
• To develop immunity naturally that will improve resistance against many health disorders.

UNIT I	HEALTH AND ITS IMPORTANCE	3
Health - Definition - Importance of maintaining health - More importance on prevention than treatment, Types of health, Present health status - The life expectancy-present status - mortality rate - dreadful diseases - Non-communicable diseases (NCDs) the leading cause of death - 60% - heart disease - cancer - diabetes - chronic pulmonary diseases - risk factors - tobacco - alcohol - unhealthy diet - lack of physical activities. Types of diseases and disorders - Causes of the diseases / disorders - Importance of prevention of illness - Simple lifestyle modifications to maintain health - Maintaining BMI-Importance and actions to be taken.		
UNIT II	**DIET**	**3**
Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, Balanced diet and its 7 Components - Carbohydrates - Proteins - Fats - Vitamins - Minerals - Fibre and Water, Food additives and their merits & demerits - Effects of food additives - Types of food additives - Food additives and processed foods - Food additives and their reactions, Definition of BMI and maintaining it with diet Importance - Consequences of not maintaining BMI - different steps to maintain optimal BM.		

UNIT III	ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH	3
AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy, Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life, Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Pancheekarana Theory / **(**Five Element Theory) 96 fundamental Principles - Uyir Thathukkal **(**Tri-Dosha Theory) - Udal Thathukkal.		
UNIT IV	**MENTAL WELLNESS**	**3**
Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life -Short term and long term effects of emotional disturbances, Stress management - Stress definition - Stress in daily life - How stress affects one's life - Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement.		
UNIT V	**YOGA**	**3**
Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Learn the importance of different components of health.
CO2: Understand the importance of diet and workouts in maintaining health.
CO3: Learn new techniques of Ayurveda and Siddha systems.
CO4: Understand about emotional health and stress management.
CO5: Understand the concept of Yogasanas.

TEXT BOOK(S)	
T1.	Ashley Martin, "Nutrition and Dietetics", White Word Publications, New York, NY 10001, USA, 2012.
T2.	Cory Martin, "Yoga for Beginners_ 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body", Althea Press, Berkeley, California, 2015.

REFERENCE BOOK(S)	
R1.	Moshe Zeidner, Gerald Matthews, and Richard D. Roberts, "What We Know About Emotional Intelligence - How It Affects Learning, Work, Relationships, and Our Mental Health", Cambridge, Massachusetts, London, England, 2012.
R2.	Kristin Neff and Christopher Germer, "A Bradford Book", The MIT Press, Cambridge, Massachusetts, London, England, 2015.

Course Code: 24MAC007	Course Title: Elements of Literature	
Course Category: MC	Credits: 0	
L:T:P (Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks: 100

COURSE OBJECTIVES
• To develop an awareness of the finer sensibilities of human existence through art.
• To appreciate the role of literature in expressing human experience.
• To explore different forms of literature as modes of human expression.
• To understand the elements of drama.

UNIT I	RELEVANCE OF LITERATURE	3
a) Enhances Reading, thinking, discussing and writing skills. b) Develops finer sensibility for better human relationship. c) Increases understanding of the problem of humanity without bias. d) Providing space to reconcile and get a cathartic effect.		
UNIT II	**ELEMENTS OF FICTION**	**3**
a) Fiction, fact and literary truth. b) Fictional modes and patterns. c) Plot character and perspective.		
UNIT III	**ELEMENTS OF POETRY**	**3**
a) Emotions and imaginations. b) Figurative language. c) (Simile, metaphor, conceit, symbol, pun and irony). d) Personification and animation. e) Rhetoric and trend.		

UNIT IV	ELEMENTS OF DRAMA	3
a) Drama as representational art. b) Content mode and elements. c) Theatrical performance. d) Drama as narration, mediation and persuasion. e) Features of tragedy, comedy and satire.		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Develop an awareness of the finer sensibilities of human existence through art
CO2: Appreciate the role of literature in expressing human experience
CO3: Explore different forms of literature as modes of human expression
CO4: Understand the features and varieties of drama

TEXT BOOK(S)	
T1.	W.H. Hudson, "An Introduction to the Study of English Literature", Atlantic, 2007.
T2.	Mario Klarer, Routledge, "An Introduction to Literary Studies", Pearson, 2013.

REFERENCE BOOK(S)	
R1.	Graham Mode, "The Experience of Poetry", Open college of Arts with Open Unv Press, 2012.
R2.	J.L.Styan, "The Elements of Drama", Literary Licensing, 2011.

MANAGEMENT COURSES

Sl. No	Course Code	Course Name	Category	Type	Contact Periods / Week	L	T	P	Credits
1.	24HSM301	Principles of Management	HSMC	T	2	2	0	0	2
2.	24HSM302	Total Quality Management	HSMC	T	2	2	0	0	2
3.	24HSM303	Engineering Economics and Financial Accounting	HSMC	T	2	2	0	0	2
4.	24HSM304	Human Resource Management	HSMC	T	2	2	0	0	2
5.	24HSM305	Knowledge Management	HSMC	T	2	2	0	0	2
6.	24HSM306	Industrial Management	HSMC	T	2	2	0	0	2
Total					**12**	**12**	**0**	**0**	**12**

Course Code: 24HSM301	Course Title: Principles of Management	
Course Category: HSMC	Credits: 2	
L:T:P (Hours/Week) 2:0:0	Total Contact Hours: 30	Max Marks : 100

COURSE OBJECTIVES
• To outline the fundamental activities of managers.
• To apply the planning techniques and decision making.
• To understand the concept of Human Resource Management.
• To understand motivation, leadership and communication principles.
• Analyze the position of self and company goals towards business.

UNIT I	INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	6
Definition of Management - Science or Art - Manager vs Entrepreneur - types of managers - managerial roles and skills - Evolution of Management - Scientific, human relations, system and contingency approaches - Types of Business organization - Sole proprietorship, partnership, company - public and private sector enterprises - Organization culture and Environment - Current trends and issues in Management.		
UNIT II	**PLANNING**	**6**
Nature and purpose of planning - Planning process - Types of planning - Objectives - Setting objectives - Policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.		
UNIT III	**ORGANISING**	**6**
Nature and purpose - Formal and informal organization - Organization chart - Organization structure - Types - Line and staff authority - Departmentalization - delegation of authority - Centralization and decentralization - Job Design - Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.		

UNIT IV	DIRECTING	6
Foundations of individual and group behavior - Motivation - Motivation theories - Motivational techniques - Job satisfaction - Job enrichment - Leadership - types and theories of leadership - Communication - Process of communication - Barrier in communication - Effective communication - Communication and IT.		
UNIT V	**CONTROLLING**	**6**
System and process of controlling - Budgetary and non - Budgetary control techniques - Use of computers and IT in Management control - Productivity problems and management - Control and performance - Direct and preventive control - Reporting.		
		Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Understand the role of managers in an organization.
CO2: Understand the planning process in the organization.
CO3: Examine the managerial functions having an impact on the organizational effectiveness.
CO4: Show the ability in directing, leadership and communicate effectively.
CO5: Analyze the isolate issues and formulate best control methods.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1			1		1	2	2	2	3	3	1	1	1	
CO2	1			2	1	1	1	2	2	2	2	1	1	1	
CO3	1			1	1	1	1	1	2	3	2	1	1	1	
CO4	1			1	1	1	1	1	2	3	2	1	1	1	

CO5	1			1	1	1	1	2	2	2	2	1	1	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Harold Koontz and Heinz Weihrich "Essentials of Management", 11th Edition, Tata McGraw Hill, 2020.
T2.	Stephen P. Robbins and Mary Coulter, "Management", 13th Edition, Prentice Hall Pvt. Ltd., 2017.

REFERENCE BOOK(S)	
R1.	Robert Kreitner and Mamata Mohapatra, "Management", Biztantra, 2008.
R2.	Stephen A. Robbins and David A. Decenzo and Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
R3.	P C Tripathi, P N Reddy and Ashish Bajpai, "Principles of Management", 7th Edition, Tata McGraw Hill, 2021.

Course Code: 24HSM302	Course Title: Total Quality Management	
Course Category: HSMC	Credits: 2	
L:T:P (Hours/Week) 2:0:0	Total Contact Hours: 30	Max Marks: 100

COURSE OBJECTIVES
• To communicate the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
• To explain the TQM Principles for application.
• To define the basics of Six Sigma and apply traditional tools, new tools, Benchmarking and FMEA.
• To describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
• To illustrate and apply QMS and EMS in any organization.

UNIT I	INTRODUCTION	6
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Definition of TQM- Basic concepts of TQM - Gurus of TQM - TQM Framework- Barriers to TQM - Benefits of TQM.		
UNIT II	**TQM PRINCIPLES**	**6**
Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning- Customer Satisfaction - Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal- Continuous process improvement - Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating and Relationship development.		
UNIT III	**TQM TOOLS & TECHNIQUES I**	**6**

The seven traditional tools of quality - New management tools - Six-sigma Process Capability- Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: Design FMEA and Process FMEA.		
UNIT IV	**TQM TOOLS & TECHNIQUES II**	**6**
Quality circles - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures - Cost of Quality - BPR.		
UNIT V	**QUALITY MANAGEMENT SYSTEM**	**6**
Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards - Sector - Specific Standards - AS 9100, TS16949 and TL 9000 - ISO 9001 Requirements - Implementation - Documentation - Internal Audits - Registration - Environmental Management System: Introduction - ISO 14000 Series Standards - Concepts of ISO 14001 - Requirements of ISO 14001-Benefits of EMS.		
		Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Apply TQM concepts in a selected enterprise.
CO2: Apply TQM principles in a selected enterprise.
CO3: Understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
CO4: Understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
CO5: Apply QMS and EMS in any organization.

COURSE ARTICULATION MATRIX															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1					1	1	1	2	1	3	1	1	1	
CO2	1	1			1	1	1	2	2	1	3	1	1	1	
CO3	1	1		1	3	1	1	2	2	1	3	1	1	1	
CO4		1			1	1	1	2	2	1	3	1	1	1	
CO5					3	3	3	3	2	1	3	1	1	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield, Mary Besterfield-Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", 3rd Edition, Pearson Education, Indian Reprint, 2018.
T2.	Joel. E. Ross, "Total Quality Management - Text and Cases and Readings", 3rd Edition, St. Lucie Press, New York, 2017.

REFERENCE BOOK(S)	
R1.	D. R. Kiran, "Total Quality Management: Key concepts and case studies", Butterworth - Heinemann, 2016.
R2.	John S. Oakland, "Total Quality Management text with cases", 3rd Edition, Butterworth - Heinemann, Oxford, 2012.
R3.	L. Suganthi and Anand A. Samuel, "Total Quality Management", PHI Learning Private Limited, 2011.

Course Code: 24HSM303	Course Title: Engineering Economics and Financial Accounting	
Course Category: HSMC	Credits: 2	
L:T:P (Hours/Week) 2:0:0	Total Contact Hours: 30	Max Marks: 100

COURSE OBJECTIVES
• To understand the concepts of demand and supply analysis.
• To provide the insight on theory of production and cost analysis.
• To understand the different procedures of pricing.
• To acquire in depth knowledge of financial accounting.
• To determine the factor influencing working capital and its importance.

UNIT I	Demand & Supply Analysis	6
Managerial Economics - Relationship with other disciplines - Firms: Types, objectives and goals - Managerial decisions - Decision analysis. Demand - Types of demand - Determinants of demand - Demand function - Demand elasticity - Demand forecasting - Supply - Determinants of supply - Supply function -Supply elasticity.		
UNIT II	**Production and Cost Analysis**	**6**
Production function - Returns to scale - Production optimization - Least cost input - Isoquants - Managerial uses of production function. Cost Concepts - Cost function - Determinants of cost - Short run and Long run cost curves - Cost Output Decision - Estimation of Cost.		
UNIT III	**Pricing**	**6**
Determinants of Price - Pricing under different objectives and different market structures - Price discrimination - Pricing methods in practice.		
UNIT IV	**Financial Accounting (Elementary Treatment)**	**6**
Balance sheet and related concepts - Profit & Loss Statement and related concepts - Financial Ratio Analysis - Cash flow analysis - Funds flow analysis - Comparative financial		

statements - Analysis & Interpretation of financial statements.		
UNIT V	**Capital Budgeting (Elementary Treatment)**	**6**
Investments - Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value - Internal rate of return.		
		Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Describe the overall functions of Demand, Supply, Price and Income of the firms.
CO2: Evaluate the production function and identifies the least cost combination to control the costs of production.
CO3: Understand the structures of various market types and their pricing policies.
CO4: Understand the basic concepts of financial accounting and evaluation of company performance using ratio analysis.
CO5: Understand the types of business forms and also be able to evaluate the investments using capital budgeting techniques.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		1			2		1	2	1	2	1	1	1	
CO2	1		1			2		1	2	1	2	1	1	1	
CO3	1		1			2		1	2	1	2	1	1	1	
CO4	1		1			1	1	1	2	1	3	1	1	1	
CO5	1		1			1	1	1	2	1	2	1	1	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	R. Panneer Selvam, "Engineering Economics", 2nd Edition, PHI Learning Private Limited, New Delhi, 2013.
T2.	Lila J.Truett and Dale B. Truett, "Managerial Economics: Analysis, Problems and Cases", 8th Edition, Wiley-India, 2008.

REFERENCE BOOK(S)	
R1.	Chan S. Park, "Contemporary Engineering Economics", Global Edition, Pearson Education, 2016.
R2.	Donald G. Newnan, Ted G. Eschenbach, Jerome P. Lavelle and Neal A. Lewis, "Engineering Economics and Analysis", Oxford University Press, 2017.
R3.	William G. Sullivan, Elin M.Wicks and C. Patrick Koelling, "Engineering Economy", 14th Edition, Pearson Education, 2011.

Course Code: 24HSM304	Course Title: Human Resource Management	
Course Category: HSMC	Credits: 2	
L:T:P (Hours/Week) 2:0:0	Total Contact Hours: 30	Max Marks: 100

COURSE OBJECTIVES
• To understand the functions, systems and policies of human resource management.
• To recruit and interview job candidates and appraise the performance of the employees.
• To train using various methods of training and implement management development techniques.
• To learn the factors determining the pay rates and salary administration.
• To provide knowledge about management issues related to human factors consideration and compliance with human resource requirements.

UNIT I	INTRODUCTION TO HUMAN RESOURCE MANAGEMENT	6
Importance of Human Resources - Objective of Human Resource Management - Human Resource Policies - Role of Human Resource Manager.		
UNIT II	**HUMAN RESOURCE PLANNING**	**6**
Importance of Human Resource Planning - Internal and External sources of Human Resources -Recruitment - Selection - Socialization.		
UNIT III	**TRAINING AND EXECUTIVE DEVELOPMENT**	**6**
Types of training and Executive Development methods - Purpose - Benefits.		
UNIT IV	**EMPLOYEE COMPENSATION**	**6**
Compensation plan - Reward - Motivation - Career Development - Mentor - Protege relationships.		
UNIT V	**PERFORMANCE EVALUATION AND CONTROL**	**6**

Performance evaluation - Feedback - the control process - Importance - Methods - Grievances - Causes - Redressal methods.
Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Develop understanding of the basic concepts, functions and processes of human resource management.
CO2: Apply knowledge of human resource planning and implement techniques of job design.
CO3:Design HRM processes such as Recruitment/Selection/Training/Performance appraisals/Reward Systems etc.
CO4: Implement Employee benefits and Welfare measures.
CO5: Handle employee issues and evaluate the new trends in HRM.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			1	1		2	1	2	2	1	3	1	1	1	
CO2		1	1	1		1		2	2	2	3	1	1	1	
CO3	1			3	1	1		2	2	2	3	1	1	1	
CO4	1			3		1		2	2	1	3	1	1	1	
CO5		1		3	1	1	1	2	2	2	3	1	1	1	

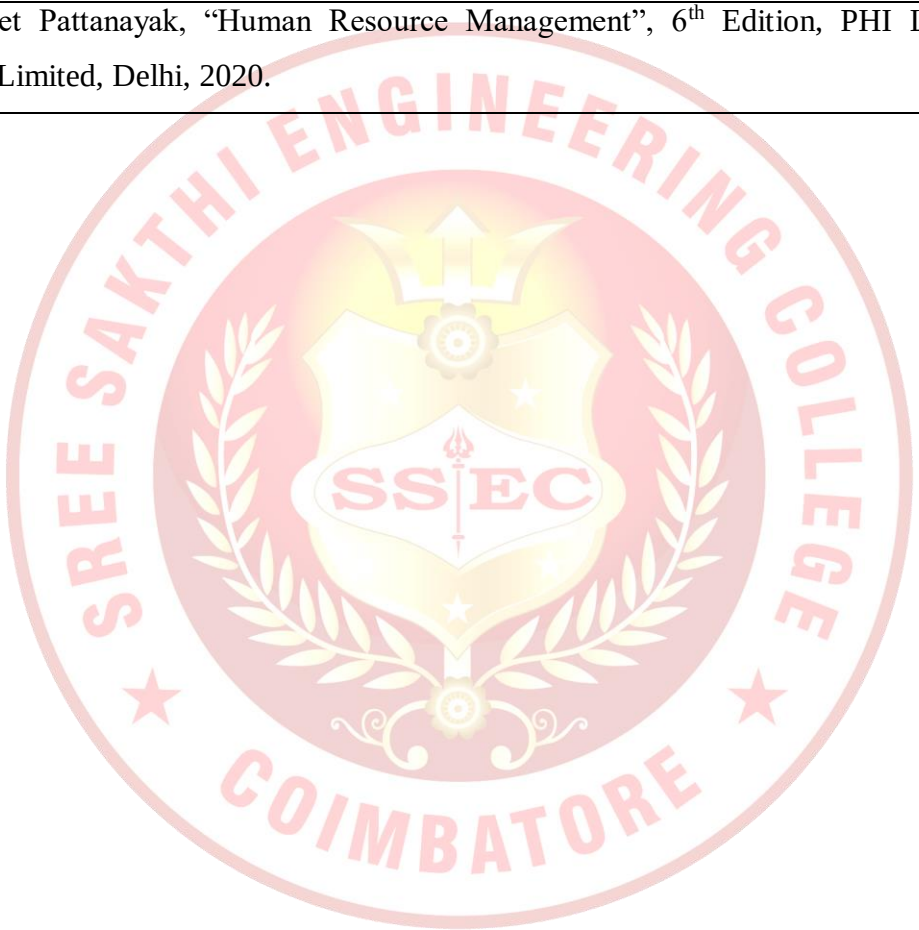
(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	David A. DeCenzo and Stephen P. Robbins, "Fundamentals of Human Resource Management", 8th Edition, Wiley, 2007.
T2.	H John Bernardin, "Human Resource Management - An Experimental Approach",

	Fifth Edition, Tata McGraw Hill, New Delhi, 2010.

REFERENCE BOOK(S)	
R1.	Luis R, Gomez-Mejia, David B. Balkin and Robert L. Cardy, "Managing Human Resources", 8th Edition, Pearson Education, India, 2016.
R2.	Gary Dessler, "Human Resource Management", 13th Edition, Pearson Education, 2013.
R3.	Biswajeet Pattanayak, "Human Resource Management", 6th Edition, PHI Learning Private Limited, Delhi, 2020.



Course Code: 24HSM305	Course Title: Knowledge Management	
Course Category: HSMC	Credits: 2	
L:T:P (Hours/Week) 2:0:0	Total Contact Hours: 30	Max Marks: 100

COURSE OBJECTIVES
• To understand the basic concept of knowledge management and knowledge management systems.
• To know the Organizational Structure, Culture, Communities and KM practices, Information Technology as an enabler.
• To identify some of the key tools and techniques used in knowledge management applications.
• To analyze the recent trends in Knowledge Management.
• To formulate a framework for thinking about knowledge intensive organizations.

UNIT I	INTRODUCTION	6
Introduction to knowledge management - foundations of knowledge management - including cultural issues - technology applications organizational concepts and processes - management aspects - and decision support systems. The evolution of knowledge management: From information management to knowledge management - Key challenges facing the evolution of knowledge management - Ethics for knowledge management.		
UNIT II	**CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING**	**6**
Organization and Knowledge Management - Building the Learning Organization. Knowledge Markets: Cooperation among distributed technical specialists - Tacit Knowledge and Quality Assurance.		
UNIT III	**KNOWLEDGE MANAGEMENT-THE TOOLS**	**6**
Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management -		

Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval - Information Coding in the Internet Environment - Repackaging Information.		
UNIT IV	**KNOWLEDGE MANAGEMENT APPLICATION**	**6**
Components of a knowledge strategy - Case Studies from Library to Knowledge Center, Knowledge Management in the Health Sciences, Knowledge Management in Developing Countries.		
UNIT V	**FUTURE TRENDS AND CASE STUDIES**	**6**
Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life - cycles of an organization.		
		Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Analyze the issues in knowledge management.
CO2: Discuss the various levels in knowledge sharing and learning.
CO3: Express effectively about knowledge management systems, tools and portals.
CO4: Apply the knowledge management in library and information centers.
CO5: Create a knowledge management plan to leverage opportunities to create, capture, represent and share knowledge within an organization.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1								3			3	1	1	1	
CO2	1	1				2	1	3	2	3	3	1	1	1	
CO3	1	1	1		2	2	1	3	2		3	1	1	1	
CO4	1	1	1	1	2		1	3	1	1	3	1	1	1	
CO5			1	1	1			3	1	1	3	1	1	1	

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	T. Kanti Srikantaiah and Michael E.D.Koenig, "Knowledge Management for the Information Professional", Information Today, Inc., 2000.
T2.	Mohammad Nazim and Bhaskar Mukherjee, "Knowledge Management in Libraries Concepts, Tools and Approaches", Chandos Publications, 2016.

REFERENCE BOOK(S)	
R1.	Kimiz Dalkir, "Knowledge Management in Theory and Practice", 4th Edition, the MIT Press, 2023.
R2.	Donald Hislop, Rachelle Bosua and Remko Helms, "Knowledge Management in Organizations a critical Introduction", 4th Edition, Oxford University Press, 2018.

Course Code: 24HSM306	**Course Title: Industrial Management**

Course Category: HSMC	Credits: 2	
L:T:P (Hours/Week) 2:0:0	Total Contact Hours: 30	Max Marks: 100

COURSE OBJECTIVES
• To study the basic concepts of management, approaches to management, contributors to management studies; various forms of business organization and professional organizations.
• To study the planning, organizing and staffing functions of management in professional organization.
• To study the leading, controlling and decision making functions of management in professional organization.
• To learn the organizational theory in professional organization.
• To learn the principles of productivity and modern concepts in management in professional organization.

UNIT I	INTRODUCTION TO MANAGEMENT	6
Management : Introduction; Definition and Functions - Approaches to the study of Management - Mintzberg's Ten Managerial Roles - Principles of Taylor; Fayol; Weber; Parker - Forms of Organization : Sole Proprietorship; Partnership; Company (Private and Public); Cooperative - Public Sector vs Private Sector Organization - Business Environment : Economic; Social; Political; Legal - Trade Union : Definition; Functions; Merits & Demerits.		
UNIT II	**FUNCTIONS OF MANAGEMENT - I**	**6**
Planning: Characteristics; Nature; Importance; Steps; Limitation; Planning Premises; Strategic Planning; Vision & Mission statement in Planning - Organizing : Organizing Theory; Principles; Types; Departmentalization; Centralization and Decentralization; Authority & Responsibility - Staffing : Systems Approach; Recruiting and Selection Process; Human Resource Development (HRD) Concept and Design.		
UNIT III	**FUNCTIONS OF MANAGEMENT - II**	**6**

Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake-Mounton, Reddin) - Communication: Purpose; Model; Barriers - Controlling: Process; Types; Levels; Guidelines; Audit (External, Internal, Merits); Preventive Control - Decision Making: Elements; Characteristics; Nature; Process; Classifications.		
UNIT IV	**ORGANIZATION THEORY**	**6**
Organizational Conflict : Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management - Maslow's hierarchy of needs theory; Herzberg's motivation-hygiene theory; McClelland's three needs motivation theory; Vroom's valence-expectancy theory - Change Management : Concept of Change; Lewin's Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.		
UNIT V	**PRODUCTIVITY AND MODERN TOPICS**	**6**
Productivity : Concept; Measurements; Affecting Factors; Methods to Improve - Modern Topics (concept, feature/characteristics, procedure, merits and demerits) : Business Process Reengineering (BPR); Benchmarking; SWOT/SWOC Analysis; Total Productive Maintenance; Enterprise Resource Planning (ERP); Management of Information Systems (MIS).		
		Total: 30 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
CO2: Discuss the planning; organizing and staffing functions of management in professional organization.
CO3: Apply the leading; controlling and decision making functions of management in professional organization.
CO4: Discuss the organizational theory in professional organization.

CO5: Apply principles of productivity and modern concepts in management in professional organization.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1							1	2	2	3	1	1	1	
CO2	1	1		1	2	1	1	1	2	2	3	1	1	1	1
CO3	1	1		1	2	1	1	1	2	2	3	1	1	1	1
CO4	1		2	1		1		1	2	2	3	1	1	1	1
CO5	1		2	1	2	1		1	2	2	3	1	1	1	

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	M. Govindarajan and S. Natarajan, "Principles of Management", PHI Learning Private Limited, New Delhi, 2012.
T2.	Harold Koontz and Heinz Weihrich and Mark V. Cannice, "Essentials of Management: An International, Innovation and Leadership Perspective", 11th Edition, Mc Graw Hill, New Delhi, 2020.

REFERENCE BOOK(S)

R1.	Joseph L Massie, "Essentials of Management", 4th Edition, Prentice-Hall, 1987.
R2.	Saxena, P. K., "Principles of Management: a Modern Approach", Global India Publications Private Limited, New Delhi, 2009.
R3.	Samuel C. Certo and S.Trevis Certo, "Modern Management: Concepts and Skills (What's New in Management)", 15th Edition, Pearson Education, 2018.

EMPLOYABILITY ENHANCEMENT COURSES

Course Code: 24CDC101	Course Title: Career Development Skills I	
Course Category: EEC	Credits: 1	
L:T:P (Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks: 100

COURSE OBJECTIVES
• Learn about the career planning and goal setting to meet the corporate world.
• Develop motivational skills and personality development.
• Develop the methodologies for team building.

UNIT I	CAREER PLANNING AND GOAL SETTING	3

Career planning: Self-Assessment – Skills Development – Networking – Professional Development – Flexibility and Adaptability – Work-Life Balance – Seeking Feedback – Stay Updated

Goal Settings: - Set SMART > Specificity – Measurability – Achievability – Relevance – Time-bound – Breakdown into Steps – Review and Adjust – Accountability – Celebrate Achievements

UNIT II	MOTIVATION	3

Motivation I – Purpose **–** Learning mind-set – Stay Organized – Embrace Responsibility – Stay appositive – Reflect and Adapt – Peer Recognition and Support – Inspirational Guest Speakers of Role Models

Personality Effectiveness - Self –Awareness **–** Emotional Intelligence – Adaptability – Conflict Resolution – Leadership Skills – Time Management – Continuous Learning – Positive Attitude

i) Building Personality – Self-Reflection and Awareness – Assertiveness and Confidence – Relationship Building – Personal Branding

ii) Discipline – Consistency and Persistence – Self-Control and Delayed Gratification – Accountability – Resilience – Interpersonal Skills and Collaboration – Presentation skills –

Learning from Mistakes		
UNIT III	**PERSONALITY DEVELOPMENT**	**3**
i) Grooming – Dress Code Etiquette – Personal Appearance – Body Language and Posture **ii) Hygiene –** Practices & clothing care **iii) Cleanliness –** Workspace maintenance – Environmental Awareness & Digital hygiene Overall preparation – Role of confidence & Cultural Sensitivity		
UNIT IV	**PRESENTATION AND PUBLIC SPEAKING SKILLS**	**3**
Presentation Speaking Skills – Know the audience – Clear objective – Content structure – Postures and Gestures – Voice projection – Eye contact – appropriate language – Speech Clarity – Visual aids interaction **Public Speaking skills** – Research – audience pulse – Pace and Pause – Expertise – Authenticity – Adaptability to unexpected situations **SWOT Analysis –** Enhanced Self-awareness – Benchmarking with Strength, Weakness, Challenges and Opportunities – Risk management – Versatility – Decision making		
UNIT V	**TEAM BUILDING**	**3**
Team building – Openness – Cooperation – Building trust – Respect – Diversity and Inclusion – Cohesion – Prioritisation – Learning team culture – Celebrate success **Activity Sessions- i) Debate –** Critical thinking – Confidence building – Persuasive techniques – Ethical reasoning – Empathy **ii) Picture connector –** Imagination and Innovation – Analysis – Societal awareness – Expression – Cognitive development – Playful exploration		
		Total : 15 Hours

COURSE OUTCOMES

At the end of this course, students will be able to
CO1: Learn about the career planning and goal setting to meet the corporate world.
CO2: Develop motivational skills and personality development.
CO3: Develop the methodologies for team building

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1								3			
CO2								2	2	3		2			
CO3	1	1	1					1	2	2					

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Dr.R.S.Aggarwal, "A Modern Approach to Verbal and Non-verbal Reasoning", S Chand Publishing, 2023.
T2.	Arun Sharma and Meenakshi Upadhyay, "Verbal Ability and Reading comprehension", Tata McGraw Hill Education, 2014.
T3.	Sanjay Kumar and Pushp Lata, "Communication skills", Oxford Higher Education, 2011.

REFERENCE BOOK(S)

R1.	Arun Sharma, "Logical Reasoning for CAT", Tata McGraw Hill Education, 2024.
R2.	Peeyush Bhardwaj, "The Hand on Guide to Analytical and Logical Reasoning", Arihant Publication, 2023.
R3.	Nira Konar, "Communication Skills for Professionals", PHI learning Pvt. Ltd, 2011.

Course Code: 24CDC102	Course Title: Career Development Skills II	
Course Category: EEC	Credits: 1	
L:T:P (Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks: 100

COURSE OBJECTIVES
• Develop interpersonal skills.
• Develop Listening and Speaking skills.
• Make interferences and predictions about spoken discourse that enhance RW skills.

UNIT I	MOTIVATION AND INTERPERSONAL SKILLS	3

Motivation II – Offer personalised guidance and support – Engage active learning methods – Create a supportive environment personally – Highlight success stories – Celebrate progress – Follow ups.

Interpersonal Skills – Verbal, Non-verbal and Listening skills – Analysing problems – Contributing ideas – Positive relationships – Mutual respect – Negotiation.

UNIT II	LISTENING AND CONVERSATION SKILLS	3

Listening skills – Focus and attention – Non-verbal cues – Paraphrasing – Understanding emotions – Reflecting feelings – Allowing pause – Avoiding interruption – Respond appropriately – Clarifying and Confirming – Maintaining open-mindedness

Conversation skills – Opening lines – Ice-breakers – Sharing and expressing ideas – Clarity and relevance – Smooth translations – Articulate thoughts - Avoid judgement – Polite language – Express appreciation – Open to feedback

UNIT III	TYPES OF SKILLS	3

Reading skills – Speed and Accuracy – Understanding main ideas – Skimming and Scanning – Word recognition – Expanding vocabulary – Analysing text – Making connections – Evaluate and Synthesise – Academic / Professional/ Personal reading

Writing skills – Clear communication – Logical organization – Grammar and Mechanics – Avoiding redundancy – Choosing strong words – Tone and Style – Concluding structure – Editing and Revision – Originality – Academic/ Professional/ Personal writing

Attitudes – Positive Attitudes - Preparedness – Adaptability – Professionalism – Resilience – Listening skills – Teamwork and Collaboration – Curiosity and Learning orientation – Gratitude and Humility

Manners & Behaviour – Politeness and Courtesy – Confidence without arrogance – Respect for personal space and boundaries – Flexibility and Conflict Resolution skills

UNIT IV	TIME AND STRESS MANAGEMENT	3

i)Self-awareness – Understanding Strengths and Weaknesses – Personal values – Emotional intelligence – Self-Reflection and Learning Style

ii)Self-confidence – building a Positive Self – Image – Overcoming fear of failure – Assertiveness

Time management – Setting Priorities – Planning and Scheduling – Time Estimation and Budgeting – Minimizing Procrastination – Effective decision making

Stress management – Stressors Identification - Relaxation techniques – Mindfulness-Physical Activity – Positive thinking - Healthy lifestyle – Sound sleep – Hobbies and leisure activities – Humour and laughter – Say 'no' to unwanted

Emotional intelligence – Self-regulation – empathy – Societal bearing – Understanding causes and consequences of emotions

UNIT V	HIGHER EDUCATION AND ENTREPRENEURSHIP	3

i) Introduction to Higher Education – Specialization – Research opportunities – Career advancement – Employability –

ii) Competitive exams – Merit recognition – Validation of academic abilities – Global recognition (GRE, GMAT, SAT) – Competitive edge – Global career opportunities – Excel, Grow and Achieve professionally

Introduction to Entrepreneurship – Independence and autonomy – Opportunity to pursue passion – Innovation and creativity – Creating jobs – Sharing and Mutual growth via collaborations and partnerships.
Total : 15 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Develop strong interpersonal skills.
CO2: Develop strong listening and speaking skills.
CO3: Make predictions about spoken discourse that enhance RW skills

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1								3			
CO2								2	2	3		2			
CO3	1	1	1			1		1	2	2		1			

(1 – Low, 2 – Medium, 3 – High)

TEXT BOOK(S)

T1.	Dr.R.S.Aggarwal, "A Modern Approach to Verbal and Non-verbal Reasoning", S Chand Publishing, 2023.
T2.	Arun Sharma and Meenakshi Upadhyay, "Verbal Ability and Reading comprehension", Tata McGraw Hill Education, 2014.
T3.	Sanjay Kumar and Pushp Lata, "Communication skills", Oxford Higher Education, 2011.

REFERENCE BOOK(S)	
R1.	Arun Sharma, “Logical Reasoning for CAT”, Tata McGraw Hill Education, 2024.
R2.	Peeyush Bhardwaj, “The Hand on Guide to Analytical and Logical Reasoning”, Arihant Publication, 2023.
R3.	Nira Konar, “Communication Skills for Professionals”, PHI learning Pvt. Ltd, 2011.

Course Code: 24CDC201	Course Title: Career Development Skills III	
Course Category: EEC	Credits: 1	
L:T:P (Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks: 100

COURSE OBJECTIVES
• To enhance numerical, analytical, and logical reasoning skills.
• To develop professional workplace etiquette and effective email communication skills.

UNIT I	QUANTITATIVE APTITUDE AND REASONING	12
Quantitative Aptitude - Number System - HCF and LCM - Average - AP&GP - Logarithm. Data Interpretation and Logical Reasoning Skills - Tabulations - Logical Sequence - Puzzle Test. Verbal and Non-Verbal Reasoning - Logical Sequence of Words - Truth Verification - Analogy - Figure Matrix. Verbal Ability - Grammar Concepts - Antonyms and Synonyms - Reading Comprehension.		
UNIT II	**BUSINESS ETIQUETTE**	**3**
Workplace Etiquette - Punctuality and Time Management - Professional Attire and Grooming - Respectful Communication - Workspace Cleanliness and Organization - Ethical Behavior and Integrity. E-Mail Etiquette - Importance of Professional Email Communication - Crafting an Effective Subject Line - Maintaining a Polite and Respectful Tone - Respond with Proper Salutations and Closings - Responding Promptly to Emails - Avoid Excessive Formatting or Emojis - Proper Use of Reply All and Forward Functions - Handling Sensitive or Confidential Information. Activities - Role Play, Presentation, Case Study, Mock Team Meeting, Discussion, Responding to Email.		
Total: 15 Hours		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Develop strong analytical, reasoning, and verbal skills across quantitative aptitude, data interpretation, logical reasoning, and verbal ability.
CO2: Apply professional workplace etiquette and exhibit proficiency in crafting clear, respectful, and effective email communication.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1								3			
CO2								2	2	3		2			

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Dr.R.S.Aggarwal, "A Modern Approach to Verbal and Non-verbal Reasoning", S Chand Publishing, 2023.
T2.	Arun Sharma and Meenakshi Upadhyay, "Verbal Ability and Reading comprehension", Tata McGraw Hill Education, 2014.
T3.	Sanjay Kumar and Pushp Lata, "Communication skills", Oxford Higher Education, 2011.

REFERENCE BOOK(S)	
R1.	Arun Sharma, "Logical Reasoning for CAT", Tata McGraw Hill Education, 2024.
R2.	Peeyush Bhardwaj, "The Hand on Guide to Analytical and Logical Reasoning", Arihant Publication, 2023.
R3.	Nira Konar, "Communication Skills for Professionals", PHI learning Pvt. Ltd, 2011.

Course Code: 24CDC202	Course Title: Career Development Skills IV	
Course Category: EEC	Credits: 1	
L:T:P (Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks: 100

COURSE OBJECTIVES
• To strengthen numerical, analytical, and logical reasoning abilities.
• To improve business communication abilities.

UNIT I	QUANTITATIVE APTITUDE AND REASONING	12
Quantitative Aptitude - Percentage - Profit and Loss - Ratio and Proportion - Pipes and Cistern - Time and Work. Data Interpretation and Logical Reasoning Skills - Bar Graphs - Coding and Decoding - Venn Diagram. Verbal and Non-Verbal Reasoning - Critical Reasoning - Types of Reasoning - Cube and Dice - Pattern Completion. Verbal Ability - Grammar Concepts - Enhancing Vocabulary - One Word Substitution.		
UNIT II	**BUSINESS COMMUNICATION SKILLS**	**3**
Business Communication - Effective Listening Skills - Summarizing and Paraphrasing - Presentation, Planning and Delivery. Sales and Negotiations - Understanding Customers' Needs, Building Rapport and Trust - Negotiation Techniques and Closing the Deal - Continuous Improvement and Professional Development. Customer Service - Importance and Key Elements of Effective Customer Service - Empowering Frontline Employees and Leveraging Technology - Measuring and Improving Customer Satisfaction. Activities - Paraphrasing, Self-Introduction, Presentation, Role Play, Group Discussion.		
Total: 15 Hours		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Solve problems using numerical, analytical, and logical reasoning skills.
CO2: Utilize communication techniques for effective business interactions for improving professional efficiency.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1								3			
CO2								2	2	3		2			

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Dr.R.S.Aggarwal, "A Modern Approach to Verbal and Non-verbal Reasoning", S Chand Publishing, 2023.
T2.	Arun Sharma and Meenakshi Upadhyay, "Verbal Ability and Reading comprehension", Tata McGraw Hill Education, 2014.
T3.	Sanjay Kumar and Pushp Lata, "Communication skills", Oxford Higher Education, 2011.

REFERENCE BOOK(S)

R1.	Arun Sharma, "Logical Reasoning for CAT", Tata McGraw Hill Education, 2024.
R2.	**Peeyush Bhardwaj, "The Hand on Guide to Analytical and Logical Reasoning", Arihant Publication, 2023.**
R3.	Nira Konar, "Communication Skills for Professionals", PHI learning Pvt. Ltd, 2011.

exercises.

Course Code: 24CDC301	Course Title: Career Development Skills V	
Course Category: EEC	Credits: 1	
L:T:P (Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks: 100

COURSE OBJECTIVES
• To extend logical reasoning, analytical, and numerical skills.
• To learn how to create effective resumes and job applications.

UNIT I	QUANTITATIVE APTITUDE AND REASONING	12
Quantitative Aptitude - Time and Distance - Boats and Streams - Mixture - Simple Interest - Compound Interest. Data Interpretation and Logical Reasoning Skills - Pie Chart - Blood Relation - Direction Sense. Verbal and Non-Verbal Reasoning - Verbal Analogy -Syllogism - Series - Counting of Figures. Verbal Ability - Word Roots, Affixes and Foreign Words - Idioms and Phrases - Spotting Common Errors.		
UNIT II	**EMPLOYABILITY SKILLS**	**3**
Resume Building - Basic Facts - Resume Types - Sections of Resume - Resume Format - Ordinary Resume “Do's and Don’ts” - Electronic Resume Formats - Using Resume Keywords - Online Resume Banks. Job Application Basic Formats - Personal Information - Work History - Education - Skills and Qualifications - Achievements and Awards - References - Examples. Activities - Developing Corporate Resume, Drafting Job Application, Rendering Presentation, Discussion.		
		Total: 15 Hours

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Use the logical reasoning, analytical thinking, and numerical skills to find answers for complex problems.
CO2:Apply appropriate formats, sections and keywords to effectively present their qualifications while preparing resume and job application.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1								3			
CO2								2	2	3		2			

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)

T1.	Dr.R.S.Aggarwal, "A Modern Approach to Verbal and Non-verbal Reasoning", S Chand Publishing, 2023.
T2.	Arun Sharma and Meenakshi Upadhyay, "Verbal Ability and Reading comprehension", Tata McGraw Hill Education, 2014.
T3.	Sanjay Kumar and Pushp Lata, "Communication skills", Oxford Higher Education, 2011.

REFERENCE BOOK(S)

R1.	Arun Sharma, "Logical Reasoning for CAT", Tata McGraw Hill Education, 2024.
R2.	**Peeyush Bhardwaj, "The Hand on Guide to Analytical and Logical Reasoning", Arihant Publication, 2023.**
R3.	Nira Konar, "Communication Skills for Professionals", PHI learning Pvt. Ltd, 2011.

Course Code: 24CDC302	Course Title: Career Development Skills VI	
Course Category: EEC	Credits: 1	
L:T:P (Hours/Week) 1:0:0	Total Contact Hours: 15	Max Marks: 100

COURSE OBJECTIVES
• To broaden logical reasoning, analytical and numerical skills.
• To equip students with essential leadership traits.

UNIT I	QUANTITATIVE APTITUDE AND REASONING	12
Quantitative Aptitude - Area - Calendar - Clocks - Permutation &Combination - Probability. Data Interpretation and Logical Reasoning Skills - Line Graph-Data Sufficiency - Seating Arrangement. Verbal and Non-Verbal Reasoning - Cause and Effect - Cloze Test - Mirror and Water Images - Mathematical Operator. Verbal Ability - Sentence Formation, Completion, Correction and Improvement - Change of Voice and Speech - Jumbled Sentences and Paragraph Formation.		
UNIT II	**LEADERSHIP ETIQUETTE**	**3**
Leadership - Characteristics and Styles - Developing Leadership Skills - Communication and Interpersonal Skills - Motivating and Inspiring Teams - Ethical Leadership - Decision Making - Problem Solving. Behavioural Skills (Using Star Method - Situation, Task, Action and Result) - Introduction - Defining the Context - Identifying the Objectives - Describing the Steps to be Taken - Highlighting the Outcome - Developing Behavioral Skills - STAR Method in Interviews and Benefits. Specific Technical Knowledge - Specialized Skills - Foundational Concepts and Principles - Practical Applications - Industry-Specific Regulations and Standards - Emerging Trends and Innovations - Continuous Learning and Professional Development - Troubleshooting and Problem - Solving Techniques - Collaboration and Knowledge Sharing. Activities - Role Play, Presentation, Case Study, Group Discussion**.**		
Total: 15 Hours		

COURSE OUTCOMES
At the end of this course, students will be able to
CO1: Utilize logical reasoning, analytical thinking, and numerical skills to solve complex problems.
CO2: Demonstrate key leadership traits to effectively lead teams.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1								3			
CO2								2	2	3		2			

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Dr.R.S.Aggarwal, "A Modern Approach to Verbal and Non-verbal Reasoning", S Chand Publishing, 2023.
T2.	Arun Sharma and Meenakshi Upadhyay, "Verbal Ability and Reading comprehension", Tata McGraw Hill Education, 2014.
T3.	Sanjay Kumar and Pushp Lata, "Communication skills", Oxford Higher Education, 2011.

REFERENCE BOOK(S)	
R1.	Arun Sharma, "Logical Reasoning for CAT", Tata McGraw Hill Education, 2024.
R2.	Peeyush Bhardwaj, "The Hand on Guide to Analytical and Logical Reasoning", Arihant Publication, 2023.
R3.	Nira Konar, "Communication Skills for Professionals", PHI learning Pvt. Ltd, 2011.

Course Code: 24CDC401	Course Title: Career Development Skills VII	
Course Category: EEC	Credits: 1	
L:T:P (Hours/Week) 2:0:0	Total Contact Hours: 30	Max Marks: 100

COURSE OBJECTIVES
• To build skills to prepare for interviews, focusing on professionalism, clear communication, and making a positive impression.
• To enhance students ability for effective communication and professional success.

UNIT I	INTERVIEW SKILLS	15

Preparing for the Interview - Company and Role - Common Interview Questions - Skills and Experience - Maintain Positive Mind-Set. Before the Interview - Practice Critical Interview Questions - Genuine Questions to Ask the Interviewer - Reviewing Resume - Dress code - Early Arrival - Keep Enough Copies of Resume. During the Interview - Professional Look - Greeting the Interviewer - Answering Questions Confidently. The Interviewee's Behavior - Importance - Creating Good Impression - Body Language - Eye Contact - Tone - Voice - Confidence and Composure - Enthusiasm and Engagement - Responding to Questions. Taking Questions-Types of Questions Expected - Strategies for Answering Questions - Avoiding Pitfalls While Answering-Turning Questions into Opportunities - Maintaining Emotional Control - Leaving a Positive Impression. Tackling Questions - Answering to Behavioural Questions - Responding to Technical Questions - Handling Situational and Hypothetical Questions - Handling Weaknesses and Challenges. Questioning the Interviewer - Demonstrating Interest and Engagement - Showcasing Talents, Knowledge and Research Expertise - Exploring the Company Culture and Values - Inquiring about Growth Opportunities - Addressing Concerns or Challenges - Closing the Interview on a Strong Positive Note. Farewell and Follow-Up - Expressing gratitude - Offering Resources and Support - Importance of Staying in Touch - Contact Information - Inviting Feedback and Follow-Up - Closing Wishes.

UNIT II	GROUP DISCUSSION AND MOCK INTERVIEW	15

Group Discussion - Introduction & Importance - Effective Communication in Group Discussion - Roles and Responsibilities - Strategies for Active Participation - Overcoming Challenges in Group Discussion - Evaluating the Process - Conclusion and Key Takeaways. Body Language, Voice Modulation - Importance & Techniques for Effective Voice Modulation - Pitch Variation - Tone and Inflection - Volume Control - Pace and Pause - Practical Applications of Voice Modulation. Content and Creativity - Importance of Engaging Content - Leveraging Creativity to Stand Out - Crafting Compelling Narratives - Optimizing for Different Platforms - Measuring and Analyzing Content Performance - Staying Ahead of Trends and Innovations. Basic Mock Interview Sessions - Introduction - Purpose and Benefits - Interview Preparation - Common Interview Questions - Behavioral Interview Techniques -Technical Interview Strategies - Mock Interview Feedback and Reflection - Steps and Resources. Activities - Group Discussion, Role Play, Presentation, Mock Interview.

Total: 30 Hours

COURSE OUTCOMES

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

CO1: Show professionalism, apply clear communication strategies, and effectively present themselves during interviews to make a positive impression.

CO2: Apply effective communication strategies and professional behavior to enhance their success in various workplace scenarios.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								3	2	3		2			
CO2								3	2	3		2			

(1 - Low, 2 - Medium, 3 - High)

TEXT BOOK(S)	
T1.	Marry Stella, “Facing Job Interviews”, Lotus Press, New Delhi, 2007.
T2.	Uco Jillert Wiersma, “Interview Charisma”, Career Knows Publishing, Norwalk, Connecticut, 2016.
T3.	Theodore Kingsley, “Interviewing Skills 3 in 1”, Indy Pub, 2023.

REFERENCE BOOK(S)	
R1.	Stephen R Covey, “Seven Habits of Highly Effective People”, G.K Hall, 1997.
R2.	Sanjay Kumar and Pushp Lata, “Communication skills”, Oxford Higher Education, 2011.
R3.	Nira Konar, “Communication Skills for Professionals”, PHI learning Pvt. Ltd, 2011.

Course Code : 24CDC221	Course Title : Mini Project I	
Course Category : EEC	Credits : 1	
L:T:P(Hours/Week) : 0:0:2	Total Contact Hours : 30	Max Marks : 100

COURSE OBJECTIVES
• To enhance students' analytical skills for better problem understanding and evaluation.
• To foster a passion for problem-solving through engaging and challenging tasks.
• To develop students' ability to apply engineering concepts in real-world scenarios effectively.

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Formulate a real-world problem, identify the requirements, and design solutions.
CO 2: Identify technical ideas, strategies, and methodologies.
CO 3: Utilize new tools, algorithms, and techniques to contribute to the solution.
CO 4: Test and validate the prototype for cost-effectiveness.
CO 5: Prepare a report and deliver oral demonstrations.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	2	-	-	2	2	2	-	-			
CO2	1	2	1	1	2	-	-	2	2	2	-	-			
CO3	1	2	1	1	2	-	-	2	2	2	2	-			
CO4	1	2	1	1	2	-	-	2	2	2	2	-			

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

Course Code :24CDC222	**Course Title: Mini Project II**	
Course Category: EEC	**Credits:1**	
L:T:P(Hours/Week) : 0:0:2	**Total Contact Hours:30**	**Max Marks:100**

COURSE OBJECTIVES
• To enhance students' analytical skills for better problem understanding and evaluation.
• To foster a passion for problem-solving through engaging and challenging tasks.
• To develop students' ability to apply engineering concepts in real-world scenarios effectively.

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Formulate a real-world problem, identify the requirements, and design solutions.
CO 2: Identify technical ideas, strategies, and methodologies.
CO 3: Utilize new tools, algorithms, and techniques to contribute to the solution.
CO 4: Test and validate the prototype for cost-effectiveness.
CO 5: Prepare a report and deliver oral demonstrations.

COURSE ARTICULATION MATRIX

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	1	1	2	-	-	2	2	2	-	-			
CO2	1	2	1	1	2	-	-	2	2	2	-	-			
CO3	1	2	1	1	2	-	-	2	2	2	2	-			
CO4	1	2	1	1	2	-	-	2	2	2	2	-			

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

Course Code :24CDC321	**Course Title: Mini Project III**	
Course Category: EEC	**Credits:1**	
L:T:P(Hours/Week) : 0:0:2	**Total Contact Hours:30**	**Max Marks:100**

COURSE OBJECTIVES
• To enhance students' analytical skills for better problem understanding and evaluation.
• To foster a passion for problem-solving through engaging and challenging tasks.
• To develop students' ability to apply engineering concepts in real-world scenarios effectively.

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Formulate a real-world problem, identify the requirements, and design solutions.
CO 2: Identify technical ideas, strategies, and methodologies.
CO 3: Utilize new tools, algorithms, and techniques to contribute to the solution.
CO 4: Test and validate the prototype for cost-effectiveness.
CO 5: Prepare a report and deliver oral demonstrations.

COURSE ARTICULATION MATRIX

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	1	1	2	-	-	2	2	2	-	-			
CO2	1	2	1	1	2	-	-	2	2	2	-	-			

CO3	1	2	1	1	2	-	-	2	2	2	2	-			
CO4	1	2	1	1	2	-	-	2	2	2	2	-			
CO5	1	2	-	-	2	-	-	2	2	2	-	-			

Course Code :24CDC322	**Course Title: Mini Project IV**	
Course Category: EEC	**Credits:1**	
L:T:P(Hours/Week) : 0:0:2	**Total Contact Hours:30**	**Max Marks:100**

COURSE OBJECTIVES
• To enhance students' analytical skills for better problem understanding and evaluation.
• To foster a passion for problem-solving through engaging and challenging tasks.
• To develop students' ability to apply engineering concepts in real-world scenarios effectively.

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Formulate a real-world problem, identify the requirements, and design solutions.
CO 2: Identify technical ideas, strategies, and methodologies.
CO 3: Utilize new tools, algorithms, and techniques to contribute to the solution.
CO 4: Test and validate the prototype for cost-effectiveness.
CO 5: Prepare a report and deliver oral demonstrations.

COURSE ARTICULATION MATRIX

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	1	1	2	-	-	2	2	2	-	-			
CO2	1	2	1	1	2	-	-	2	2	2	-	-			

CO3	1	2	1	1	2	-	-	2	2	2	2	-			
CO4	1	2	1	1	2	-	-	2	2	2	2	-			
CO5	1	2	-	-	2	-	-	2	2	2	-	-			

Course Code : 24CDC422	**Course Title : Project Work Phase I**	
Course Category : EEC	**Credits : 2**	
L:T:P(Hours/Week) : 0:0:4	**Total Contact Hours :60**	**Max Marks :100**

COURSE OBJECTIVES
• To enable students to apply learned technologies in the design, analysis, and simulation of physical systems.
• To help students integrate various systems into a cohesive and functional product.
• To develop students' ability to work effectively in teams and manage time constraints.
• To improve students' skills in presenting and documenting technical work clearly in both oral and written formats.

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Design, analyze, realize/simulate a physical system by using the technology they learned during the program.
CO 2: Integrate various systems into a single product.
CO 3: Work in a team with confined time duration.
CO 4: Disseminate their work both in oral and written format.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	2	2	-	-	-	3			

CO2	3	3	3	3	3	2	2	2	-	-	-	3			
CO3	-	-	-	-	-	-	-	-	3	-	-	-			
CO4	-	-	-	-	-	-	-	-	-	3	3	-			

COURSE ASSESSMENT METHODS:

Direct	**Indirect**
1. Interdisciplinary work 2. Innovation 3. Working model/ simulation result 4. Report with good referencing 5. End Semester Viva Voce	1.Course end survey
Students are required to work in groups of up to 4 members to complete their main project. Special exceptions may be granted for interdisciplinary projects and computer-based simulations, with prior approval from the department committee. Management-related projects will not be permitted. Interdisciplinary projects will be given higher weightage.	

Course Code : 24CDC423	**Course Title : Project Work Phase II**	
Course Category : EEC	**Credits : 2**	
L:T:P(Hours/Week) : 0:0:4	**Total Contact Hours :60**	**Max Marks : 100**

COURSE OBJECTIVES
• To enable students to apply learned technologies in the design, analysis, and simulation of physical systems.
• To help students integrate various systems into a cohesive and functional product.
• To develop students' ability to work effectively in teams and manage time constraints.
• To improve students' skills in presenting and documenting technical work clearly in both oral and written formats.

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Design, analyze, realize/simulate a physical system by using the technology they learned during the program.
CO 2: Integrate various systems into a single product.
CO 3: Work in a team with confined time duration.
CO 4: Disseminate their work both in oral and written format.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	2	2	-	-	-	3			

CO2	3	3	3	3	3	2	2	2	-	-	-	3			
CO3	-	-	-	-	-	-	-	-	3	-	-	-			
CO4	-	-	-	-	-	-	-	-	-	3	3	-			
Max															

COURSE ASSESSMENT METHODS:

Direct	**Indirect**
1. Interdisciplinary work 2. Innovation 3. Working model/ simulation result 4. Report with good referencing 5. End Semester Viva Voce	1.Course end survey
Students are required to work in groups of up to 4 members to complete their main project. Special exceptions may be granted for interdisciplinary projects and computer-based simulations, with prior approval from the department committee. Management-related projects will not be permitted. Interdisciplinary projects will be given higher weightage.	

Course Code: 24MAC221	Course Title: Summer Internship I	
Course Category: MC	Credits: 0	
L:T:P (Hours/Week):0:0:0	Total Contact Hours: 2weeks	Max Marks: 100

COURSE OBJECTIVES
• To enable students to apply theoretical knowledge to real-world engineering challenges.
• To expose students to industry-standard tools, technologies, and practices.
• To enhance professional skills such as teamwork, communication, and time management in a workplace environment

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Apply engineering principles to design and solve real-world problems using acquired knowledge.
CO 2: Analyze industry processes and technologies to evaluate their effectiveness in solving engineering challenges.
CO 3: Evaluate the performance of engineering systems and propose enhancements based on hands-on experience.
CO 4: Design and implement innovative solutions in collaborative projects, demonstrating leadership and teamwork.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	1	2	1	2	1			

CO2	3	3	2	3	2	2	2	1	2	2	2	2			
CO3	3	2	3	3	2	2	2	2	2	2	2	2			
CO4	3	2	3	2	3	2	3	1	3	3	3	2			

Course Code: 24MAC321	**Course Title: Summer Internship II**	
Course Category: MC	**Credits: 0**	
L:T:P (Hours/Week):0:0:0	**Total Contact Hours: 2 Weeks**	**Max Marks: 100**

COURSE OBJECTIVES
• To enable students to apply theoretical knowledge to real-world engineering challenges.
• To expose students to industry-standard tools, technologies, and practices.
• To enhance professional skills such as teamwork, communication, and time management in a workplace environment

COURSE OUTCOMES
At the end of this course, students will be able to:
CO 1: Apply engineering principles to design and solve real-world problems using acquired knowledge.
CO 2: Analyze industry processes and technologies to evaluate their effectiveness in solving engineering challenges.
CO 3: Evaluate the performance of engineering systems and propose enhancements based on hands-on experience.
CO 4: Design and implement innovative solutions in collaborative projects, demonstrating leadership and teamwork.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	3	3	3	2	2	2	1	1	2	1	2	1			
CO2	3	3	2	3	2	2	2	1	2	2	2	2			
CO3	3	2	3	3	2	2	2	2	2	2	2	2			
CO4	3	2	3	2	3	2	3	1	3	3	3	2			