NARAYANA ENGINEERING COLLEGE::GUDUR
NAAC 'A' GRADE (AUTONOMOUS)
Dhurjati Nagar, Gudur, Tirupati Dist., AP - 524101

B. Tech (Regular-Full time)

Effective for the students admitted into I - Year from the

Academic Year **2023-24** onwards

DEPARTMENT OF

ELECTRICAL & ELECTRONICS ENGINEERING

COURSE STRUCTURE AND SYLLABUS

NARAYANA ENGINEERING COLLEGE

Vision of the Institute:

To be one among the premier institutions of the country for professional education in producing technocrats with competent skills, Innovative ideas and Ethical values and commitment to societal and sustainable development

Mission of the Institute:

M1: To provide an environment most conducive to learning with state-of-the-art infrastructure, well equipped laboratories and research facilities supported by modern teaching learning practices to impart high-quality technical education.

M2: To emphasize on innovative ideas and creative thinking and prepare them to meet the growing challenges of the industry and contribute to sustainable development

M3: To inculcate the leadership qualities, multi-disciplinary approach, Ethics and lifelong learning in graduates to serve the diverse societal needs of our nation

Department of Electrical and Electronics Engineering

Vision of the department:

To produce technically competent Electrical and Electronics Engineers capable of meeting the evolving needs of industry and society through innovation, leadership, research, professional ethics, lifelong learning and sustainable development.

Mission of the department:

M1: To impart strong technical knowledge and professional skills through core and industry-oriented teaching-learning practices and continuous assessment.

M2: To foster competency, creativity, and innovation among students through emerging technologies, experiential learning, and skill enhancement programs to develop sustainable solutions for real-world challenges.

M3: To cultivate professional competence, ethical values, leadership qualities, and lifelong learning, empowering students to contribute responsibly and effectively to society.

Program Educational Outcomes:

PEOs	Statements
PEO1	Technical Competence: Apply knowledge of Electrical and Electronics Engineering fundamentals to analyze, formulate, and solve complex engineering problems using appropriate theoretical and practical skills.
PEO2	Professional Growth and Innovation: Pursue successful careers in industry, research, or entrepreneurship by applying technical, communication, and problem-solving skills to develop innovative solutions for real-world challenges and sustainable development.
PEO3	Leadership and Ethical Responsibility: Demonstrate leadership, teamwork, effective communication, lifelong learning, and professional ethics while contributing responsibly to society and ensuring safety, reliability, and sustainable use of technology.

Program Specific Outcomes:

PSO_1: Electrical Engineering Competence: Apply the principles of Electrical and Electronics Engineering to analyze, design, and develop innovative solutions for complex real-world engineering problems using appropriate modern techniques.

PSO_2: Professional and Sustainable Practice: Demonstrate interdisciplinary and professional skills by applying emerging hardware and software technologies to address complex engineering problems while upholding ethical values, societal responsibilities, teamwork, leadership, and sustainable development.

Program Outcomes

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

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

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

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

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

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

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

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

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

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

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

EEE - COURSE STRUCTURE & SYLLABUS – R23

1st Year Semester –I

Course Code	Category	Course Title	Contact Periods Per Week				Credits	*Scheme of Examination Max Marks*		
			L	T	P	Total		Internal Marks	External Marks	Total Marks
233PH1001	BS & H	Engineering Physics	3	0	0	3	3	30	70	100
23MA1001	BS & H	Linear Algebra & Calculus	3	0	0	3	3	30	70	100
233ES1003	ES	Basic Electrical & Electronics Engineering	3	0	0	3	3	30	70	100
23ES1001	ES	Introduction to Programming	3	0	0	3	3	30	70	100
233ES1505	ES	Engineering Graphics	1	0	4	5	3	30	70	100
233ES1504	ES	IT Workshop	0	0	2	2	1	30	70	100
233PH1501	BS & H	Engineering Physics Lab	0	0	2	2	1	30	70	100
23ES1502	ES	Electrical & Electronics Engineering Workshop	0	0	3	3	1.5	30	70	100
23ES1501	ES	Computer Programming Lab	0	0	3	3	1.5	30	70	100
23EX1501	BS & H	NSS/NCC/Scouts & Guides/Community Service	0	0	1	1	0.5	-	-	-
23MC8101	MC	Mandatory Course - Induction Programme	———							
		Counselling/Mentoring	0	0	1	1	0	-	-	-
		Sports/Hobby Clubs/Activities	0	0	2	2	0	-	-	-
		Activity Point Program	During the Semester					20 Points		
			13	0	18	31	20.5	270	630	900

1st Year Semester –II

Course Code	Category	Course Title	Contact Periods Per Week				Credits	*Scheme of Examination Max Marks*		
			L	T	P	Total		Internal Marks	External Marks	Total Marks
23EN1001	BS & H	Communicative English	2	0	0	2	2	30	70	100
23CH1001	BS & H	Chemistry	3	0	0	3	3	30	70	100
23MA1002	BS & H	Differential Equations & Vector Calculus	3	0	0	3	3	30	70	100
23ES1002	ES	Basic Civil & Mechanical Engineering	3	0	0	3	3	30	70	100
23EE2001	PC	Electrical Circuit Analysis – I	3	0	0	3	3	30	70	100
23EN1501	BS & H	Communicative English Lab	0	0	2	2	1	30	70	100
23CH1501	BS & H	Chemistry Lab	0	0	2	2	1	30	70	100
23ES1503	ES	Engineering Workshop	0	0	3	3	1.5	30	70	100
23EE2501	PC	Electrical Circuit Analysis – I Lab	0	0	3	3	1.5	30	70	100
23LS1501	BS & H	Health and wellness, Yoga and Sports	0	0	1	1	0.5	-	-	-
		Counselling/Mentoring	0	0	1	1	0	-	-	-
		Sports/Hobby Clubs/Activities	0	0	2	2	0	-	-	-
		Activity Point Program	During the Semester					20 Points		
			14	0	14	28	19.5	270	630	900

2nd Year Semester-I

Course Code	Category	Course Title	Contact Periods per week				Credits	*Scheme of Examination Max Marks*		
			L	T	P	Total		Internal Marks	External Marks	Total Marks
23MA1004	BS&H	Complex Variables & Numerical Methods	3	0	0	3	3	30	70	100
23EN1002	BS&H	Universal Human Values-Understanding Harmony & Ethical Human Conduct	2	1	0	3	3	30	70	100
23ES1004	ES	Electromagnetic Field Theory	3	0	0	3	3	30	70	100
23EE2003	PC	Electrical Circuit Analysis-II	3	0	0	3	3	30	70	100
23EE2004	PC	DC Machines & Transformers	3	0	0	3	3	30	70	100
23SC6103	SEC	Data Structures	0	1	2	3	2	30	70	100
23EE2503	PC	Electrical Circuit Analysis-II and Simulation Lab	0	0	3	3	1.5	30	70	100
23EE2504	PC	DC Machines & Transformers Lab	0	0	3	3	1.5	30	70	100
23MC8102	AC	Environmental Science	2	0	0	2	0	30	---	30
Activity Point Program			During the Semester					20 Points		
		Total	**16**	**2**	**08**	**26**	**20**	**270**	**560**	**830**

2nd Year Semester-II

S.No.	Course code	Title	L	T	P	Total	C	Internal Marks	External Marks	Total Marks
1	23ES1010	Managerial Economics and Financial Analysis	2	0	0	2	2	30	70	100
2	23ES1013	Analog Circuits	3	0	0	3	3	30	70	100
3	23EE2005	Power Systems-I	3	0	0	3	3	30	70	100
4	23EE2006	Induction and Synchronous Machines	3	0	0	3	3	30	70	100
5	23EE2007	Control Systems	3	0	0	3	3	30	70	100
6	23EE2505	Induction and Synchronous Machines Lab	0	0	3	3	1.5	30	70	100
7	23EE2506	Control Systems Lab	0	0	3	3	1.5	30	70	100
8	23SC6102	Python Programming	0	1	2	3	2	30	70	100
9	23SC6105	Design Thinking & Innovation	1	0	2	3	2	30	70	100
10	Activity Point Programme		During the semester					20 Points		
Total			15	1	10	26	21	270	630	900
Mandatory Community Service Project of 08 weeks duration during summer vacation										

3rd Year Semester-I

Course Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
23EE2008	PC	Power Electronics	3	0	0	3	3	30	70	100
23EE2009	PC	Digital Circuits	3	0	0	3	3	30	70	100
23EE2010	PC	Power Systems-II	3	0	0	3	3	30	70	100
23ES1014	ES	Introduction to Quantum Technology & Applications	3	0	0	3	3	30	70	100
	PE-I	Professional Elective – I	3	0	0	3	3	30	70	100
	OE-I	Open Elective-I	3	0	0	3	3	30	70	100
23SC6104	SEC	Soft Skills	0	1	2	3	2	30	70	100
23ES1507	ES	Tinkering Lab	0	0	2	2	1	30	70	100
23EE2507	PC	Power Electronics Lab	0	0	3	3	1.5	30	70	100
23EE2508	PC	Analog and Digital Circuits Lab	0	0	3	3	1.5	30	70	100
23PR7501	Internship	Evaluation of Community Service Internship	0	0	0	0	2	--	--	--
Activity Point Programme			During the semester					20 Points		
		Total	**18**	**1**	**10**	**29**	**26**	**300**	**700**	**1000**

3rd Year Semester-II

S. No.	Course code	Title	L	T	P	Credits	Internal Marks	External Marks	Total Marks
1	23EE2011	Electrical Measurements and Instrumentation	3	0	0	3	30	70	100
2	23EE2012	Microprocessors and Microcontrollers	3	0	0	3	30	70	100
3	23EE2013	Power System Analysis	3	0	0	3	30	70	100
4		**Professional Elective-II**	3	0	0	3	30	70	100
5		**Professional Elective-III**	3	0	0	3	30	70	100
6		**Open Elective – II**	3	0	0	3	30	70	100
7	23EE2509	Electrical Measurements and Instrumentation Lab	0	0	3	1.5	30	70	100
8	23EE2510	Microprocessors and Microcontrollers Lab	0	0	3	1.5	30	70	100
9	23SC6112	**Skill Enhancement course:** Applications of Soft Computing Tools in Electrical Engineering	0	1	2	2	30	70	100
10	23MC8104	**Mandatory non-credit course/ Audit Course:** Technical Paper Writing & IPR	2	0	0	0	30	---	30
11	**Activity Point Program**		During the Semester				20 Points		
		Total	20	1	8	23	300	630	930
Mandatory Industry Internship of 08 weeks duration during summer vacation									

4th Year Semester-I

S.No.	Course code	Title	L	T	P	Credits	Scheme of Examination Max. Marks		
							Internal Marks	External Marks	Total Marks
1	23EE2014	Power System Operation and Control	3	0	0	3	30	70	100
2	23ES1003 23ES1009 23ES1015	**Management Course-II** 1.Business Ethics and Corporate Governance 2.E-Business **3.Management Science**	2	0	0	2	30	70	100
3		**Professional Elective-IV**	3	0	0	3	30	70	100
4		**Professional Elective-V**	3	0	0	3	30	70	100
5		**Open Elective-III**	3	0	0	3	30	70	100
6		**Open Elective-IV**	3	0	0	3	30	70	100
7	23SC6117	**Skill Enhancement course** Power Systems and Simulation Lab	0	1	2	2	30	70	100
8	23MC8104	**Audit Course** Gender Sensitization	2	0	0	-	30	---	30
9	23PR7502	Evaluation of Industry Internship	-	-	-	2	30	70	100
10		**Activity Point Program**	During the Semester - 20 Points						
Total			**19**	**1**	**2**	**21**	**270**	**560**	**830**

4th Year Semester-II

Course Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
23PR7503	PR	Internship	--	--	12	12	4	40	60	100
23PR7504	PR	Project	--	--	12	12	8	60	140	200

PROFESSIONAL ELECTIVES

Elective Track / Group	Professional Elective-1	Professional Elective-2	Professional Elective-3	Professional Elective-4	Professional Elective-5
Modern Power Systems	Electrical Safety and Risk Management	Switchgear and Protection	Renewable and Distributed Energy Technologies	HVDC and FACTS	Electrical Distribution System
Industrial Automation	Signals and Systems	Programmable Logic Controllers	Communication Systems	Digital Signal Processing	Modern Control Theory
Green Technology	Utilization of Electrical Energy	AI & ML for Electrical Engineering	Electrical Drives	Electric Vehicle Technology	Switched Mode Power Conversion
Modern Electrical Engineering	Machine Modeling and Analysis	Electrical Machine Design	Programmable Control Devices and Applications	Hybrid Electrical Vehicles	Automotive Electrical Engineering
Sustainable Energy Systems	Advanced Power Semiconductor Devices and Protection	Solar and Fuel Cell Energy Systems	Wind andBiomass Energy Systems	Renewable Energy Conversion Systems	Energy Audit and Demand Side Management

Open Elective – I

S.No.	Course Code	Course Name	Offered by the Dept.
1	23CE3001	Green Buildings	CIVIL
2	23CE3002	Construction Technology and Management	
3	23EE3001	Electrical Safety Practices and Standards	EEE
4	23ME3001	Sustainable Energy Technologies	ME
5	23EC3001	Electronic Circuits	ECE
6	23CS3001	Java Programming	CSE & Allied/IT
7	23CS3002	Fundamentals of Artificial Intelligence	
8	23MA3001	Mathematics for Machine Learning and AI	Mathematics
9	23PH3001	Materials Characterization Techniques	Physics
10	23CH3001	Chemistry of Energy Systems	Chemistry
11	23HE3001	English for Competitive Examinations	Humanities
12	23HE3002	Entrepreneurship and New Venture Creation	

Open Elective – II

S. No.	Course Code	Course Name	Offered by the Dept.
1	23CE3003	Disaster Management	Civil
2	23CE3004	Sustainability in Engineering Practices	
3	23EE3002	Renewable Energy Sources	EEE
4	23ME3002	Automation and Robotics	ME
5	23EC3002	Digital Electronics	ECE
6	23CS3003	Operating Systems	CSE& Allied/IT
7	23CS3004	Machine Learning	
8	23MA3002	Optimization Techniques for Engineers	Mathematics
9	23MA3003	Mathematical Foundation of Quantum Technologies	
10	23PH3002	Physics of Electronic Materials and Devices	Physics
11	23CH3002	Chemistry of Polymers and Applications	Chemistry
12	23HE3003	Academic Writing and Public Speaking	Humanities

Open Elective – III

S.No	Course Code	Course Name	Offered by the Dept.
1	23CE3005	Building Materials and Services	CIVIL
2	23CE3006	Environmental Impact Assessment	
3	23EE3003	Smart Grid Technologies	EEE
4	23ME3003	3D Printing Technologies	ME
5	23EC3003	Microprocessors and Microcontrollers	ECE
6	23CS3005	Data Base Management Systems	CSE & Allied/IT
7	23CS3006	Cyber Security	

8	23MA3004	Wavelet transforms and its Applications	Mathematics
9	23PH3003	Smart Materials And Devices	Physics
10	23PH3004	Introduction to Quantum Mechanics	
11	23CH3003	Green Chemistry And Catalysis For Sustainable Environment	Chemistry
12	23HE3004	Employability Skills	Humanities

Open Elective – IV

S.No	Course Code	Course Name	Offered by the Dept.
1	23CE3007	Geo-Spatial Technologies	CIVIL
2	23CE3008	Solid Waste Management	
3	23EE3004	Electric Vehicles	EEE
4	23ME3004	Total Quality Management	ME
5	23EC3004	Transducers and Sensors	ECE
6	23CS3007	Computer Networks	CSE & Allied/IT
7	23CS3008	Internet of Things	
8	23CS3009	Quantum Computing	
9	23MA3005	Financial Mathematics	Mathematics
10	23PH3005	Sensors And Actuators For Engineering Applications	Physics
11	23CH3004	Chemistry Of Nanomaterials and Applications	Chemistry
12	23HE3005	Literary Vibes	Humanities

Overall Credits

S. NO	CATEGORY	CREDITS PER SEMESTER								Credits
		I	II	III	IV	V	VI	VII	VIII	
1	BS&H	7.5	10.5	6						**24**
2	ES	13	4.5	3	5	4		2		**31.5**
3	PC		4.5	9	12	12	12	3		**52.5**
4	PE					3	6	6		**15**
5	OE					3	3	6		**12**
6	SC			2	4	2	2	2		**12**
7	PR					2		2	12	**16**
	TOTAL	**20.5**	**19.5**	**20**	**21**	**26**	**23**	**21**	**12**	**163**

1st Year Semester –I

Course Code	Category	Course Title	Contact Periods Per Week				Credits	*Scheme of Examination Max Marks*		
			L	T	P	Total		Internal Marks	External Marks	Total Marks
233PH1001	BS & H	Engineering Physics	3	0	0	3	3	30	70	100
23MA1001	BS & H	Linear Algebra & Calculus	3	0	0	3	3	30	70	100
233ES1003	ES	Basic Electrical & Electronics Engineering	3	0	0	3	3	30	70	100
23ES1001	ES	Introduction to Programming	3	0	0	3	3	30	70	100
233ES1505	ES	Engineering Graphics	1	0	4	5	3	30	70	100
233ES1504	ES	IT Workshop	0	0	2	2	1	30	70	100
233PH1501	BS & H	Engineering Physics Lab	0	0	2	2	1	30	70	100
23ES1502	ES	Electrical & Electronics Engineering Workshop	0	0	3	3	1.5	30	70	100
23ES1501	ES	Computer Programming Lab	0	0	3	3	1.5	30	70	100
23EX1501	BS & H	NSS/NCC/Scouts & Guides/Community Service	0	0	1	1	0.5	-	-	-
23MC8101	MC	Mandatory Course - Induction Programme	———							
		Counselling/Mentoring	0	0	1	1	0	-	-	-
		Sports/Hobby Clubs/Activities	0	0	2	2	0	-	-	-
		Activity Point Program	During the Semester					20 Points		
			13	0	18	31	20.5	270	630	900

NARAYANA ENGINEERING COLLEGE:GUDUR								
Year-I	ENGINEERING PHYSICS							R2023
Semester-I	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	30	70	100

Pre-requisite: Nil

Course Objectives:

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

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

CO 1	Analyze the intensity variation of light due to polarization, interference and diffraction and familiarize with the basics of crystals and their structures
CO 2	Explain fundamentals of quantum mechanics and apply to one dimensional motion of particles.
CO 3	Summarize various types of polarization of dielectrics and classify the magnetic materials.
CO 4	Explain the basic concepts of Quantum Mechanics and the band theory of solids.
CO 5	Identify the type of semiconductor using Hall effect.

CO-PO Mapping

CO	PO											PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2			1						1	1	
CO2	3	2		1							1	1	
CO3	3	1				1					1	1	1
CO4	3	2		1	1						1	1	1
CO5	3	2		2	2						1	2	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Wave Optics (10 Hours)

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colors in thin films- Newton's Rings- Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

MODULE -2: Crystallography and X-ray diffraction (08 Hours)
Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes. **X-ray diffraction:** Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods.
MODULE-3: Dielectric and Magnetic Materials (08 Hours)
Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dilectric constant – Frequency dependence of polarization – dielectric loss **Magnetic Materials:** Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.
MODULE-4: Quantum Mechanics and Free electron theory (08 Hours)
Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well. **Free Electron Theory:** Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy.
MODULE-5: Semiconductors (14 Hours)
Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation - Hall effect and its applications.
Total hours: 48 hours

Term work:

1. Determination of the wavelength of monochromatic light using Newton's rings.
2. Calculation of interplanar spacing and verification of Bragg's law.
3. Study of the hysteresis curve and comparison of soft and hard magnetic materials.
4. Analysis of a particle in a one-dimensional infinite potential well and calculation of its energy levels.
5. Determination of the Hall coefficient and identification of semiconductor type.

Content beyond syllabus:

1. Nanomaterials and Their Applications in Modern Engineering: Properties, synthesis, and applications of nanomaterials in sensors, energy storage, and electronic devices.
2. Superconductivity and Its Engineering Applications: Critical temperature, Meissner effect, superconducting materials, and applications in MRI, magnetic levitation, and power systems.

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Web Reference

	1	Newton's Rings: determination of wavelength and applications of interference	CO1	https://tbc-python.fossee.in/book-details/72/?utm_source
	2	Schrödinger's wave equation and particle in a one-dimensional potential well	CO2	https://nptel.ac.in/courses
	3	Dielectric polarization and classification of magnetic materials	CO3	https://tbc-python.fossee.in/book-details/179/?utm_source
	4	Energy-band theory and Fermi energy in solids	CO4	https://nptel.ac.in/courses
	5	Hall effect, Hall coefficient, and identification of semiconductor type	CO5	https://tbc-python.fossee.in/book-details/179/?utm_source

Text Book(s):

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

Reference Book(s):

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

Online Resources:

1. NPTEL (National Programme on Technology Enhanced Learning): Online courses and lectures covering wave optics, quantum mechanics, solid-state physics, and semiconductor physics.
2. FOSSEE – Textbook Companion Project: Engineering Physics chapter resources, worked examples, and computational learning materials.

Web Resources: (any three links)

1. Quantum Mechanics I – NPTEL, IIT Bombay
2. Engineering Physics – FOSSEE Textbook Companion Covers interference, diffraction, polarization, crystallography, quantum mechanics, dielectric materials, and magnetic materials.
3. Engineering Physics – FOSSEE, Semiconductor and Solid-State Physics Resources Includes semiconductor physics, energy bands, Hall voltage, dielectric properties, and magnetic materials.

NARAYANA ENGINEERING COLLEGE:GUDUR								
Year-I	LINEAR ALGEBRA & CALCULUS							R2023
Semester-I	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	30	70	100

Pre-requisite: Nil

Course Objectives:

To equip the students with standard concepts and tools of mathematics to handle various real-world problems and their applications.

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

CO 1	Develop matrix algebra techniques that is needed by engineers for practical applications.
CO 2	Familiarize with functions of several variables which is useful in optimization.
CO 3	Learn important tools of calculus in higher dimensions.
CO 4	Familiarize with differential of functions of several variables in two and three dimensions.
CO 5	Familiarize with double and triple integrals of functions of several variables in two and three dimensions.

CO-PO Mapping

CO	PO											PSO	
	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	3	3			1						1	1	
CO2	3	2	1								1	1	
CO3	3	2		1							1	1	
CO4	3	3	1								1	1	
CO5	3	3	2	1	1						1	1	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Matrices (10 Hours)

Rank of a matrix by echelon form, normal form. Cauchy –Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

MODULE -2: Linear Transformation and Orthogonal Transformation (08 Hours)

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

MODULE-3: Calculus (08 Hours)

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

MODULE-4: Partial differentiation and Applications (Multi variable calculus) (08 Hours)

Partial derivatives, total derivatives, chain rule, change of variables, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.
MODULE-5: Multiple Integrals (Multi variable Calculus) (14 Hours)
Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Total hours:	**48 hours**

Term work:

1. Solve a system of simultaneous linear equations using Gauss elimination and Gauss–Seidel iteration methods.

2. Determine eigenvalues and eigenvectors, diagonalize a matrix, and verify the Cayley–Hamilton theorem.

3. Verify Lagrange's Mean Value Theorem for a suitable function over a specified interval.

4. Determine the maxima and minima of a function of two variables using partial derivatives.

5. Evaluate a double integral to determine the area of a bounded region, or use a triple integral to calculate volume.

Content beyond syllabus:

1. Applications of Linear Algebra in Electrical Engineering: Use of matrices, eigenvalues, and eigenvectors in electrical network analysis, power-system studies, and control-system modeling.
2. Applications of Multivariable Calculus in Engineering Optimization: Use of partial derivatives, gradients, and Lagrange multipliers in minimizing cost, optimizing power-system performance, and maximizing efficiency.

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Web Reference
1	Rank of a matrix, inverse of a matrix, and solution of simultaneous linear equations	CO1	https://onlinecourses.nptel.ac.in/noc20_ma37/preview
2	Eigenvalues, eigenvectors, diagonalization, and the Cayley–Hamilton theorem	CO2	https://nptel.ac.in/courses
3	Rolle's theorem, Lagrange's Mean Value Theorem, and Taylor's theorem	CO3	https://onlinecourses.nptel.ac.in/noc20_ma37/preview
4	Partial derivatives, Jacobians, and maxima and minima of functions of two variables	CO4	https://nptel.ac.in/courses
5	Double and triple integrals, change of order of integration, and	CO5	https://ocw.mit.edu/courses/18-02-multivariable-calculus-fall-2007

		applications to area and volume		

Text Book(s):

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

Reference Book(s):

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
3. Glyn James, Advanced Modern Engineering Mathematics, 5/e, Pearson publishers, 2018.
4. Michael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
5. H. K Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand,2021

Online Resources:

1. NPTEL – Engineering Mathematics I, IIT Kharagpur: Covers matrices, linear systems, eigenvalues, mean value theorems, Taylor expansions, partial derivatives, and multiple integrals.
2. MIT OpenCourseWare – Multivariable Calculus: Provides lecture notes, assignments, and study materials on partial derivatives, optimization, and multiple integrals.

Web Resources:

1. NPTEL – Linear Algebra: Matrices, rank, eigenvalues, eigenvectors, diagonalization, and the Cayley–Hamilton theorem.
2. NPTEL – Multivariable Calculus, IIT Roorkee: Partial derivatives, chain rule, Lagrange multipliers, Jacobian-related calculus, and multiple integrals.
3. MIT OpenCourseWare – Multivariable Calculus: Vectors, matrices, partial derivatives, double integrals, triple integrals, and applications.

NARAYANA ENGINEERING COLLEGE :: GUDUR								
I. B. Tech.	BASIC ELECTRICAL & ELECTRONICS ENGINEERING							R23
Semester I	Hours / Week			Total Hours	Credits	Max. Marks		
23ES1003	L	T	P		C	CIE	SEE	Total
	3	0	0	24	3	30	70	100

Pre-requisite: NIL

Course Objectives:

Course Outcomes: At the end of this course students will demonstrate the ability to

CO1	Apply fundamental electrical laws, network theorems, and AC circuit concepts to analyze and solve simple DC and AC circuit problems. (BL-3)
CO2	Explain the construction, working principles, and applications of various electrical machines and measuring instruments. (BL-2)
CO3	Explain conventional and non-conventional energy resources, calculate domestic electricity bills, and describe electrical protection and safety measures. (BL-3)

CO-PO Mapping

Cos	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3									2	3
CO2	3	3	3									2	3
CO3	3	3	3	2								3	3

1 - Low, 2 - Medium, 3 - High

Course Content

PART-A: BASIC ELECTRICAL ENGINEERING

Module-1	DC & AC Circuits	Hours: 10

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

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

At the end of the Module – 1, Students will be able to:

1. Explain the solution techniques to solve the DC & AC Circuits.

Module-2	Machines and Measuring Instruments	Hours: 07

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

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

At the end of the Module – 2, Students will be able to:

1. Explain the working of different types of motors.
2. Explain the usage of different types of Instruments.

Module-3	Energy Resources, Electricity Bill & Safety Measures	Hours: 07

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

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

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

At the end of the Module – 3, Students will be able to:

1. Understand the different resources available in nature.
2. Understand the billing procedure of their home.
3. Explain the different safety rules against the electrical shock.

Total Hours: 24

Content beyond Syllabus:

Usage of different measurement equipments in electrical system.

Self Study:

S. No.	Topic	COs	Reference
1	Concept of Impedance, Active power, reactive power and apparent power	**CO1**	https://www.allaboutcircuits.com/textbook/alternating-current/chpt-11/true-reactive-and-apparent-power/#:~:text=As%20a%20rule%2C%20true%20power,circuit's%20total%20impedance%20(Z).
2	Applications of electrical machines	**CO2**	https://en.wikipedia.org/wiki/Electric_machine#:~:text=Electric%20motors%20are%20found%20in,AC%20motors%20and%20DC%20motors.
3	Earthing and its types	**CO3**	https://www.electricaltechnology.org/2015/05/earthing-and-electrical-grounding-types-of-earthing.html

Text Book(s):

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

Reference Book(s):

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

Online Resources / Web References:

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
Year-I	INTRODUCTION TO PROGRAMMING							R2023
Semester-I	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	30	70	100

Pre-requisite: Nil

Course Objectives:

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

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

CO 1	Understand basics of computers, the concept of algorithm and algorithmic thinking.
CO 2	Develop the ability to analyze a problem, develop an algorithm to solve it.
CO 3	Proficiently use the C programming language to implement various algorithms.
CO 4	Understand more advanced features of C language.
CO 5	Develop problem-solving skills and the ability to debug and optimize the code.

CO-PO Mapping

CO	PO											PSO	
	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	2	1			1						1	1	
CO2	2	3	1	1	1						1	1	
CO3	2	3	2	1	3						1	2	1
CO4	2	2	2	1	3						1	2	1
CO5	2	3	2	2	3		1	2			2	2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction to Programming and Problem Solving (10 Hours)

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

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

MODULE -2: Control Structures (08 Hours)

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

MODULE-3: Arrays and Strings (08 Hours)

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

MODULE-4: Functions (08 Hours)
Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables
MODULE-5: User Defined Data types, File Handling, Pointers (14 Hours)
User-defined data types-Structures and Unions, pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers. Basics of File Handling.
Total hours: 48 hours

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

Term work:

1. Develop an algorithm, flowchart, and pseudocode to calculate the electricity bill for a given number of units consumed.

2. Write a C program to determine whether a number is prime and display all prime numbers within a given range.

3. Write a C program to sort an array of integers and perform basic string operations.

4. Develop a menu-driven calculator using user-defined functions and demonstrate parameter passing.

5. Develop a student-record management program using structures and file handling, with pointer-based data access.

Content beyond syllabus:

1. Introduction to Data Structures using C: Basics of linked lists, stacks, queues, and their applications in engineering problem-solving.
2. Introduction to Version Control using Git and GitHub: Repository creation, version tracking, commits, and collaborative programming practices.

Self-Study:

Contents to promote self-Learning:

SNO	Topic (one topic from syllabus to each CO)	CO	Web Reference (one link for each CO)
1	Computer organization, algorithms, flowcharts, pseudocode, and basic C data types	CO1	https://www.learn-c.org
2	Algorithm development and implementation of decision-making and looping statements	CO2	https://www.programiz.com/c-programming
3	Array operations, string manipulation, and implementation of algorithms in C	CO3	https://www.geeksforgeeks.org/c/c-programming-language
4	Functions, parameter passing, pointers, and scope and lifetime of variables	CO4	https://en.cppreference.com/w/c/language
5	Structures, unions, pointers, pointer	CO5	https://www.programiz.com/c-programming

		arithmetic, and file handling in C		

Text Book(s):

1. "The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie
2. Schaum's Outline of Programming with C by Byron S Gottfried (1996), McGraw-Hill Education (ISBN:978-0070240353)

Reference Book(s):

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

Online Resources:

1. https://www.learn-c.org
2. https://www.programiz.com/c-programming

Web Resources:

1. https://www.geeksforgeeks.org/c/c-programming-language
2. https://en.cppreference.com/w/c/language
3. https://www.programiz.com/c-programming

NARAYANA ENGINEERING COLLEGE:GUDUR								
Year-I	ENGINEERING GRAPHICS							R2023
Semester-I	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	2	0	2	48	3	30	70	100

Pre-requisite: Nil

Course Objectives:

The students completing the course are expected to:

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

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

CO 1	Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.
CO 2	Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
CO 3	Understand and apply concepts of sectional views to represent details of solids in simple positions.
CO 4	Gain a clear understanding of the principles behind development of surfaces and to understand how to unfold basic geometric shapes into flat patterns.
CO 5	Develop the ability to draw isometric views and orthographic views and should be able to convert isometric views to orthographic views and vice versa.

CO-PO Mapping

CO	PO											PSO	
	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	2	2	1		2				1		1	1	
CO2	2	3	2		2				1		1	2	1
CO3	2	2	3		2	1			1		1	2	1
CO4	2	2	3		2	2			1	1	1	2	2
CO5	2	2	3		3				2		2	2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction (10 Hours)

Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

MODULE -2: Orthographic Projections (08 Hours)

Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

MODULE-3: Projections of Solids (08 Hours)

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

MODULE-4: Sections of Solids (08 Hours)

Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

MODULE-5: Conversion of Views (14 Hours)

Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings ofobjects including PCB and Transformations using Auto CAD (*Not for end examination*).

Total hours:	**48 hours**

Term work:

1. Construct an ellipse, parabola, and involute using engineering drawing methods, and draw a plain or diagonal scale.

2. Draw the projections of a straight line inclined to both the horizontal and vertical reference planes.

3. Draw the projections of a prism or pyramid with its axis inclined to one reference plane and parallel to the other.

4. Draw the sectional views and true shape of a section of a solid, and develop the lateral surface of a cylinder or cone.

5. Convert the given orthographic views into an isometric view and create a simple 2D/3D component using AutoCAD.

Content beyond syllabus:

1. Introduction to 3D CAD Modelling and Parametric Design: Basic 3D modelling, geometric constraints, and parametric design of engineering components.

2. Engineering Graphics in Electrical and Electronics Engineering: Preparation and interpretation of electrical installation layouts, printed circuit board (PCB) layouts, and basic electrical equipment drawings using CAD tools.

Self-Study:

Contents to promote self-Learning:

SNO	Topic (one topic from syllabus to each CO)	CO	Web Reference (one link for each CO)
1	Geometrical constructions,	CO1	https://nptel.ac.in/courses/112103019

	engineering curves, and scales		
2	Orthographic projections of points, lines, and planes	CO2	https://nptel.ac.in/courses/124107157
3	Sectional views and true shapes of sections of solids	CO3	https://nptel.ac.in/courses/112103019
4	Parallel-line and radial-line development of surfaces of solids	CO4	https://nptel.ac.in/courses/112103019
5	Conversion between isometric and orthographic views; 2D and 3D CAD drawing	CO5	https://app.learn-one.autodesk.com/learn/ondemand/collection/get-started-with-autocad

Text Book(s):

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

Reference Book(s):

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

Online Resources:

1. https://nptel.ac.in/courses/112103019
2. https://app.learn-one.autodesk.com/learn/ondemand/collection/get-started-with-autocad

Web Resources:

1. https://nptel.ac.in/courses/124107157
2. https://nptel.ac.in/courses/124107159
3. https://help.autodesk.com/cloudhelp/2026/ENU/AutoCAD-GettingStarted/files/GUID-39B76D69-225D-45EE-A9AC-59CCBF48AF64.htm

NARAYANA ENGINEERING COLLEGE :: GUDUR							
I. B. Tech.	IT WORKSHOP						R23
Semester I	Hours / Week			Total Hours	Credits	Max. Marks	
	L	T	P		C	CIE	SEE	Total
	0	0	2	30	1	30	70	100

Pre-requisite: NIL

Course Objectives:

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

Course Outcomes: At the end of this course students will demonstrate the ability to

CO1	Perform Hardware troubleshooting
CO2	Understand Hardware components and inter dependencies
CO3	Safeguard computer systems from viruses/worms
CO4	Document/ Presentation preparation
CO5	Perform calculations using spreadsheets

CO-PO Mapping

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	3		1	3		2				1	1	1
CO2	2	2			3		1				1	1	1
CO3	1	2			3		3				2	1	2
CO4	1				3			1	3		1	1	2
CO5	2	2		1	3				1		1	2	2

1 - Low, 2 - Medium, 3 - High

Course Content

List of Experiments:

PC Hardware

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

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

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

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

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings,

bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.
Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.
Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

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

Excel
Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.
Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text
Task 2 : Calculating GPA - .Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,
LOOKUP/VLOOKUP
Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting.

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

AI Tools – ChatGPT
Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.
Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of

France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas
Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Code Generation: Test the model's ability to generate code by giving it partial code snippets and asking it to complete them. You can also ask the model to explain programming concepts or help you debug code.
Ex:Prompt: "Complete the following Python code to swap the values of two variables: \npython\na = 5\nb = 10\ntemp = a\na = b\nb = temp\n"

Task 4: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.
Ex:Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Task 5: Summarization: Provide a long piece of text, such as an article or a blog post, and ask the model to summarize it. Compare the model's summary with the original text to assess its ability to condense information effectively.
Ex: Prompt: "Summarize the article titled ‘Ramayanam' in 3-4 sentences."

Task 6: Futuristic Predictions: Have fun by asking the model to predict future technological advancements, societal changes, or even hypothetical scenarios. Compare its responses with your own ideas.
Ex:Prompt: "Predict how artificial intelligence will transform everyday life in the next 20 years."

Task 7: Technical Explanations: Challenge the model with technical questions from different domains. Ask it to explain scientific concepts, mathematical theorems, or complex algorithms in simple terms.
Ex:Prompt: "Explain the concept of neural networks in machine learning, including their layers and the process of backpropagation."

Text Book(s):

1. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dream tech
2. The Complete Computer upgrade and repair book, 3rd edition Cheryl A Schmidt, WILEY Dream tech

Reference Book(s):

3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. PC Hardware - A Handbook – Kate J. Chase PHI (Microsoft)
5. LaTeX Companion – Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfins on and Ken Quamme. – CISCO Press, Pearson Education.
7. IT Essentials PC Hardware and Software Labs and Study Guide Third Edition by Patrick Regan– CISCO Press, Pearson Education.

Online Resources / Web References:

1. https://www.libreoffice.org
2. https://help.openai.com/en/articles/10032626-prompt-engineering-best-practices-for-chatgpt

NARAYANA ENGINEERING COLLEGE :: GUDUR								
I. B. Tech.	ENGINEERING PHYSICS LAB							R23
Semester I	Hours / Week			Total Hours	Credits	Max. Marks		
	L	T	P		C	CIE	SEE	Total
	0	0	2	30	1	30	70	100

Pre-requisite: NIL

Course Objectives:

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

Course Outcomes: At the end of this course students will demonstrate the ability to

CO1	Operate optical instruments like travelling microscope and spectrometer and estimate the wavelengths of different colors using diffraction grating.
CO2	Plot the intensity of the magnetic field of circular coil carrying current with distance and evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic materials respectively.
CO3	Calculate the band gap of a given semiconductor and identify the type of semiconductor using Hall effect.

CO-PO Mapping

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2		3	3		1	1	2		2	1	1
CO2	2	3		3	3	1	1	1	2		2	2	2
CO3	2	3		3	3		1	1	2		2	2	2

1 - Low, 2 - Medium, 3 - High

Course Content

List of Experiments:

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

double cantilever) method.

18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

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

Virtual Lab:

URL: *www.vlab.co.in*

Text Book(s):

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

NARAYANA ENGINEERING COLLEGE :: GUDUR						
ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP						R23
Hours / Week			Total Hours	Credits	Max. Marks	
L	T	P		C	CIE	SEE	Total
0	0	3	15	1.5	30	70	100

Pre-requisite: NIL

Course Outcomes: At the end of this course students will demonstrate the ability to

CO1. Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.

CO2. Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments.

CO3. Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.

CO-PO Mapping

	POs											PSOs	
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1									2	3
CO2	2	2	2									2	3
CO3	3	2	2									2	3

1 - Low, 2 - Medium, 3 - High

Course Content

(PART-A: ELECTRICAL ENGINEERING LAB)

List of experiments:

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

Note: Minimum Six Experiments to be performed.

Text Book(s):

1. Basic Electrical Engineering, D.C. Kulshreshtha, Tata Mc Graw Hill, 2019, First Edition.

Reference Book(s):

1. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
2. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition.

Online Resources / Web References:

https://www.roboversity.com/workshops

NARAYANA ENGINEERING COLLEGE :: GUDUR							
I. B. Tech.	COMPUTER PROGRAMMING LAB						R23
Semester I	Hours / Week			Total Hours	Credits	Max. Marks	
	L	T	P		C	CIE	SEE	Total
	0	0	3	30	1.5	30	70	100

Pre-requisite: NIL

Course Objectives:

- To use basic data types, operators, expressions and expression evaluation mechanisms using C Programming Language.
- To implement control flows, construct in C Programming Language and understand the syntax, semantics and usability contexts of these different constructs.
- To develop composite data types in C and constructs available to develop their datatypes, utilize them to model things and dealing with data from and to external files.
- To design programs with different variations of the constructs available for practicing modular programming and understand the pros and cons of using different variants and apply optimization.

Course Outcomes: At the end of this course students will demonstrate the ability to

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

CO-PO Mapping

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2		2	3				2		2	2	1
CO2	2	3	2	2	3				1		2	2	1
CO3	2	3	2	2	3		1		1		2	3	2
CO4	2	3	2	3	3		1	1	2		2	3	2

1 - Low, 2 - Medium, 3 - High

Course Content

List of Experiments:

WEEK 1
Objective: Getting familiar with the programming environment on the computer and writing the first program.
Suggested Experiments/Activities:
Tutorial 1: Problem-solving using Computers.
Lab1: Familiarization with programming environment
i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
ii) Exposure to Turbo C, gcc
iii) Writing simple programs using printf(), scanf()

WEEK 2
Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.
Suggested Experiments /Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.
Lab 1: Converting algorithms/flow charts into C Source code.
Developing the algorithms/flowcharts for the following sample programs
i) Sum and average of 3 numbers
ii) Conversion of Fahrenheit to Celsius and vice versa
iii) Simple interest calculation

WEEK 3
Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.
Suggested Experiments/Activities:
Tutorial 3: Variable types and type conversions:
Lab 3: Simple computational problems using arithmetic expressions.
i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

WEEK 4
Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.
Suggested Experiments/Activities:
Tutorial4: Operators and the precedence and as associativity:
Lab4: Simple computational problems using the operator' precedence and associativity
i) Evaluate the following expressions.
a. A+B*C+(D*E) + F*G
b. A/B*C-B+A*D/3
c. A+++B---A
d. J= (i++) + (++i)
ii) Find the maximum of three numbers using conditional operator
iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5
Objective: Explore the full scope of different variants of "if construct" namely if-else, null-else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".
Suggested Experiments/Activities:
Tutorial 5: Branching and logical expressions:
Lab 5: Problems involving if-then-else structures.

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

WEEK 6
Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more

appropriate to use.

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

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

i) Find the factorial of given number using any loop.

ii) Find the given number is a prime or not.

iii) Compute sine and cos series

iv) Checking a number palindrome

v) Construct a pyramid of numbers.

WEEK 7:

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

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7:1D Array manipulation, linear search

i) Find the min and max of a 1-D integer array.

ii) Perform linear search on1D array.

iii) The reverse of a 1D integer array

iv) Find 2's complement of the given binary number.

v) Eliminate duplicate elements in an array.

WEEK 8:

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

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort

i) Addition of two matrices

ii) Multiplication two matrices

iii) Sort array elements using bubble sort

iv) Concatenate two strings without built-in functions

v) Reverse a string using built-in and without built-in string functions

WEEK 9:

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

Suggested Experiments/Activities:

Tutorial 9: Functions, call by value, scope and extent,

Lab 9: Simple functions using call by value, solving differential equations using Eulers theorem

i) Write a C function to calculate NCR value

ii) Write a C function to find the length of a string

iii) Write a C function to transpose of a matrix

iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 10:

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be

invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.
Suggested Experiments/Activities:
Tutorial 10: Recursion, the structure of recursive calls
Lab 10: Recursive functions
i) Write a recursive function to generate Fibonacci series
ii) Write a recursive function to find the lcm of two numbers
iii) Write a recursive function to find the factorial of a number
iv) Write a C Program to implement Ackermann function using recursion
v) Write a recursive function to find the sum of series.

WEEK 11:
Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers
Suggested Experiments/Activities:
Tutorial 11: Call by reference, dangling pointers
Lab 11: Simple functions using Call by reference, Dangling pointers
i) Write a C program to swap two numbers using call by reference
ii) Demonstrate Dangling pointer problem using a C program
iii) Write a C program to copy one string into another using pointer
iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK12:
Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C
Suggested Experiments/Activities:
Tutorial 12: Pointers, structures and dynamic memory allocation
Lab12: Pointers and structures, memory dereference.
i) Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list
iv) Read student name and marks from the command line and display the student details along with the total.
v) Write a C program to implement realloc()

WEEK 13:
Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures
Suggested Experiments/Activities:
Tutorial 13: Bitfields, Self-Referential Structures, Linked lists
Lab13 : Bitfields, linked lists
Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit-fields
i) Create and display a singly linked list using self-referential structure.
ii) Demonstrate the differences between structures and unions using a C program.
iii) Write a C program to shift/rotate using bitfields.
iv) Write a C program to copy one structure variable to another structure of the same type.

WEEK14:
Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and

binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

i) Write a C program to write and read text into a file.

ii) Write a C program to write and read text into a binary file using fread() and fwrite()

iii) Copy the contents of one file to another file.

iv) Write a C program to merge two files into the third file using command-line arguments.

v) Find no. of lines, words and characters in a file

vi) Write a C program to print last n characters of a given file.

Text Book(s):

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

Reference Book(s):

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

Online Resources / Web References:

1. https://www.programiz.com/c-programming

2. https://nptel.ac.in

NARAYANA ENGINEERING COLLEGE:GUDUR								
Year-I	NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE							R2023
Semester-I	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	0	0	1	30	0.5	---	---	100

Pre-requisite: Nil

Course Objectives:

- To impart discipline, character, and fraternity amongst young citizens
- To train them to work in teams/groups to enhance their team spirit.
- To enable the students to acquire leadership qualities.
- To induce social consciousness among students through various activities.
- To instill self-confidence and the ideals of selfless service
- To engage students in responsible and challenging actions for the common good.

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

CO 1	Understand the importance of discipline, character and service motto and outline the needs and problems of the community.
CO 2	Solve some societal issues by applying acquired knowledge, facts, and techniques and explore human relationships by analyzing social problems.
CO 3	Determine to extend their help for the fellow beings and downtrodden people and develop leadership skills and civic responsibilities.

CO-PO Mapping

CO	PO											PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1		1		1		3	3	2	2		2		2
CO2	1	3	2	2		3	2	2	3	1	2	1	3
CO3		2	2	2		3	3	3	2	2	2	1	3

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Orientation (10 Hours)

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

Activities:

i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills

ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc.

iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.

iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

MODULE -2: Nature & Care (08 Hours)

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

MODULE-3: Community Service (08 Hours)

Activities:
i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authoritiesexperts- etc.
ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc.
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
v) Any other programmes in collaboration with local charities, NGOs etc.

Total hours:	**30 hours**

Text Book(s):
1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi

Reference Book(s):
3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering", McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

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

Evaluation Guidelines:
- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

1st Year Semester –II

Course Code	Category	Course Title	Contact Periods Per Week				Credits	*Scheme of Examination Max Marks*		
			L	T	P	Total		Internal Marks	External Marks	Total Marks
23EN1001	BS & H	Communicative English	2	0	0	2	2	30	70	100
23CH1001	BS & H	Chemistry	3	0	0	3	3	30	70	100
23MA1002	BS & H	Differential Equations & Vector Calculus	3	0	0	3	3	30	70	100
23ES1002	ES	Basic Civil & Mechanical Engineering	3	0	0	3	3	30	70	100
23EE2001	PC	Electrical Circuit Analysis – I	3	0	0	3	3	30	70	100
23EN1501	BS & H	Communicative English Lab	0	0	2	2	1	30	70	100
23CH1501	BS & H	Chemistry Lab	0	0	2	2	1	30	70	100
23ES1503	ES	Engineering Workshop	0	0	3	3	1.5	30	70	100
23EE2501	PC	Electrical Circuit Analysis – I Lab	0	0	3	3	1.5	30	70	100
23LS1501	BS & H	Health and wellness, Yoga and Sports	0	0	1	1	0.5	-	-	-
		Counselling/Mentoring	0	0	1	1	0	-	-	-
		Sports/Hobby Clubs/Activities	0	0	2	2	0	-	-	-
		Activity Point Program	During the Semester					20 Points		
			14	0	14	28	19.5	270	630	900

NARAYANA ENGINEERING COLLEGE::GUDUR								
Course code 23EN1001	**Course Title: COMMUNICATIVE ENGLISH**							R23
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	48	2	30	70	100

Pre-requisite: English

Course Objectives: The main objective of introducing this course, communicative English, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry-ready.

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

CO 1	Understandthe context, topic, and pieces of specific information from social or transactional dialogues.(BL 2)
CO 2	Applygrammatical structures to formulate sentences and correct word forms. `(BL 3)
CO3	Analyzediscourse markers to speak clearly on a specific topic in informal discussions.(BL4)
CO 4	Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.(BL 5)
CO 5	Createa coherent paragraph, essay, and resume.(BL 6)

CO-PO Mapping													
CO	**PO**											**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO 2**
CO1									1	3			
CO2									1	3			
CO3									3	3			
CO4									2	3			
CO5									2	3			
1: Low, 2-Medium, 3- High													

COURSE CONTENT		
UNIT – 1	**Lesson: HUMAN VALUES: The Gift of the Magi (Short Story)** **Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and	**8H**

	interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information. Writing: Mechanics of **Writing-**Capitalization, Spellings, Punctuation-Parts of Sentences. **Grammar**: Parts of Speech, Basic Sentence Structures-forming questions Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.	
At the end of the Module -1, students will be able tolearn the context and specific information.		
UNIT -2	**Lesson: NATURE: The Brook by Alfred Tennyson (Poem)** **Listening:** Answering a series of questions about main ideas and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/small groups on specific topics followed by short structure talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. **Writing:** Structure of a paragraph - Paragraph writing (specific topics). **Grammar:** Cohesive devices - linkers, use of articles and zero article; prepositions. Vocabulary: Homonyms, Homophones, Homographs.	**7 H**
At the end of the Module - 2, students will be able to discuss with small group of people.		
UNIT-3	Lesson: BIOGRAPHY: ElonMusk. Listening: Listening for global comprehension and summarizing what is listened to. Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed. Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context	8 H

	clues; strategies to use text clues for comprehension. Writing: Summarizing, Note-making, paraphrasing. Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations Vocabulary: Compound words, Collocations.	
At the end of the Module - 3, students will be able to learn how to recognizing and interpreting specific context.		
UNIT-4	**Lesson: INSPIRATION: The Toys of Peace by Saki.** **Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Letter Writing: Official Letters, Resumes. **Grammar:** Reporting verbs, Direct & Indirect speech, Active & Passive Voice Vocabulary: Words often confused, Jargons.	**8 H**
At the end of the Module - 4, students will be able to practice conversational dialogues.		
UNIT-5	**Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay).** **Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. **Speaking:** Formal oral presentations on topics from academic contexts Reading: Reading comprehension. **Writing:** Writing structured essays on specific topics. **Grammar:** Editing short texts –identifying and	**9 H**

	correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement) Vocabulary: Technical Jargons.	
At the end of the Module - 5, students will be able to give presentational topics.		
	Total hours:	**48 HOURS**

Content Beyond Syllabus:

1. Inspirational Human values.
2. Soft skills.
3. Technical communication.

Text Book(s):

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

Reference Books :

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

NARAYANA ENGINEERING COLLEGE: GUDUR								
Course code :23CH1001	Course title**: CHEMISTRY**							R23
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	48	3	30	70	100

Pre-requisite: Formation of Sigma, Pi Bonds-Chemical bonding, Crystal lattice in solids, Engineering materials used in industries, Galvanic Cell, Acid-Base Neutralization reaction, sensors, applications of polymers in daily human life, EMR, separation techniques, PH-meter.

Course Objectives:

- To familiarize chemistry and its applications to the Engineering students.
- To train the students on the principles and applications of electrochemistry, polymers.
- To Introduce Instrumental methods and separation of organic compounds

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

CO 1	**Compare** the materials of construction for battery and electrochemical sensors.
CO 2	**Explain** the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.
CO 3	**Explain** the principles of spectrometry, slc in separation of solid and liquid mixtures.
CO 4	**Apply** the principle of Band diagrams in the application of conductors and semiconductors.
CO 5	**Summarizes** the concepts of Instrumental methods.

CO-PO Mapping

CO	PO											PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	3												
CO2	3					2							
CO3	3	2				2							
CO4	3					2							
CO5	3					2	2						

1: Low, 2-Medium, 3- High

COURSE CONTENT		
UNIT – 1	**Structure and Bonding Models:** Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2, particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.	**8H**
At the end of the Module 1, students will be able to: Know 1. **concept** of orbitals, **Structure** of molecules, **Stability**, bond order, magnetic properties (nature of molecules).		

UNIT -2	Semiconductors,banddiagraminsolids,Semiconductordevices(p-njunctiondiodeasrectifierandtransistors) Superconductors-Introduction basic concept, applications. Supercapacitors: Introduction, BasicConcept-Classification–Applications. nomaterials:Introduction,classification,propertiesandapplicationsofFullerenes, Carbon nanotubes and Graphines nanoparticles.	**7 H**
At the end of the Module 2, students will be able to: Know Types of materials,their**characteristics** and Industrial Applications.		
UNIT-3	Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conduct metric titrations (acid-base titrations). Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples. Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).	**8 H**
At the end of the Module 3, students will be able to: Know **Concept** of electrodes, Types of batteries and their applications, uses of sensors in both **industrial** and **humanlife**.		
UNIT-4	Introductiontopolymers,functionalityofmonomers,chaingrowthandstepgrowthpolymerization,coordination polymerization,withspecificexamplesandmechanismsofpolymerformation. Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of –PVC,Teflon,Bakelite,Nylon-6,6,carbonfibres. Elastomers–Buna-S,Buna-N–preparation,propertiesandapplications. Conductingpolymers–polyacetylene,polyaniline,–mechanismofconductionandapplications.Bio-Degradablepolymers-PolyGlycolicAcid(PGA),PolylLacticAcid(PLA).	**8 H**
At the end of the Module 4, students will be able to: Know 1.Importance of polymers in industrial and daily human life. 2.To know Disadvantages of polymers		
UNIT-5	Electromagneticspectrum.Absorptionofradiation: UV-VisibleSpectroscopy, electronic transition, Instrumentation, Beer-Lambert'slaw, IR spectroscopies, fundamental modesand selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC:Principle,InstrumentationandApplications	**9 H**
At the end of the Module 5, students will be able to: Know **Different** types of spectrophotometers, they know separationtechnics and **industrialapplications**.		
	Total hours:	**48 HOURS**

Content Beyond Syllabus:
Valance bond theory, Basics of Allotropes, Electrochemical series and its applications, Fibres and its classifications and applications of spectroscopic techniques in pharmaceutical analysis.

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

Reference Books:

1. J. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
3. J.M.Lehn, Supra Molecular Chemistry, VCH Publications.

NARAYANA ENGINEERING COLLEGE: GUDUR								
Course code	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS (23MA1002)							R23
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	49	3	30	70	100

Pre-requisite: Intermediate Mathematics

Course Objectives:

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

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

CO 1	**Learn** the knowledge of differential equations related to various engineering fields. **(L1)**
CO 2	**Apply** the technique of linear differential equations with Constant coefficients, to solve electrical circuits and Simple Harmonic motion etc. **(L3)**
CO 3	**Identify** solution methods for partial differential equations that model physical process . **(L1)**
CO 4	**Interpret** the physical meaning of different operators such as gradient, curl and divergence. **(L3)**
CO 5	**Using** Green's, Stokes and Gauss's divergence theorems to evaluate double and triple integrals. **(L3)**

CO-PO Mapping

CO	PO											PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	3	2										1	
CO2	3	2										1	
CO3	3	2										1	
CO4	3	2										1	
CO5	3	2										1	
1- Low, 2- Medium, 3- High													

COURSE CONTENT

UNIT – 1	Differential equations of first order and first degree	10H

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

At the end of the Unit- 1, students will be able to:

(1) Student can get the knowledge to solve differential equations. (L 1)

(2) Students apply the Knowledge of applications of differential equations to solve diverse problems (L 3)

UNIT -2	Linear differential equations of higher order (Constant Coefficients)	10H

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear

<table>
<tr><td colspan="3">equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.</td></tr>
<tr><td colspan="3">At the end of the Unit-2, students will be able to
(1) Students can get the knowledge to find the solution of linear differential equations with variable coefficients and simultaneous linear equations. (L 1)
(2) Student identify the methods to Solve linear differential equations with variable coefficients and simultaneous linear equations. (L 2)</td></tr>
<tr><td>UNIT-3</td><td>Partial Differential Equations</td><td>9 H</td></tr>
<tr><td colspan="3">Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange’s method. Homogeneous Linear Partial differential equations with constant coefficients.</td></tr>
<tr><td colspan="3">At the end of the Unit- 3, students will be able to:
(1) Students get knowledge to solve linear and non-linear partial differential equations. (L 1)
(2) Students apply the knowledge of homogeneous and non-homogeneous partial differential equations to solve the diverse problems. (L 3)</td></tr>
<tr><td>UNIT-4</td><td>Vector differentiation</td><td>8 H</td></tr>
<tr><td colspan="3">Scalar and vector point functions, vector operator Del, Del applies to scalar point functions-Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.</td></tr>
<tr><td colspan="3">At the end of the Unit 4, students will be able to:
(1) Students get knowledge to find the gradient, divergence and curl of a vector point functions. (L 1)
2) Students identify the methods to find the gradient, divergence and curl of vector point functions. (L 2)
(3) Students apply the Knowledge of gradient, divergence and curl of vector point functions to solve the diverse problems. (L 3)</td></tr>
<tr><td>UNIT-5</td><td>Vector integration</td><td>12 H</td></tr>
<tr><td colspan="3">Line integral-circulation-work done, surface integral-flux, Green’s theorem in the plane (without proof), Stoke’s theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.</td></tr>
<tr><td colspan="3">At the end of the Unit 5, students will be able to:
(1) Students get knowledge on applying Green’s, Stokes and Gauss’s divergence theorems to evaluate double and triple integrals. (L 1)
(2) Students identify the physical significance of Green’s, Stokes and Gauss’s divergence theorems. (L 2)
(3) Students apply the Knowledge of Vector Integration to solve diverse problems. (L 3)</td></tr>
<tr><td colspan="2">Total hours:</td><td>49 HOURS</td></tr>
<tr><td colspan="3">Content Beyond Syllabus
1. Orthogonal trajectories.
2. Applications of partial differential equations - wave equations.</td></tr>
<tr><td colspan="3">Text Book(s):
(1) Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
(2) Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.</td></tr>
</table>

Reference Books:

(1) Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.

(2) Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.

(3) Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.

(4) Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).

(5) Higher Engineering Mathematics, B. V. Ramana, McGraw Hill Education, 2017

NARAYANA ENGINEERING COLLEGE:GUDUR								
PC	BASIC CIVIL AND MECHANICAL ENGINEERING (PART-A)							R23
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	26	3	30	70	100

Pre-requisite: Nil

Course Objectives:

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

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

CO 1	Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.
CO 2	Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.
CO 3	Understand importance of engineering measures related to Transportation and the importance of Water Storage and Conveyance Structures.

CO-PO Mapping

CO	PO											PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	3	2	2								1	2	
CO2	3	2	2									2	
CO3	3	2	1									2	

1: Low, 2-Medium, 3- High

COURSE CONTENT

UNIT – I **BASICS OF CIVIL ENGINEERING** **9H**

Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water

Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.
At the end of the Module 1, students will be able to: 1. To learn about various disciplines of Civil Engineering 2. To learn about different construction materials
UNIT – II SURVEYING 8H
Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings- Contour mapping.
At the end of the Module 2, students will be able to: 1. To learn about bearings 2. To do leveling for undulated ground.
UNIT – III Transportation Engineering & Water Resources and Environmental Engineering 9H
Transportation Engineering Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering. **Water Resources and Environmental Engineering**: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).
At the end of the Module 3, students will be able to: 1. To understand types of Highway pavements. 2. To understand specifications of drinking water.
Total Hours: 26

Term work: Field study on surveying instruments
Content beyond syllabus: Different Modes of Transportation
Contents to promote self-Learning:

SNO	Topic	Reference
1.	Basics of Civil Engineering	https://onlinecourses.nptel.ac.in/noc20_ce02/preview

	2.	Surveying	https://archive.nptel.ac.in/courses/105/104/105104101/
	3.	Transportation Engineering	https://archive.nptel.ac.in/courses/105/105/105105107/
	4.	Water Resources and Environmental Engineering	https://archive.nptel.ac.in/courses/105/105/105105110/

Text Book(s):

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

Reference Book(s):

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

Online Resources:

1. https://archive.nptel.ac.in/courses/105/106/105106201/
2. https://archive.nptel.ac.in/courses/105/107/105107123/

Web References:

1. https://archive.nptel.ac.in/courses/105/104/105104103/
2. https://nptel.ac.in/courses/105107122

NARAYANA ENGINEERING COLLEGE::GUDUR								
	BASIC CIVIL AND MECHANICAL ENGINEERING (PART-B)							NECR B.TECH R23
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	34	3	30	70	100

Pre-Requisite: BASIC PHYSICS AND MATERIAL ENGINEERING

Course Objectives:

1. To Explain the different engineering materials and manufacturing processes. .
2. To understand the concept of thermal engineering and its various applications and a brief knowledge about IC engines. .
3. Provide an overview of different thermal and mechanical systems introduce basics of robotics and its applications.

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

CO 1	Understand various sub-divisions of Mechanical Engineering and to appreciate their role in ensuring better society and to understand the importance of Engineering Materials.
CO 2	Understand the different manufacturing processes and explain the basics of thermal engineering and its applications.
CO 3	Describe the working of different mechanical power transmission systems and power plants; learn basics of robotics.

CO-PO Mapping

CO	PO											PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	**3**	**1**		**1**		**1**	**1**		**2**		**1**	**1**	
CO2	3	1	1	1		1			1		1	1	1
CO3	3	2	1	1					1		1	1	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	INTRODUCTION TO MECHANICAL ENGINEERING	12hours

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

MODULE -2	INTRODUCTION TO MECHANICAL ENGINEERING	10hours

Manufacturing Processes: Principles of Casting, Forming, and joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

MODULE-3	INTRODUCTION TO MECHANICAL ENGINEERING	12hours

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

Total hours:	**34 hours**

Text Book(s):

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, cengage learning India pvt. Ltd.

Reference Book:

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

NARAYANA ENGINEERING COLLEGE :: GUDUR								
I. B. Tech.	ELECTRICAL CIRCUIT ANALYSIS - I							R23
Semester I	Hours / Week			Total Hours	Credits	Max. Marks		
23EE2001	L	T	P		C	CIE	SEE	Total
	3	0	0	45	3	30	70	100

Pre-requisite: NIL

Course Objectives:

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

Course Outcomes: At the end of this course students will demonstrate the ability to

CO1	Apply network reduction techniques, source transformations, nodal analysis, and mesh analysis to solve DC electrical circuits. (BL-3)
CO2	Explain the fundamental concepts of magnetic circuits, electromagnetic induction, self and mutual inductance, and dot convention. (BL-2)
CO3	Analyze single-phase AC circuits using phasor representation to determine voltage, current, and power under sinusoidal excitation. (BL-4)
CO4	Analyze series and parallel resonant circuits and interpret their frequency response, Q-factor, bandwidth, and locus diagrams. (BL-4)
CO5	Apply various network theorems to simplify and solve electrical networks under DC and AC excitations. (BL-3)

CO-PO Mapping

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1									3	1
CO2	3	3	3									2	1
CO3	3	3	3									3	3
CO4	3	3	3									2	3
CO5	3	3	2									2	3

1 - Low, 2 - Medium, 3 - High

Course Content

Module-1	INTRODUCTION TO ELECTRICAL CIRCUITS	Hours: 10

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

At the end of the Module – 1, Students will be able to:

1. Find the series and parallel connections in a circuit.
2. Apply various techniques to analyze an electric circuit.
3. Find the behaviour of an electrical circuit.

Module-2	MAGNETIC CIRCUITS	Hours: 10

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

At the end of the Module – 2, Students will be able to:

1. Explain the laws of electromagnetic induction.

2. Explain the dot convention technique.
3. Explain the self Inductance and mutual Inductance.

Module-3	SINGLE PHASE CIRCUITS	Hours: 8

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

At the end of the Module – 3, Students will be able to:

1. Understand the advantages of single phase AC system.
2. Explain the complex and polar forms representation.
3. Find the AC circuits in order to determine the voltage, current and power for the given problem.

Module-4	RESONANCE AND LOCUS DIAGRAMS	Hours: 10

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

At the end of the Module – 4, Students will be able to:

1. Explain AC circuits along with resonance and locus diagrams.
2. Understand the effect of resonance on series and parallel resonance circuits.
3. Explain the frequency response for a resonant circuits.

Module-5	NETWORK THEOREMS (DC & AC EXCITATIONS)	Hours: 10

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

At the end of the Module – 5, Students will be able to:

1. Understand the way of approaching to solve for a given network.
2. Solve theorems for finding the solutions of network problem.
3. Explain the application of network theorems.

Total Hours:	48

Content beyond Syllabus:

1. Three Phase circuits and its Importance in Electrical Engineering.
2. Real time applications of network theorems.

Self Study:

S. No.	Topic	CO	Reference
1	Introduction to the electrical& magnetic circuits	CO1	https://nptel.ac.in/courses/117/106/117106108/
2	Single phase AC circuit	CO2	https://nptel.ac.in/courses/108/105/108105053/
3	Locus diagram andresonance	CO3	https://nptel.ac.in/courses/108/105/108105112/
4	Analysis of electrical circuitand Graph theory	CO4	https://nptel.ac.in/courses/108/105/108105159/
5	Network theorem	CO5	https://nptel.ac.in/courses/117/106/117106108/

Text Book(s):

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

Reference Book(s):

1. Fundamentals of Electrical Circuits, Charles K. Alexander and Mathew N.O. Sadiku, Mc Graw Hill

Education (India), 2013, Fifth Edition

2. Electric Circuits (Schaum's outline Series), Mahmood Nahvi, Joseph Edminister, and K. Rao, Mc Graw Hill Education, 2017, Fifth Edition.

3. Electric Circuits, David A. Bell, Oxford University Press, 2009, Seventh Edition.

4. Introductory Circuit Analysis, Robert L Boylestad, Pearson Publications, 2023,Fourteenth Edition.

5. Circuit Theory: Analysis and Synthesis, A. Chakrabarti, Dhanpat Rai & Co., 2018, Seventh Revised Edition.

Online Resources / Web References:

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

NARAYANA ENGINEERING COLLEGE :: GUDUR							
COMMUNICATIVE ENGLISH LAB							R23
Hours / Week			Total Hours	Credits	Max. Marks		
L	T	P		C	CIE	SEE	Total
0	0	2	30	1	30	70	100

Pre-requisite: NIL

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

Course Outcomes: At the end of this course students will demonstrate the ability to

CO1: Understand the different aspects of the English language proficiency with emphasis on LSRW skills.

CO2: Apply communication skills through various language learning activities.

CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.

CO4: Evaluate and exhibit professionalism in participating in debates and group discussions.

CO5: Create effective resonate and prepare themselves to face interviews in future.

CO-PO Mapping

	POs											PSOs	
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1					1	1	1	1	3		2		1
CO2		1			1	1	2	2	3		2		2
CO3					1			1	3		2		1
CO4		2	1		1	2	3	3	3	1	2		2
CO5		1	1		2	1	3	2	3	2	3		2

1 - Low, 2 - Medium, 3 - High

Course Content

List of experiments:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

Suggested Software:

- Walden Infotech
- Young India Films

Text Book(s):

1. Meenakshi Raman, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.
2. Grant Taylor: English Conversation Practice, Tata McGraw-Hill Education India, 2016

Reference Book(s):

3. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
4. T. Balasubramanyam, A Textbook of English Phonetics for Indian Students,(3rd Ed) Trinity Press.

Online Resources / Web References:

Spoken English:

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

Voice & Accent:

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

NARAYANA ENGINEERING COLLEGE :: GUDUR							
CHEMISTRY LAB							R23
Hours / Week			Total Hours	Credits	Max. Marks		
L	T	P		C	CIE	SEE	Total
0	0	2	30	1	30	70	100

Pre-requisite: NIL

Course Objective: Verify the fundamental concepts with experiments.

Course Outcomes: At the end of this course students will demonstrate the ability to

CO1: Determine the cell constant and conductance of solutions.

CO2: Prepare advanced polymer Bakelite materials.

CO3: Measure the strength of an acid present in secondary batteries.

CO4: Analyze the IR spectra of some organic compounds.

CO-PO Mapping

	POs											PSOs	
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2		2	3		1		1		2	1	1
CO2	2	2	1	2	2	1	2	2	1		2	1	2
CO3	2	2	1	2	3	1	2		1		2	2	2
CO4	2	2		2	3		1		1		2	1	1

1 - Low, 2 - Medium, 3 - High

Course Content

List of experiments:

1. Measurement of 10Dq by spectrophotometric method
2. Conductometric titration of strong acid vs. strong base
3. Conductometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of simple organic compounds by IR
11. Preparation of nanomaterials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

Text Book(s):

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

NARAYANA ENGINEERING COLLEGE :: GUDUR							
ENGINEERING WORKSHOP							R23
Hours / Week			Total Hours	Credits	Max. Marks		
L	T	P		C	CIE	SEE	Total
0	0	3	30	1.5	30	70	100

Pre-requisite: NIL

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

Course Outcomes: At the end of this course students will demonstrate the ability to

CO1: Identify workshop tools and their operational capabilities.

CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.

CO3: Apply fitting operations in various applications.

CO4: Apply basic electrical engineering knowledge for House Wiring Practice

CO-PO Mapping

	POs											PSOs	
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1			3	1	3	1	1		2	2	2
CO2	2	2	2	1	3	1	3	3	2	1	2	2	3
CO3	2	2	2	1	3	1	3	2	1	1	2	3	2
CO4	3	2	2	1	3	2	3	2	1	2	2	3	3

1 - Low, 2 - Medium, 3 - High

Course Content

Syllabus:

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.

a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint

3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.

a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.

a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre

5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.

a) Parallel and series b) Two-way switch c) Godown lighting

d) Tube light e) Three phase motor f) Soldering of wires

6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

Text Book(s):

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.

2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE :: GUDUR								
I. B. Tech.	ELECTRICALCIRCUIT AANALYSIS – I LABORATORY							R23
Semester I	Hours / Week			Total Hours	Credits	Max. Marks		
23EE2501	L	T	P		C	CIE	SEE	Total
	0	0	3	48	1.5	30	70	100

Pre-requisite: NIL

Course Objectives:

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

Course Outcomes: At the end of this course students will demonstrate the ability to

CO1	Understand the concepts of network theorems, node and mesh networks, series and parallel resonance and Locus diagrams.
CO2	Apply various theorems to compare practical results obtained with theoretical calculations.
CO3	Determine self, mutual inductances and coefficient of coupling values, parameters of choke coil.
CO4	Analyze different circuit characteristics with the help of fundamental laws and various configurations.
CO5	Create locus diagrams of RL, RC series circuits and examine series and parallel resonance.

CO-PO Mapping

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	1	1		1	2		1	2	2	2
CO2	2	2	2	1	1		1	2		1	2	2	2
CO3	2	2	2	1	1		1	2		1	2	2	2
CO4	2	2	2	1	1		1	2		1	2	2	2
CO5	2	2	1				1				2	2	3

1 - Low, 2 - Medium, 3 - High

Course Content

List of Experiments:

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

Virtual Labs:

1. Parallel RC Circuits

2. Parallel LC Circuits
3. Thevenin's theorem
4. Series RL Circuits
5. Norton's Theorem
6. Series LCR Circuit

Text Book(s):

1. Engineering Circuits Analysis, Jack Kemmerly, William Haytand Steven Durbin, Tata Mc Graw Hill Education, 2005, sixth edition.

Reference Book(s):

1. Network Analysis, M.E. Van Valken burg, Pearson Education, 2019, Revised Third Edition.

Online Resources / Web References:

1. https://www.ee.iitkgp.ac.in/
2. http://www.vlab.co.in/lab_ready_for_use.php
3. http://vlab.amrita.edu/?sub=1&brch=75

SNO	Topic	CO	Reference
1	Thevinins and nortons	CO1	**https://www.youtube.com/watch?v=7JfoDFk61o8**
2	Series Resonance in RLC Circuit	CO2	**https://www.youtube.com/watch?v=YLGrugmDvc0**
3	Phasor Diagram of RL, RC and RLC Circuits	CO3	**https://www.youtube.com/watch?v=HaFrY0qQ-NU**

NARAYANA ENGINEERING COLLEGE :: GUDUR						
Health And Wellness, Yoga and Sports						**R23**
Hours / Week			**Total Hours**	**Credits**	**Max. Marks**	
L	**T**	**P**		**C**	**CIE**	**SEE**	**Total**
0	**0**	**1**	**30**	**0.5**	**30**	**70**	**100**

Pre-requisite: NIL

Course Objective:

- To maintain their mental and physical wellness upright and develop ability in them to cope up with the stress arising in the life.
- To create space in the curriculum to nurture the potential of the students in sports/games/yoga etc.
- To introduce a practice oriented introductory course on the subject.

Course Outcomes: At the end of this course students will demonstrate the ability to

CO1: Be Physical fit to perform daily routine without undue fatigue.

CO2: Be Mentally alert and Socially Cohesive

CO3: Consider success and failure equally.

CO4: Develop Positive Personality

CO5: Improve Leadership qualities.

CO-PO Mapping

	Pos											PSOs	
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1			2			3	2	2			2		2
CO2			2			3	3	3	2		2		3
CO3		2	2			3	3	2	2		3		2
CO4		1	2			2	3	2	2		3		2
CO5		2	2			2	3	3	2	2	3		3

1 - Low, 2 - Medium, 3 - High

Course Content

UNIT I

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

Activities:

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

UNIT II

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

Activities:

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

UNIT III

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

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

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

Evaluation Guidelines:
- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

2nd Year Semester-I

Course Code	Category	Course Title	Contact Periods per week				Credits	*Scheme of Examination Max Marks*		
			L	T	P	Total		Internal Marks	External Marks	Total Marks
23MA1004	BS	Complex Variables & Numerical Methods	3	0	0	3	3	30	70	100
23EN1002	HSMC	Universal Human Values-Understanding Harmony & Ethical Human Conduct	2	1	0	3	3	30	70	100
23ES1004	ES	Electromagnetic Field Theory	3	0	0	3	3	30	70	100
23EE2003	PC	Electrical Circuit Analysis-II	3	0	0	3	3	30	70	100
23EE2004	PC	DC Machines & Transformers	3	0	0	3	3	30	70	100
23SC6103	SEC	Data Structures	0	1	2	3	2	30	70	100
23EE2503	PC	Electrical Circuit Analysis-II and Simulation Lab	0	0	3	3	1.5	30	70	100
23EE2504	PC	DC Machines & Transformers Lab	0	0	3	3	1.5	30	70	100
23MC8102	AC	Environmental Science	2	0	0	2	0	30	---	30
Activity Point Program			During the Semester					20 Points		
		Total	**16**	**2**	**08**	**26**	**20**	**270**	**560**	**830**

NARAYANA ENGINEERING COLLEGE :: GUDUR								
Course code	COMPLEX VARIABLES & NUMERICAL METHODS							R23
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	3	0	0	48	3	30	70	100

Pre-requisite: Basic Complex variables and Basic equations

Course Objectives:

This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables. The student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

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

CO 1	**Analyze** limit, continuity and differentiation of functions of complex variables. **(L4)**
CO 2	Understand Cauchy theorem, Cauchy integral formulas and **apply** these to **evaluate** complex contour integrals. **(L3, L5)**
CO 3	**Apply** numerical methods to **solve** algebraic and transcendental equations**. (L3)**
CO 4	**Find** interpolating polynomials using interpolation formulae **(L1)**
CO 5	**Solve** differential and integral equations numerically. **(L3)**

CO-PO Mapping

CO	PO											PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	3	2										1	
CO2	3	2										1	
CO3	2	3		1								1	
CO4	2	3		1								1	
CO5	2	3		1								1	

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Complex Variable – Differentiation**	**10H**
Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method.		
At the end of the Module 1, students will be able to: (1) Understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions. (L1) (2) Find the conjugate harmonic function. (L1)		
MODULE -2	**Complex Variable – Integration**	**10 H**
Line integral-Contour integration, Cauchy's integral theorem (Simple Case), Cauchy Integral formula, Power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.		
At the end of the Module 2, students will be able to: (1) Classify singularities and poles. (L2) (2) Find residues and evaluate complex integrals using the residue theorem. (L1)		
MODULE-3	**Solution of Algebraic & Transcendental Equations**	**9 H**

Introduction-Bisection Method-Iterative method, Regula-falsi method and Newton Raphson method. System of Algebraic equations: Gauss Elimination, Jacoby and Gauss-Seidel method.		
At the end of the Module 3, students will be able to: (1) Find roots of algebraic and transcendental equations. (L1) (2) Solve system of linear equations. (L3)		
MODULE-4	**Interpolation**	**9 H**
Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Curve fitting: Fitting of straight line, second-degree and Exponential curve by method of least squares.		
At the end of the Module 4, students will be able to: (1) Develop skills in analyzing the methods of interpolating a given data, properties of interpolation with unequal intervals and derive conclusions, approximate a function using an appropriate numerical method. (L3) (2) Estimate the missing terms through interpolation methods. (L5)		
MODULE-5	**Solution of Initial value problems to Ordinary differential equations**	**10 H**
Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's and modified Euler's methods-Runge-Kutta methods (second and fourth order).		
At the end of the Module 5, students will be able to: (1) understand the concept of solving integral and differential equations numerically for various real-world problems. (L3) (2) Solve initial value problems which have great significance in engineering practice using ordinary differential equations. (L3)		
	Total hours:	**48 HOURS**
Content Beyond Syllabus: **Special functions:** Beta function, Improper Integrals, Gamma function, Relation between Beta and Gamma functions.		
Text Book(s): (1) B. S. Grewal, Higher Engineering Mathematics, KhannaPublishers,2017, 44th Edition. (2) S. S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited.		
Reference Books: (1) Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2018, 10th Edition. (2) B. V. Ramana, Higher Engineering Mathematics, by Mc Graw Hill publishers. (3) R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd., 2021 5th Edition (9th reprint).		

II Year B.Tech. EEE – I Semester

L	T	P	C
2	1	0	3

(23A52301) UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT

Course Objectives:

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

Course Outcomes:

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

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations

Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards

Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body

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

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)
PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:

Textbook and Teachers Manual

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

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

Reference Books

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
II-B.Tech	ELECTROMAGNETIC FIELD THEORY							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite: Nil

Course Objectives:

1. To review the fundamentals of the different coordinate systems, vector algebra and calculus
2. To teach the basic laws of electromagnetism
3. To learn to compute and visualize the electrostatic and magnetostatic fields for simple configurations
4. To analyse the time varying electric and magnetic fields and to understand Maxwell's equations
5. To understand the propagation of electromagnetic waves through different media

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

CO 1	Apply vector algebra, vector calculus, and electrostatic principles to determine electric field intensity, electric flux density, and electric potential for different charge distributions. (BL-3)
CO 2	Analyze the behavior of conductors and dielectrics in electric fields and determine capacitance, stored energy, and electric field characteristics. (BL-4)
CO 3	Apply Biot-Savart's law and Ampere's circuital law to determine magnetic fields, forces, and torque due to current-carrying conductors. (BL-3)
CO 4	Calculate self and mutual inductances of different conductor configurations and determine the energy stored in magnetic fields. (BL-3)
CO 5	Explain and apply Maxwell's equations, electromagnetic induction, displacement current, and Poynting theorem to analyze time-varying electromagnetic fields. (BL-3)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Vector Analysis & Electrostatics

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

Coordinate Systems: Rectangular, Cylindrical and Spherical coordinate systems.

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

Electrostatics:

Coulomb's law and Electric field intensity (EFI) – EFI due to Continuous charge distributions (line and surface charge), Electric flux density, Gauss's law (Maxwell's first equation, $\nabla.\vec{D} = \rho_v$), Applications of Gauss's law, Electric Potential, Work done in moving a point charge in an electrostatic field (second

Maxwell's equation for static electric fields,$\nabla \times \vec{E} = 0$), Potential gradient, Laplace's and Poison's equations.
MODULE -2: Conductors – Dielectrics and Capacitance
Behavior of conductor in Electric field, Electric dipole and dipole moment – Potential and EFI due to an electric dipole, Torque on an Electric dipole placed in an electric field, Current density-conduction and convection current densities, Ohm's law in point form, Behavior of conductors in an electric field, Polarization, dielectric constant and strength, Continuity equation and relaxation time, Boundary conditions between conductor to dielectric, dielectric to dielectric and conductor to free space, Capacitance of parallel plate, coaxial and spherical capacitors, Energy stored and density in a static electric field, Coupled and decoupled capacitors.
MODULE-3: Magneto statics, Ampere's Law and Force in magnetic fields
Biot-Savart's law and its applications viz. Straight current carrying filament, circular, square, rectangle and solenoid current carrying wire – Magnetic flux density and Maxwell's second Equation ($\nabla . \vec{B} = 0$), Ampere's circuital law and its applications viz. MFI due to an infinite sheet, long filament, solenoid, toroidal current carrying conductor, point form of Ampere's circuital law, Maxwell's third equation ($\nabla \times \vec{H} = \vec{J}$). Magnetic force, moving charges in a magnetic field – Lorentz force equation, force on a current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors, Magnetic dipole, Magnetic torque, and moment.
MODULE-4: Self and mutual inductance
Self and mutual inductance – determination of self-inductance of a solenoid, toroid, coaxial cable and mutual inductance between a straight long wire and a square loop wire in the same plane – Energy stored and energy density in a magnetic field.
MODULE-5: Time Varying Fields
Faraday's laws of electromagnetic induction, Maxwell's fourth equation($\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$), integral and point forms of Maxwell's equations, statically and dynamically induced EMF, Displacement current, Modification of Maxwell's equations for time varying fields, Poynting theorem and Poynting vector.

Total hours:	**54 hours**

Term work:
Design of solenoid and thoroid.

Content beyond syllabus:
Electric power transmission

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Gauss's law and its applications	CO1	https://www.youtube.com/watch?v=M0GInI0vNh8

	2	Poisson's and Laplace's equations	CO2	https://www.youtube.com/watch?v=I-lKnLnnbY4
	3	Biot– Savart's Law	CO3	https://www.youtube.com/watch?v=X9mYh8aG2AQ
	4	Neumann's formula	CO4	https://www.youtube.com/watch?v=iVANETIf3cM
	5	Displacement current	CO5	https://www.youtube.com/watch?v=77PZPBXMl1w

Text Book(s):

1. Mathew N. O. Sadiku, S.V.Kulkarni, 'Principles of Electromagnetics', 6th Edition, Oxford University Press, 2015, Asian Edition
2. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', Tata McGraw Hill ,8th Revised edition, 2014
3. "Elements of Electromagnetics" by Matthew N O Sadiku, Oxford Publications, 7th edition, 2018.
4. "Engineering Electromagnetics" by William H. Hayt& John. A. Buck Mc. Graw-Hill, 7th Editon.2006.

Reference Book(s):

1. Bhag Singh Guru and Huseyin R. Hiziroglu "Electromagnetic field theory fundamentals", Cambridge University Press; Second Revised Edition, 2009.
2. Ashutosh Pramanik, 'Electromagnetism – Theory and Applications', PHI Learning Private Limited, New Delhi, Second Edition-2009
3. Inan U. S. and A. S. Inan, Engineering Electromagnetics, Pearson Education, 2010.
4. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), Tata McGraw Hill, 2010
5. "Introduction to Electro Dynamics" by D J Griffiths, Prentice-Hall of India Pvt. Ltd, 2nd edition.
6. "Electromagnetic Field Theory" by Yaduvir Singh, Pearson India, 1st edition, 2011.
7. "Fundamentals of Engineering Electromagnetics" by Sunil Bhooshan, Oxford University Press, 2012.

Online Resources:

1. http://alumni.media.mit.edu/~aggelos/papers/EM_Hayt_6th.pdf
2. https://nptel.ac.in/courses/108/106/108106073/

Web Resources:

1. https://www.youtube.com/watch?v=pGdr9WLto4A&list=PLl6m4jcR_DbOx6s2toprJQx1MORqPa9rG
2. https://www.youtube.com/watch?v=G5P6dInMTFg&list=PLuv3GM6-gsE3-hVNaw-YEb7EeY5XVPZdz
3. https://archive.nptel.ac.in/courses/108/106/108106073/

NARAYANA ENGINEERING COLLEGE:GUDUR								
II-B.Tech	Electrical Circuit Analysis – II							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite: Nil

Course Objectives:

1. To know the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
2. Knowing how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.
3. To introduce the various two-port networks parameters for a given circuit.
4. To evaluation of poles and zeros of a given transfer function.
5. To study the different types of filters

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

CO 1	Analyze balanced and unbalanced three-phase circuits and determine line and phase quantities, active power, and reactive power using suitable analytical methods. (BL-4)
CO 2	Apply Laplace transform techniques and differential equations to analyze the transient response of RL, RC, and RLC circuits under DC and sinusoidal excitations. (BL-3)
CO 3	Determine and convert different two-port network parameters and analyze their interconnections based on reciprocity and symmetry conditions. (BL-3)
CO 4	Apply Fourier series techniques to analyze periodic electrical waveforms and determine their effective value, average value, power factor, and harmonic effects. (BL-3)
CO 5	Analyze and design constant-k low-pass and high-pass filters and explain the characteristics and applications of different types of electrical filters. (BL-4)

CO-PO Mapping

CO	PO												PSO	
	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
CO1	3	3	3	2									3	3
CO2	3	3	3	2									3	3
CO3	3	3	3	2									3	2
CO4	3	3	3	2									1	2
CO5	2	2	3	2									2	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Analysis of three phase balanced & unbalanced circuits

Analysis of three phase balanced circuits:

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

Analysis of three phase unbalanced circuits:

Loop method, Star-Delta transformation technique, two-wattmeter method for measurement of

three phase power.

MODULE-2: Laplace Transform and Transient Analysis

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

MODULE-3: Network Parameters

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

MODULE-4: Analysis of Electric Circuits with Periodic Excitation

Fourier series and evaluation of Fourier coefficients, Trigonometric and complex Fourier series for periodic waveforms, Application to Electrical Systems – Effective value and average value of non-sinusoidal periodic waveforms, power factor, effect of harmonics

MODULE-5: Filters

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

Total hours:	**54 hours**

Term work:

Must be submit at least two assignments.

Content beyond syllabus:

1.Locus diagram and Electro magnetism

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Analysis of Three Phase balanced circuits	CO1	https://www.youtube.com/watch?v=xaeob9lTXS0
2	Analysis of Three Phase unbalanced circuits	CO2	https://www.youtube.com/watch?v=xaeob9lTXS0
3	Transient response for RL and RC circuits	CO3	https://www.youtube.com/watch?v=2MaPC8Iw7nc
4	Fourier Theorem	CO4	https://nptel.ac.in/courses/108/104/108104139/
5	RC, RL filters	CO5	https://www.youtube.com/watch?v=AGyjYG88LlE

Text Book(s):

1. William Hayt, Jack E. Kemmerly and Jamie Phillips, "Engineering Circuit Analysis", Mc Graw Hill, 9th Edition, 2019.
2. A. Chakrabarti, "Circuit Theory: Analysis & Synthesis", Dhanpat Rai & Sons, 2008.
3. Fundamentals of Electric Circuits, Charles K. Alexander, Mathew N. O. Sadiku, 3rd Edition, Tata McGraw-Hill, 2019

Reference Book(s):

1. M.E. Van Valkenberg, "Network Analysis", 3rd Edition, Prentice Hall (India), 1980.
2. V. Del Toro, "Electrical Engineering Fundamentals", Prentice Hall International, 2009.
3. Charles K. Alexander and Matthew. N. O. Sadiku, "Fundamentals of Electric Circuits" Mc Graw Hill, 5th Edition, 2013.
4. Mahamood Nahvi and Joseph Edminister, "Electric Circuits" Schaum's Series, 6th Edition, 2013.
5. John Bird, Routledge, "Electrical Circuit Theory and Technology", Taylor & Francis, 5th Edition, 2014.
6. Sudhakar, A., Circuits and Networks, Tata McGraw
7. Suresh Kumar, K.S. Electrical circuits and Networks, Pearson Education.
8. Network Analysis and Synthesis – Umesh Sinha- Satya Prakashan Publications
9. A. Anand Kumar, Network Analysis and Synthesis, PHI publication
10. Network Theory, N. C. Jagan and C. Lakshminarayana, 1st Edition, B. S. Publications, 2012.
11. Circuits and Networks Analysis and Synthesis, A. Sudhakar, Shyam Mohan S. Palli, 5th Edition, Tata McGraw-Hill, 2017.
12. Engineering Network Analysis and Filter Design (Including Synthesis of One Port Networks)- Durgesh C. KulshreshthaGopal G. Bhise, Prem R. Chadha ,Umesh Publications 2012.
13. Circuit Theory: Analysis and Synthesis, A. Chakrabarti, DhanpatRai& Co., 2018, 7th Revised Edition.

Online Resources:

1. http://www.acadmix.com/eBooks_Download
2. http://www.freetechbook.com/software-engineering-f15.html

Web References:

1) http://www.mathtutordvd.com/products/Engineering-Circuit-Analysis-Volume-1.cfm
2) http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-andelectronics-spring-2007/video-lectures/lecture-2/
3) http://www.facstaff.bucknell.edu/mastascu/elessonsHTML/Circuit/Circuit1.html
4) https://archive.nptel.ac.in/courses/117/106/117106108/
5) https://archive.nptel.ac.in/courses/108/105/108105159/

NARAYANA ENGINEERING COLLEGE:GUDUR								
II-B.Tech	DC MACHINES AND TRANSFORMERS							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite: Nil

Course Objectives:

1. To understand the constructional features of DC machines.
2. To understand the phenomena of armature reaction and commutation.
3. To understand the characteristics and parallel operation of dc machines.
4. To understand the methods for speed control of DC motors and applications of DC motors.
5. To understand the various types of losses that occurs in DC machines and how to calculate efficiency.
6. To understand the constructional features of a single phase transformer.
7. To understand the efficiency and voltage regulation of a transformer.
8. To understand the Autotransformers Construction & Comparison with two winding transformer.
9. To suggest a suitable three phase transformer connection for a particular operation.
10. To understand the tap changing of transformers.

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

CO 1	Explain the construction, working principles, EMF and torque equations, characteristics, and applications of DC generators and motors. (BL-2)
CO 2	Analyze the characteristics, speed control methods, losses, and efficiency of DC machines and apply suitable testing methods to evaluate their performance. (BL-4)
CO 3	Analyze the performance of single-phase transformers using equivalent circuits and phasor diagrams to determine voltage regulation, losses, and efficiency under different load conditions. (BL-4)
CO 4	Apply different testing methods to determine transformer parameters, losses, efficiency, and analyze the parallel operation of transformers and autotransformers. (BL-3)
CO 5	Explain different three-phase transformer connections, vector groups, parallel operation, tap-changing methods, and Scott connections. (BL-2)

CO-PO Mapping

CO	PO											PSO	
	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	2	2	2	2		2				1	2	2	1
CO2	2	2	2	2		2				1	2	1	2
CO3	2	2	2	2		2				1	2	2	1
CO4	2	3	3	2		2				1	2	2	1
CO5	3	3	3	3		2				1	2	1	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: DC Generators

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

MODULE -2: Starting, Speed Control and Testing of DC Machines
Characteristics of DC motors – losses and efficiency – applications of DC motors. Necessity of a starter – starting by 3-point and 4-point starters – speed control by armature voltage and field current control – testing of DC machines – brake test, Swinburne's test –Hopkinson's test–Field Test.
MODULE-3: Single-phase Transformers
Introduction to single-phase Transformers (Construction and principle of operation)–emf equation – operation on no-load and on load –lagging, leading and unity power factors loads –phasor diagrams– equivalent circuit –regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – all day efficiency, Applications.
MODULE-4: Testing of Transformers
Open Circuit and Short Circuit tests – Sumpner's test – separation of losses— Parallel operation with equal and unequal voltage ratios– auto transformer – equivalent circuit – comparison with two winding transformers.
MODULE-5: Three-Phase Transformers
Polyphase connections- Y/Y, Y/Δ, Δ/Y, Δ/Δ, open Δ and Vector groups – third harmonics in phase voltages– Parallel operation–three winding transformers- transients in switching –off load and on load tap changers– Scott connection.
Total hours: 54 hours

Term work:

DC Machines- Lab & Transformers- Filed Work

Content beyond syllabus:

1. Advanced Speed control techniques for DC Motors.
2. Zigzag/star and V/V connections in a 3-Phase Transformers

Self-Study:

Contents to promote self-Learning:

S. No.	Topic	CO	Reference
1	DC Machines Introduction & Constructional features	CO1	https://nptel.ac.in/courses/108/102/108102146/
2	DC Generator Characteristics	CO2	https://www.youtube.com/watch?v=TaZjv_sy_jo
3	DC Motor	CO3	https://www.youtube.com/watch?v=GQatiB-JHdI
4	Testing of DC Machines	CO4	https://www.youtube.com/watch?v=8WCbTZPjcTE
5	Transformers (Auto)	CO5	https://nptel.ac.in/courses/108/105/108105155/

Text Book(s):

1. Electrical Machinery, Dr. P.S. Bimbhra, Khanna Publishers, 7th Edition, 2011.
2. Electrical Machines, S K Bhattacharya, Mc Graw Hill Education (India) Pvt. Ltd., 4th Edition, 2014, 3rd Reprint 2015.
3. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
4. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

Reference Book(s):

1..Electric Machines 4th edition, D.P.Kothari and I.J. Nagrath, Mc Graw Hill Education (India) Pvt. Ltd., 5th Edition.
2. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
3. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
4. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2011.
5. Generalized Theory of Electrical Machines by Dr. P S Bimbhra, 7th Edition, Khanna Publishers, 2021.
6. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria & Sons, 2007.
7. Electric Machinery by Fitzgerald, A.E.,Kingsley, Jr.,C.,&Umans, S. D, 7th edition, McGraw-Hill Education, 2014.

Online Resources:

1. http://175.101.102.82/moodle/
2. https://www.accessengineeringlibrary.com/
3. https://www.slideshare.net/
4. https://easyengineering.net/electrical-machinery-by-bimbhra/
5.https://books.google.co.in/books?id=dh_gDwAAQBAJ&lpg=PR1&dq=electrical%20machines%20by%20kothari%202020&pg=PR8#v=onepage&q&f=false

Web Resources:

1. https://electrical-engineering-portal.com/
2. https://www.electrical4u.com/
3. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html
4. https://www.engineering.com/
5. nptel.ac.in/courses/108/105/108105112
6. nptel.ac.in/courses/108/105/108105155

NARAYANA ENGINEERING COLLEGE:GUDUR								
II-B.Tech	ELECTRICAL CIRCUIT ANALYSIS - II AND SIMULATION LAB							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	CS	TOTAL
I	0	0	3	54	1.5	30	70	100

Pre-requisite: Basics concepts of Electrical Circuits & Basics of Laplace transform

Course Objectives:

The objectives are to study:

1. To design electrical systems.
2. To analyze a given network by applying various Network Theorems.
3. To measure three phase Active and Reactive power.
4. To understand the locus diagrams

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

CO 1	Understand the power calculations in three phase circuits. (BL2)
CO 2	Analyze the time response of given network. (BL4)
CO 3	Determination of two port network parameters. (BL4)
CO 4	Simulate and analyze electrical circuits using software tools. (BL4)
CO 5	Apply various theorems to solve different electrical networks using simulation tools. (BL3)

CO-PO & PSO Mapping:

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

1 – Low Level; 2 – Moderate Level; 3 – High Level

List of Experiments

Any 10 of the following experiments are to be conducted:

TASK - 1 - Measurement of Active Power and Reactive Power for balanced loads.
TASK - 2 - Measurement of Active Power and Reactive Power for unbalanced loads.
TASK - 3 - Determination of Z and Y parameters.
TASK – 4 - Determination of ABCD and hybrid parameters
TASK - 5 - Verification of Kirchhoff's current law and voltage law using simulation tools.
TASK – 6 - Verification of mesh and nodal analysis using simulation tools.
TASK - 7 - Verification of super position and maximum power transfer theorems using simulation tools.

TASK - 8 - Verification of Reciprocity and Compensation theorems using simulation tools.

TASK - 9 - Verification of Thevenin's and Norton's theorems using simulation tools.

TASK - 10 - Verification of series and parallel resonance using simulation tools.

TASK - 11 - Simulation and analysis of transient response of RL, RC and RLC circuits.

TASK - 12 - Verification of self-inductance and mutual inductance by using simulation tools.

Additional Experiments:

Virtual Lab:

1. Parallel RC Circuits
2. Parallel LC Circuits
3. Series RL Circuits
4. Series LCR Circuit
5. Parallel LCR Circuits

Text Book(s):

1. Simulation of Power Electronics Circuit, M B Patil, V Ramanarayan and V T Ranganat, Alpha Science International Ltd., 2009.

Reference Book(s):

1. A Sudhakar, Shyammohan S Palli, "Circuits & Networks", Tata McGraw- Hill, 4th Edition, 2010.

2. WillamHayt.jr, Jack E.kemmerly,Steven M.Durbin, "Engineering Circuit analysis" Tata McGraw-Hill,8th Edition2012

3 A Chakrabarthy, "Electric Circuits", Dhanpat Rai & Sons, 6th Edition, 2010.

4 Rudrapratap, "Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers",Oxford University Press, 1 st Edition, 1999.

NARAYANA ENGINEERING COLLEGE:GUDUR								
II-B.Tech	DC MACHINES AND TRANSFORMERS LAB							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	CS	TOTAL
I	0	0	3	54	1.5	30	70	100

Pre-requisite: Basics concepts of Electrical Circuits & Basics of Laplace transform

Course Objectives:

1. To familiarize students about OCC and internal, external characteristics of dc shunt generator.
2. To know the performance characteristics and speed control method of dc shunt motor
3. To know how to predetermine the efficiency of dc shunt motor.
4. To find efficiency, losses and regulation of single phase transformer.
5. To know how to find motor and generator efficiency by connecting to dc shunt machines back to back
6. To familiarize students about characteristics of dc series motor

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

CO 1	Demonstrate starting and speed control methods of DC Machines. L2
CO 2	Apply theoretical concepts to determine the performance characteristics of DC Machines. L3
CO 3	Analyze the parallel operation of single phase transformers. L4
CO 4	Determine the performance parameters of single-phase transformer. L3
CO 5	Analyze the performance analysis of transformers using various tests. L4

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

List of Experiments

Any 10 of the following experiments are to be conducted:

TASK - 1 - Speed control of DC shunt motor by Field Current and Armature Voltage Control.
TASK - 2 - Brake test on DC shunt motor- Determination of performance curves.
TASK - 3 - Swinburne's test - Predetermination of efficiencies as DC Generator and Motor.
Task – 4 - Hopkinson's teston DC shunt Machines.
TASK - 5 - Load test on DC compound generator-Determination of characteristics.
TASK – 6 - Load test on DC shunt generator-Determination of characteristics.
TASK - 7 - Fields test on DC series machines-Determination of efficiency.
TASK - 8 - Brake test on DC compound motor-Determination of performance curves.
TASK - 9 - OC & SC tests on single phase transformer.

TASK - 10 - Sumpner's test on single phase transformer.
TASK - 11 - Scott connection of transformers.
TASK - 12 - Parallel operation of Single-phase Transformers.
TASK - 13 - Separation of core losses of a single-phase transformer.
Text Book(s): 1. Simulation of Power Electronics Circuit, M B Patil, V Ramanarayan and V T Ranganat, Alpha Science International Ltd., 2009.
Reference Book(s): 1. A Sudhakar, Shyammohan S Palli, "Circuits & Networks", Tata McGraw- Hill, 4th Edition, 2010. 2. WillamHayt.jr, Jack E.kemmerly,Steven M.Durbin, "Engineering Circuit analysis" Tata McGraw- Hill, 8th Edition2012 3. A Chakrabarthy, "Electric Circuits", Dhanpat Rai & Sons, 6th Edition, 2010. 4. Rudrapratap, "Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers", Oxford University Press, 1 st Edition, 1999. 5. https://ems-iitr.vlabs.ac.in/List%20of%20experiments.html

II Year B.Tech. EEE – I Semester

L	T	P	C
2	0	0	0

ENVIRONMENTAL SCIENCE

Course Objectives:

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

UNIT I

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

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

UNIT II

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

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

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

UNIT III

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

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

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

floods, earthquake, cyclone and landslides.

UNIT IV

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

UNIT V

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

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

Textbooks:

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

References:

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

2nd Year Semester-II

S.No.	Course code	Title	L	T	P	Total	C	Internal Marks	External Marks	Total Marks
1	23ES1010	Managerial Economics and Financial Analysis	2	0	0	2	2	30	70	100
2	23ES1013	Analog Circuits	3	0	0	3	3	30	70	100
3	23EE2005	Power Systems-I	3	0	0	3	3	30	70	100
4	23EE2006	Induction and Synchronous Machines	3	0	0	3	3	30	70	100
5	23EE2007	Control Systems	3	0	0	3	3	30	70	100
6	23EE2505	Induction and Synchronous Machines Lab	0	0	3	3	1.5	30	70	100
7	23EE2506	Control Systems Lab	0	0	3	3	1.5	30	70	100
8	23SC6102	Python Programming	0	1	2	3	2	30	70	100
9	23SC6105	Design Thinking & Innovation	1	0	2	3	2	30	70	100
10	Activity Point Programme		During the semester					20 Points		
Total			15	1	10	26	21	270	630	900
Mandatory Community Service Project of 08 weeks duration during summer vacation										

NARAYANA ENGINEERING COLLEGE:GUDUR

II-B.Tech	ANALOG CIRCUITS							R23
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge on concepts of electronic devices.

Course Objectives:

1. To introduce linear and non-linear wave shaping circuits BJT/s DC biasing.
2. To analyze the small signal model of BJT and feedback amplifiers.
3. To analyze oscillator circuits and operational amplifiers.
4. To explain wave form generators, comparators and OP AMP applications.
5. To discuss Timers and Phase locked loop, ADC and DAC convertors.

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

CO 1	**Demonstrate** the concepts of diode clippers and clampers and biasing circuits of BJTs (BL-2)
CO 2	**Analyze** various configurations of small signal modelling of BJT and concept of different types of feedback amplifiers (BL-4)
CO 3	**Illustrate** the concept of oscillators and operational amplifiers. (BL-2)
CO 4	**Interpret** the applications of operational amplifier and Comparators, Wave form generators (BL-2)
CO 5	**Analyze** various circuit characteristics by using timers, Phase locked loops, ADC and DAC. (BL-4)

CO-PO Mapping

CO	PO											PSO	
	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2
CO1	3	3	3		2							3	1
CO2	3	3	3		2							3	3
CO3	3	3	3		2							3	2
CO4	3	3			2							3	2
CO5	3	3	3		2							3	2

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Diode clipping and clamping circuits & DC biasing of BJTs**	**Hours: 10**
Diode clipping and clamping circuits: Diode clippers, clipping at two independent levels, Transfer characteristics of clippers, clamping circuit operation. **DC biasing of BJTs:** Load lines, Operating Point, Bias Stability, Collector-to-Base Bias, Self-Bias, Stabilization against Variations in VBE and β for the Self-Bias Circuit, Bias Compensation, Thermal Runaway, Thermal Stability.		
At the end of the Module 1, students will be able to: 1. Explain the concept Clippers and Clampers.. (BL-2) 2. Illustrate the biasing techniques of BJT.(BL-2)		
MODULE – 2	**Small Signals Modeling of BJT & Feedback amplifier**	**Hours: 10**
Small Signals Modeling of BJT: Analysis of a Transistor Amplifier Circuit using h parameters, Simplified CE Hybrid Model, Analysis of CE, CC, CB Configuration using Approximate Model, Frequency Response of CE and CC amplifiers. **Feedback amplifiers:** Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output and Input Resistances, Voltage-Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback.		
At the end of the Module 2, students will be able to: 1. Explain the small signal operation of BJT . (BL-2) 2. Illustrate various models of single stage BJT amplifier circuit using h parameters.(BL-2) 3. Explain the effect of negative feedback on amplifier characteristics.(BL-2) 4. Summarize input and output impedance of various feedback amplifiers. (BL-2)		
MODULE – 3	**Oscillator circuits and Operational Amplifiers**	**Hours: 09**
Oscillator circuits: Barkhausen Criterion of oscillation, Oscillator operation, R-C phase shift oscillator, Wien bridge Oscillator, Crystal Oscillator **Operational Amplifiers:** Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Block Diagram Representation of Typical Op-Amp, OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op-amp & its features.		
At the end of the Module 3, students will be able to: 1. Explain the working principle of oscillator. (BL-2) 2. Explain various RC oscillators by calculating frequency of oscillations and condition for oscillations.(BL-2) 3. Analyze Operational amplifier information. (BL-4) 4. Explain characteristics of IC 741 and its features. (BL-2)		
MODULE – 4	**OP –AMP applications and Waveform Generators**	**Hours: 09**
OP –AMP applications: Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator. **Comparators and Waveform Generators** Introduction, Comparator, Square Wave Generator, Mono stable Multi vibrator, Triangular Wave Generator, Sine Wave Generators.		
At the end of the Module 4, students will be able to: 1. Describe the applications of op - amp. (BL-2) 2. Classify V to I and I to V conversion. (BL-2) 3. Explain various wave form generators. (BL-2)		

MODULE – 5	Timers and PLL, DAC and ADC	Hours: 10

Timers and Phase Locked Loop: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger, PLL block schematic, principles and description of individual blocks, 565 PLL, Applications of VCO (566).

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

At the end of the Module 5, students will be able to:

1. Explain the concept of IC 555. (BL-2)
2. Design multi-vibrator circuits using timers(BL-4)
3. Describe functionality of special purpose ICs such as VCO, PLL. (BL-2)
4. List the applications PLL and VCO.(BL-1)
5. Explain operation of different A/D & D/A converters. (BL-2)

Total hours:	48 hours

Content beyond syllabus:

1. Design of two stages RC coupled amplifier using BJT-small signal analysis.
2. Differential amplifier-CMRR, Common mode gain, Differential gain.

Self-Study:

Contents to promote self-Learning:

S. No	Module	Reference
1	**Wave Shaping Circuits**	https://www.tutorialspoint.com/electronic_circuits/electronic_circuits_nonlinear_wave_shapping.htm
2	**Feedback Amplifiers**	https://www.tutorialspoint.com/amplifiers/amplifiers_feedback.htm
3	**Oscillators**	https://www.tutorialspoint.com/sinusoidal_oscillators/sinusoidal_oscillators_introduction.htm
4	**Single Stage &Multistage Amplifiers**	https://www.tutorialspoint.com/amplifiers/multi_stage_transistor_amplifier.htm
5	**Op-Amp Characteristics**	https://www.electronicstutorials.ws/opamp/opamp_8.html

Text Book(s):

1. Millman, Halkias , “Electronic Devices and Circuits”, 4th Edition, Mc Graw Hill Education (India) Private Ltd., 2015.
2. D. Roy Choudhury, ‘Linear Integrated Circuits”, New Age International (p) Ltd, 2nd Edition, 2003.

Reference Book(s):

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

Online Resources/Web references:

1. https://www.academia.edu/28016003/EDC_by_Lal_kishore
2. https://www.academia.edu/9984476/Electronic_devices_and_circuit_theory_robert_boylestad_1_ Donald A. Neaman, “Electronic Circuit Analysis and Design”, McGraw Hill.
3. https://nptel.ac.in/courses/122/106/122106025/
4. https://nptel.ac.in/courses/108102112.
5. https://www.tutorialspoint.com/semiconductor_devices/index.html
6. https://www.allaboutcircuits.com/textbook/semiconductors/
7. https://www.satishkashyap.com/

NARAYANA ENGINEERING COLLEGE::GUDUR								
II-B.Tech	POWER SYSTEM - I							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite: Basic concepts of electrical circuits and theorems

Course Objectives:

1. To understand the structure, essential components and their layout in non renewable generating stations.
2. To understand the electrical power generation from renewable energy sources as sun, wind and ocean.
3. To understand the calculation of different transmission line parameters and their use.
4. To understand the various effects in transmission line.
5. To understand the modeling of transmission line.

Course Outcomes: On successful completion of the course, student will be able to:

CO 1	Explain the site selection, layout, components and working principles of hydroelectric and thermal power stations. (BL-2)
CO 2	Explain the principles of nuclear power generation, types of nuclear reactors, radiation hazards, shielding and nuclear waste disposal. (BL-2)
CO 3	Analyze the layouts, equipment and bus-bar arrangements of air-insulated substations and explain the construction and advantages of gas-insulated substations. (BL-4)
CO 4	Analyze AC distribution systems and underground cable characteristics, including insulation resistance, dielectric stress, capacitance and cable grading methods. (BL-4)
CO 5	Analyze load curves, demand and plant performance factors, generation costs and different electricity tariff methods. (BL-4)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

Course Content

MODULE – 1: Hydroelectric & Thermal Power Stations

Hydroelectric Power Stations:

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

Thermal Power Stations:

Selection of site, general layout of a thermal power plant. Brief description of components: boilers, super heaters, economizers and electrostatic precipitators, steam turbines: impulse and reaction turbines,

condensers, feed water circuit, cooling towers and chimney.

MODULE-2: Nuclear Power Stations

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

MODULE-3: Substations

Air Insulated Substations – indoor & outdoor substations, substations layouts of 33/11 kV showing the location of all the substation equipment.Bus bar arrangements in the substations: simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one and two circuit breakers, main and transfer bus bar system with relevant diagrams.

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

MODULE-4: Distribution Systems & Cables

Distribution Systems:

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

Underground Cables:

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

Grading of cables: capacitance grading and intersheath grading.

MODULE-5: Economic Aspects & Tariff

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

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

	Total hours:	**54 hours**

Text Book(s):

1. Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, Dhanpat Rai &Co. Pvt. Ltd., 1999
2. Non Conventional Energy Sources by G.D. Rai, Khanna Publishers, 2000.
3. S. N. Singh, Electric Power Generation, Transmission and Distribution, PHI Learning Pvt Ltd, New Delhi, 2nd Edition, 2010
4. J. B. Gupta, Transmission and Distribution of Electrical Power, S. K. Kataria and sons,10th Edition, 2012

Reference Book(s):

1. Principles of power systems by V.K.Mehta,Rohith Mehta S.Chand(P), 4th Edition
2. "Generation of Electrical Energy"- by B.R Gupta-S.Chand Publications,6th Edition(Reprint 2014)
3. Electrical Power Systems for Industrial Plants, Kamalesh Das, JAICO Publishing House, 2008.

4. Electrical power systems, C.L.Wadhwa, New Age International (P) Limited, 6th Edition, 2014
5. I.J.Nagarath& D.P. Kothari, Power System Engineering, McGraw-Hill Education, 3rd Edition, 2019.
6. Turan Gonen, Electric Power Distribution System Engineering, McGraw-Hill, 1985.
7. Handbook of switchgear, BHEL, McGraw-Hill Education, 2007.

Content beyond syllabus:

1. Betz criterion, wind energy applications.
2. Underground Cables.

Online Resources:

https://www.ibef.org/industry/power-sector-india

https://www.slideshare.net/sidhu007/non-conventional-sources-of-energy-30135444

https://www.energy.gov/eere/water/types-hydropower-plants

https://www.academia.edu/34930327/Insulators

Web Resources:

https://www.birdvilleschools.net

https://www.learnpick.in/prime/documents/ppts/details/4866/solar-cell-technology

https://courses.engr.illinois.edu

https://vikaspedia.in/energy/energy-production/wind-energy/types-of-wind-energy-conversion-devices

https://www.learnpick.in/prime/documents/ppts/details/3777/biomass-conversion-technologies

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
II-B.Tech	INDUCTION AND SYNCHRONOUS MACHINES							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite: Nil

Course Objectives:

1. To understand the Constructional details, principle of operation and the importance of slip in Induction motor operation
2. To understand the slip-torque characteristics and torque calculations of Induction motor
3. To understand the methods of starting and speed control of Induction motor
4. To understand the construction and principle of working of synchronous machines
5. To understand the different methods of predetermining the regulation of alternators
6. To understand the concepts and computation of load sharing among alternators in parallel.
7. To understand the performance characteristics of synchronous motors and their use as synchronous condensers for power factor improvement.
8. To understand the different types of single phase motors and special motors used in house hold appliances and control systems.

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

CO 1	Explain the construction, working principle, equivalent circuit, phasor diagram and power flow of three-phase induction motors. (BL-2)
CO 2	Analyze the torque-slip characteristics, performance, testing, starting and speed control methods of three-phase induction motors. (BL-4)
CO 3	Explain the operating principles, theories, equivalent circuits, starting methods and applications of single-phase motors. (BL-2)
CO 4	Analyze the EMF generation, armature reaction, voltage regulation, synchronization and parallel operation of synchronous generators. (BL-4)
CO 5	Analyze the operating characteristics, excitation control, power factor improvement, power developed and starting methods of synchronous motors. (BL-4)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: 3-phase induction motors

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

MODULE -2: Performance of 3-Phase induction motors	
Torque equation – expressions for maximum torque and starting torque – torque-slip characteristics – double cage and deep bar rotors –No load, Brake test and Blocked rotor tests – circle diagram for predetermination of performance- methods of starting –starting current and torque calculations -speed control of induction motor with V/f control method, rotor resistance control and rotor emf injection technique –crawling and cogging – induction generator operation.	
MODULE-3: Single Phase Motors	
Single phase induction motors – constructional features – double revolving field theory, Cross field theory – equivalent circuit- starting methods: capacitor start capacitor run, capacitor start induction run, split phase & shaded pole, AC series motor, Applications.	
MODULE-4: Synchronous Generator	
Constructional features of non-salient and salient pole type alternators- armature windings - distributed and concentrated windings – distribution& pitch factors – E.M.F equation – armature reaction – voltage regulation by synchronous impedance method – MMF method and Potier triangle method –two reaction analysis of salient pole machines -methods of synchronization- Slip test – Parallel operation of alternators.	
MODULE-5: Synchronous Motor	
Synchronous motor principle and theory of operation – Effect of excitation on current and power factor– synchronous condenser –expression for power developed –hunting and its suppression – methods of starting, Applications.	
Total hours:	**54 hours**

Term work:

Synchronous machines & Induction machines- Power plants & Industrial visits.

Content beyond syllabus:

1. Advanced Speed Control methods for Poly phase Induction Motors.
2. Two Reaction Theory –Determination of Xd and X_q (Slip Test).
3. Principle of operation and control of Brushless DC motor.

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	3-phase Induction Motors	CO1	https://nptel.ac.in/courses/108/102/108102146/
2	Circle Diagram	CO2	https://nptel.ac.in/courses/108/105/108105131/
3	Synchronous Generator	CO3	https://www.youtube.com/watch?v=b24jORRoxEc
4	Parallel operation of Alternators	CO4	https://www.youtube.com/watch?v=aZR7JsH9QnM
5	Synchronous motor	CO5	https://www.youtube.com/watch?v=fdMIuEqh48M&list=PLPpCFgQP7QKHSJQnSwaigL89gshecycXs

Text Book(s):

1. Electrical Machinery, P.S. Bimbhra, Khanna Publishers, 7th Edition, 2011.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.

Reference Book(s):

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
5. Electrical Machines, S K Bhattacharya, Mc Graw Hill Education (India) Pvt. Ltd., 4th Edition, 2014, 3rd Reprint 2015.
6. Electric Machines 4th edition, D.P.Kothari and I.J. Nagrath, Mc Graw Hill Education (India) Pvt. Ltd., 4th Edition, 2010, 16th Reprint 2015.
7. Electrical machines, D.P. Kothari and I.J. Nagrath, McGraw Hill Education, 2017, Fifth Edition.
8. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria& Sons,2007.

Online Resources:

1. http://175.101.102.82/moodle/
2. https://www.accessengineeringlibrary.com/
3. https://www.slideshare.net/
4. https://easyengineering.net/electrical-machinery-by-bimbhra/
5. https://books.google.co.in/books?id=dh_gDwAAQBAJ&lpg=PR1&dq=electrical%20machines%20by%20kothari%202020&pg=PR8#v=onepage&q&f=false

Web Resources:

1. https://electrical-engineering-portal.com/
2. https://www.electrical4u.com/
3. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html
4. https://www.engineering.com/
5. https://nptel.ac.in/courses/108/105/108105131
6. https://nptel.ac.in/courses/108106072

NARAYANA ENGINEERING COLLEGE:GUDUR								
II-B.Tech	CONTROL SYSTEMS							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	CS	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite: Basics concepts of Electrical Circuits & Basics of Laplace transform

Course Objectives:

1. To understand the merits and demerits of open and closed loop control systems
2. To understand the mathematical modeling of Electrical and mechanical control systems
3. To understand the step response of second order control systems
4. To plot Root locus for the given system transfer function
5. To understand the stability analysis from Bode plot, polar plots
6. To understand the state space analysis

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

CO 1	Explain the fundamentals, mathematical modelling, block diagram reduction, signal flow graphs and working principles of servo motors and synchros. (BL-2)
CO 2	Analyze the time response, transient and steady-state performance, error constants and controller characteristics of control systems. (BL-4)
CO 3	Apply Routh's stability criterion and root locus techniques to analyze the stability and dynamic behaviour of control systems. (BL-3)
CO 4	Analyze the frequency response and stability of control systems using Bode, Polar and Nyquist plots, and design suitable compensation networks. (BL-4)
CO 5	Develop and analyze state-space models of continuous systems using state transition matrices, controllability and observability concepts. (BL-4)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: CONTROL SYSTEMS CONCEPTS

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

Synchros.
MODULE-2: TIME RESPONSE ANALYSIS
Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems – Time domain specifications – Steady state response - Steady state errors and error constants, P, PI, PID Controllers.
MODULE-3: STABILITY ANALYSIS IN TIME DOMAIN
The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.
MODULE-4: FREQUENCY RESPONSE ANALYSIS
Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin-Stability Analysis. Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.
MODULE-5: STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS
Concepts of state, state variables and state model, state models - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and it's Properties. System response through State Space models. The concepts of controllability and observability, Duality between controllability and observability.
Total hours: 54 hours

Term work: Problem solving with any software

Content beyond syllabus:

1. Introduction to P,PI,PID controllers.
2. State space representation of Armature and Field controlled DC motor.

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Open Loop and closed loop control systems	CO1	https://www.tutorialspoint.com/control_systems/control_systems_introduction.htm
2	Block diagram rules	CO2	https://www.tutorialspoint.com/control_systems/control_systems_block_diagram_algebra.htm
3	Time response of second order system	CO3	https://www.tutorialspoint.com/control_systems/control_systems_time_response_analysis.htm
4	Routh's stability criteria	CO4	https://www.tutorialspoint.com/control_systems/control_systems_stability_analysis.htm

	5	Frequency domain specifications	CO5	https://www.tutorialspoint.com/control_systems/control_systems_frequency_response_analysis.htm

Text Book(s):

1. " Control Systems Engineering, I. J. Nagrath and M. Gopal, New Age International Publishers, 5th edition, 2007, Reprint 2012.
2. Control Systems by A. Anand Kumar, PHI Learning pvt. Ltd., second edition
3. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th edition, 2010.

Reference Book(s):

1. Norman S. Nise, "Control Systems Engineering", John Wiley & Sons PTE Ltd, 2013
2. Modern Control Engineering, Katsuhiko Ogata, PEARSON, 1st Impression 2015.
3. Control Systems Principles & Design by M.Gopal, 4th Edition, Mc Graw Hill Education, 2012.
4. Automatic Control Systems by B. C. Kuo and Farid Golnaraghi, John wiley and sons, 8th edition, 2003.
5. Feedback and Control Systems, Joseph J Distefano III, Allen R Stubberud & Ivan J Williams, 2nd Edition, Schaum's outlines, Mc Graw Hill Education, 2013.
6. Control System Design by Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.
7. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell and Abbas Emami-Naeini, 6th Edition, Pearson, 2010.

Online Resources:

1. http://www.aoengr.com/SampleBook.pdf
2. http://www.ent.mrt.ac.lk/~rohan/teaching/EN5001/Reading/DORFCH1.pdf

Web Resources:

1. https://nptel.ac.in/courses/107/106/107106081/
2. https://www.tutorialspoint.com/control_systems/index.htm
3. https://www.youtube.com/watch?v=XYbrgwKP_6k
4. https://nptel.ac.in/courses/108102043
5. https://nptel.ac.in/courses/108106098

NARAYANA ENGINEERING COLLEGE:GUDUR								
II-B.Tech	INDUCTION AND SYNCHRONOUS MACHINES LAB							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	0	0	3	54	1.5	30	70	100

Pre-requisite: Nil

Course Objectives:

1. To find the performance of induction motor by calculating the efficiency.
2. To find direct and quadrature axis reactances of synchronous motor.
3. To find voltage regulation by using various methods on synchronous machine4.To determine 'v' and 'inverted v' curves of synchronous motor.
5. To find the efficiency and power factor from circle diagram byconducting no load andblocked rotor test on 3-phase induction motor.

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

CO 1	Analyze various performance characteristics of 3-phase and 1-phase induction Motors (BL-4)
CO 2	Evaluate the performance of 3-phase Induction Motor by obtaining the circle diagram and equivalent circuit of 3-phase Induction Motor and single phase induction motor (BL-4)
CO 3	Adapt the power factor improvement methods for single phase Induction Motor (BL-3)
CO 4	Pre-determine the regulation of 3-phase alternator (BL-3)
CO 5	Determine the synchronous machine reactance of 3-phase alternator (BL-3)

CO-PO Mapping

CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2
CO1	3	2	1									2	2
CO2	3	2	2									2	2
CO3	3	2	2									2	2
CO4	3	2	1									2	2
CO5	3	2	1									2	2
1: Low, 2-Medium, 3- High													

List of Experiments:

Any 10 experiments of the following are required to be conducted

TASK-1: Brake test on three phase Induction Motor.
TASK-2. Circle diagram of three phase induction motor.
TASK-3. Speed control of three phase induction motor by V/f method.
TASK-4. Equivalent circuit of single-phase induction motor.
TASK-5. Power factor improvement of single-phase induction motor by using capacitors.
TASK-6. Load test on single phase induction motor.
TASK-7. Regulation of a three -phase alternator by synchronous impedance &MMF methods.
TASK-8. Regulation of three-phase alternator by Potier triangle method.
TASK-9. V and Inverted V curves of a three-phase synchronous motor.

TASK-10. Determination of Xd, Xq& Regulation of a salient pole synchronous generator.
TASK-11. Determination of efficiency of three phase alternator by loading with three phase induction motor.
TASK-12. Parallel operation of three-phase alternator under no-load and load conditions.
TASK-13. Determination of efficiency of a single-phase AC series Motor by conducting Brake test.

Text Book(s):

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

2. Electrical Machines, S K Bhattacharya, Mc Graw Hill Education (India) Pvt. Ltd., 4th Edition, 2014, 3rd Reprint 2015.

Reference Book(s):

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

2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
II-B.Tech	CONTROL SYSTEMS LAB							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	CS	TOTAL
II	0	0	3	54	1.5	30	70	100

Pre-requisite: Basics concepts of Electrical Circuits & Basics of Laplace transform

Course Objectives:

The objectives are to study:

1.To provide practical knowledge for Time response of second order system

2. Determine of transfer functions of various systems and control of it by different Methodologies

3. The characteristics of Magnetic Amplifier, servo mechanisms which are helpful in automatic control systems

4. Determine the stability analysis of different system by using PSPICE and MATLAB

5. To study the closed loop performance for the given plant using P, PD, PI, PID Controllers.

6. The design of controllers/compensators to achieve desired specifications.

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

CO 1	Understand how to use feedback control system to determine transfer function of DC servo motor and any other given circuit with R, L and C components (BL-2)
CO 2	Model the systems and able to design the controllers and compensators. (BL-3)
CO 3	Get the knowledge about the effect of poles and zeros location on transient and steady state behavior of second order systems and implement through software tools (BL-4)
CO 4	Determine the performance and time domain specifications of first and second order systems. (BL-4)
CO 5	Understand the stability analysis (BL-2)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

List of Experiments:

Any 10 of the Following Experiments are to be conducted.

TASK-1. Time response of Second order system

TASK-2. Characteristics of Synchros

TASK-3. Programmable logic controller – Study and verification of truth tables of logic gates,

simple Boolean expressions and application of speed control of motor.

TASK-4. Effect of feedback on DC servo motor

TASK-5. Transfer function of DC Machine

TASK-6. Effect of P, PD, PI, PID Controller on a second order system

TASK-7. Lag and lead compensation – Magnitude and phase plot

TASK-8. Temperature controller using PID

TASK-9. Characteristics of magnetic amplifiers

TASK-10. Characteristics of AC servo motor

TASK-11. Linear system analysis (Time domain analysis, Error analysis) using MATLAB.

TASK-12. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB

TASK-13. State space model for classical transfer function using MATLAB – Verification.

Text Book(s):

1. Simulation of Electrical and electronics Circuits using PSPICE - by M.H Rashid, M/S PHI Publications.
2. MATLAB and its Tool Books yser's manual and - Mathworks, USA
3. I. J. Nagrath and M. Gopal, “Control Systems Engineering”5th edition, New AgeInternational (P) Limited Publishers, 2007.

II Year B.Tech. EEE – II Semester

L	T	P	C
1	0	2	2

DESIGN THINKING & INNOVATION

Course Objectives:

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

Course Outcomes:

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

UNIT I Introduction to Design Thinking

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

UNIT II Design Thinking Process

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

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

UNIT III Innovation

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

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

UNIT IV Product Design

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

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

UNIT V Design Thinking in Business Processes

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

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

Textbooks:

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

Reference Books:

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

Online Learning Resources:

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

3rd Year Semester-I

Course Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
23EE2008	PC	Power Electronics	3	0	0	3	3	30	70	100
23EE2009	PC	Digital Circuits	3	0	0	3	3	30	70	100
23EE2010	PC	Power Systems-II	3	0	0	3	3	30	70	100
23ES1014	ES	Introduction to Quantum Technology & Applications	3	0	0	3	3	30	70	100
	PE-I	Professional Elective – I	3	0	0	3	3	30	70	100
	OE-I	Open Elective-I	3	0	0	3	3	30	70	100
23SC6104	SEC	Soft Skills	0	1	2	3	2	30	70	100
23ES1507	ES	Tinkering Lab	0	0	2	2	1	30	70	100
23EE2507	PC	Power Electronics Lab	0	0	3	3	1.5	30	70	100
23EE2508	PC	Analog and Digital Circuits Lab	0	0	3	3	1.5	30	70	100
23PR7501	Internship	Evaluation of Community Service Internship	0	0	0	0	2	--	--	--
		Total	**18**	**1**	**10**	**29**	**24**	**300**	**700**	**1000**

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	POWER ELECTRONICS							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. To understand the various applications of Power electronic devices for conversion, control and conditioning of the electrical power and to get an overview of different types of power semiconductor devices and their dynamic characteristics.
2. To understand the operation, characteristics and performance parameters of controlled rectifiers.
3. To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
4. To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.

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

CO 1	Understand the I-V Characteristics and Gate Drive Requirements of Power Devices Including Diodes, Thyristors, MOSFETs, and IGBTs. -L2
CO 2	Design Single-Phase and Three-Phase Rectifiers with Different Load Conditions and Evaluate Power Factor and Source Inductance Effects. -L5
CO 3	Apply Duty Ratio Control and Analyze Steady-State Waveforms of Buck, Boost, and Buck-Boost Converters. L3
CO 4	Analyze the Operation of Inverters with Various Load Conditions and Commutation Techniques. L4
CO 5	Analyze the Operation of AC Voltage Controllers, and Cyclo Converters with Various Load Conditions and Commutation Techniques. L4

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Power Switching Devices

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

MODULE -2: Rectifiers

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

MODULE-3: DC-DC Converters

Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.
MODULE-4: Inverters
Single phase Voltage Source inverters – operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters – Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode – 120 degree mode of operation - Numerical problems.
MODULE-5: AC Voltage Controllers & Cyclo Converters
AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti-parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – RMS load voltage, current and power factor - wave forms – Numerical problems. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output voltage equation.
Total hours: 54

Term work:

Report submission on Multilevel converters with MATLAB-Simulation.

Content beyond syllabus:

Three phase cycloconverters

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	IGBT	CO1	https://www.youtube.com/watch?v=ekSbhm4l0Go
2	Commutation techniques of SCR	CO2	https://www.youtube.com/watch?v=mf-97ZXrOz0 https://www.youtube.com/watch?v=h7cu27etdmg https://www.youtube.com/watch?v=WX5G0RHozAs https://www.youtube.com/watch?v=d4sbVc-r7I4
3	Three phase converters	CO3	https://www.youtube.com/watch?v=VYmd3KKfCQQ
4	Switching mode regulators	CO4	https://www.youtube.com/watch?v=Q7cTuZIH8IA https://www.youtube.com/watch?v=I0ZbC7uCe9A https://www.youtube.com/watch?v=YiYQjdARZ7I
5	Resonant Pulse inverters	CO5	https://www.youtube.com/watch?v=AISpcLLiOPA

Text Book(s):

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

Reference Book(s):

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

Online Resources:

1. https://books.google.co.in/books?id=0_D6gfUHjcEC&printsec=frontcover#v=onepage&q&f=false
2. https://nptel.ac.in/courses/108/105/108105066/

Web Resources:

1. https://www.youtube.com/watch?v=ZbvWe9xBu3Q&list=PLp6ek2hDcoND7i5- DAD9mPmYF1Wg6ROdO
2. https://www.youtube.com/watch?v=1Auay7ja2oY&list=PLA07ACBDE053A8229

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	POWER SYSTEMS - II							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

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

Course Outcomes:

CO 1	Analyse the transmission lines and obtain the transmission line parameters and constants. L4
CO 2	Analyse transmission line performance.L4
CO 3	Design transmission lines to meet the day to day power requirements.L5
CO 4	Understand and apply Per Unit System for Fault Calculations. L2
CO 5	Apply load compensation techniques to control reactive power. L3

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Transmission Line Parameters

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

MODULE -2: Performance of Transmission Lines

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

MODULE-3: Overhead Line Insulators

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

MODULE-4: Short Circuit Analysis

Per-Unit System, Per-Unit equivalent reactance network of a three phase power system. Short circuit current and MVA calculations, fault levels, application of Series Reactors. Numerical problems
Symmetrical Components and Fault Analysis: Symmetrical component theory, symmetrical component transformation. Positive, negative and zero sequence components of voltages, currents and impedances
Positive, negative and zero sequence networks LG, LL, LLG faults with and without fault impedance and LLL fault. Numerical Problems

MODULE-5: Voltage Control and Power Factor Improvement

Methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase modifiers, power factor improvement methods.
Compensation in Power Systems: Concepts of Load compensation Load ability characteristics of overhead lines – Uncompensated transmission line – Symmetrical line – Radial line with asynchronous load – Compensation of lines.

Total hours:	54

Term work:
Field work to EHV Substation and report submission.

Content beyond syllabus:
Underground Cables.

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Capacitance calculation	CO1	https://www.youtube.com/watch?v=BSvnx3iVd5Y
2	Long transmission line	CO2	https://www.youtube.com/watch?v=mFXtZ_kkQSk
3	Electrical Corona	CO3	https://www.youtube.com/watch?v=m-jeQgXAqJA
4	Types of electrical faults	CO4	https://www.youtube.com/watch?v=UE3OYs5oO74
5	Power factor improvement	CO5	https://www.youtube.com/watch?v=14PLVZKQ19Y

Text Book(s):
1. C.L. Wadhwa, ―Electrical Power Systems‖, New Age International Pub. Co, Third Edition, 2001.
2. D.P. Kothari and I.J. Nagrath, ―Modern Power System Analysis‖, Tata Mc Graw Hill Pub. Co.,New Delhi, Fourth edition, 2011.

3. B.R.Gupta,—Power System Analysis and Design‖, S.ChandPublishing.1998.

Reference Book(s):

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

Online Resources:

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

Web Resources:

1. https://b-ok.asia/book/1117604/f01d10
2. https://b-ok.asia/book/2729267/f90c96
3. https://nptel.ac.in/courses/108/102/108102047/
4. https://nptel.ac.in/courses/108/107/108107112/
5. https://www.youtube.com/watch?v=ptiaNGkuylY

NARAYANA ENGINEERING COLLEGE:GUDUR							
III-B.Tech	INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS						R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

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

Course Outcomes:

CO 1	Explain core quantum principles in a non-mathematical manner. L2
CO 2	Compare classical and quantum information systems. L2
CO 3	Identify theoretical issues in building quantum computers. L2
CO 4	Discuss quantum communication and computing concepts. L2
CO 5	Recognize applications, industry trends, and career paths in quantum technology. L3

CO-PO Mapping

CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2								2	2	2	2
CO2	3	3			2						2	2	2
CO3	2	3	2	2	3						2	2	2
CO4	2	2		2	3					2	2	2	2
CO5	1				2	2			1	3	3	2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction to Quantum Theory and Technologies

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

MODULE -2: Theoretical Structure of Quantum Information Systems

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

MODULE-3: Building a Quantum Computer – Theoretical Challenges and Requirements

What is required to build a quantum computer (conceptual overview)?, Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers: Why maintaining entanglement is difficult,Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison),Superconducting circuits, Trapped ions, Photonics, Visionvs reality: what's working and what remains elusive,The role of quantum software in managing theoretical complexities
MODULE-4: Quantum Communication and Computing – Theoretical Perspective
Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD),Role of Entanglement in Communication,The Idea of the Quantum Internet – Secure Global Networking,Introduction to Quantum Computing,Quantum Parallelism (Many States at Once),Classical vs Quantum Gates, Challenges: Decoherence and Error Correction,Real-World Importance and Future Potential
MODULE-5: Applications, Use Cases, and the Quantum Future
Real-world application domains: Healthcare (drug discovery),Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, PsiQuantum,Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization, Emerging careers in quantum: roles, skillsets, and preparation pathways,Educational and research landscape – India's opportunity in the global quantum race

Total hours:	54

Term work:

Report submission on any one case studies

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Classical vs Quantum mechanics	CO1	https://quantumatlas.umd.edu/entry/quantum-classical/
2	Quantum coherence and decoherence	CO2	https://en.wikipedia.org/wiki/Quantum_decoherence
3	Fragility of quantum systems	CO3	https://link.springer.com/chapter/10.1007/978-3-642-33860-1_5
4	Basics of Quantum Communication	CO4	https://www.sciencedirect.com/topics/earth-and-planetary-sciences/quantum-communication
5	Emerging careers in quantum	CO5	https://mahatmaschools.com/emerging-opportunities-in-quantum-physics/

Text Book(s):

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

Reference Book(s):

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

Online Resources:

- IBM Quantum Experience and Qiskit Tutorials
- Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
- edX – The Quantum Internet and Quantum Computers

Web Resources:

- YouTube – Quantum Computing for the Determined by Michael Nielsen
- Qiskit Textbook – IBM Quantum

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	POWER ELECTRONICS LAB							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	CS	TOTAL
I	0	0	3	54	1.5	30	70	100

Pre-requisite:

Course Objectives:

1. This course is intended to acquire practical knowledge about the operation of various power converters.
2. To understand the basics of triggering circuits required for various power converters.

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

CO 1	Analyze the Characteristics of Power Semiconductor Devices (SCR, MOSFET, IGBT) and their Role in Power Converters. L4
CO 2	Design and Implement Gate Firing Circuits for SCR-based Power Converters. L4
CO 3	Evaluate the Performance of Single-phase and Three-phase Power Converters with R and RL Loads. L5
CO 4	Apply Different Commutation Techniques to Analyze Inverter for Efficient Power Control. L3
CO 5	Apply Different Commutation Techniques to Analyze Chopper Circuits for Efficient Power Control. L3

CO-PO & PSO Mapping:

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

1 – Low Level; 2 – Moderate Level; 3 – High Level

List of Experiments

Any 10 of the following experiments are to be conducted:

TASK - 1 - Study of Characteristics of SCR, MOSFET & IGBT
TASK - 2 - Gate firing circuits for SCR's: (a) R triggering (b) R-C triggering
TASK - 3 - Single Phase AC Voltage Controller with R and RL Loads
TASK – 4 - Single Phase fully controlled bridge converter with R and RL loads
TASK - 5 - Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E).
TASK – 6 - DC Jones chopper with R and RL Loads
TASK - 7 - Single Phase Parallel inverter with R and RL loads
TASK - 8 - Single Phase Cycloconverter with R and RL loads

TASK - 9 - Single Phase Half controlled converter with R and RL load
TASK - 10 - Single Phase Fully controlled converter with R and RL load
TASK - 11 - Three Phase half-controlled bridge converter with R, RL-load
TASK - 12 - Three Phase fully controlled bridge converter with R, RL-load
TASK – 13 - Single Phase series inverter with R and RL loads
TASK – 14 - Single Phase Bridge converter with R and RL loads
TASK – 15 - Single Phase dual converter with RL loads
Additional Experiments:
Online Learning Resources/Virtual Labs:
http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php
Text Book(s):
1. O.P. Arora, ―Power Electronics Laboratory: Theory, Practice and Organization (Narosa series in Power and Energy Systems)‖, Alpha Science International Ltd., 2007.
2. M. H. Rashid, ―Simulation of Electric and Electronic circuits using PSPICE‖, M/s PHI Publications.
Reference Book(s):
1. PSPICE A/D user‘s manual – Microsim, USA.
2. PSPICE reference guide – Microsim, USA. 5. MATLAB and its Tool Books user‘s manual and – Math works, USA.

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	TINKERING LAB							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	CS	TOTAL
I	2	0	0	36	1	30	70	100

Pre-requisite:

Course Objectives:

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

The objectives of the course are to:

1. Encourage Innovation and Creativity
2. Provide Hands-on Learning and Impart Skill Development
3. Foster Collaboration and Teamwork
4. Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship
5. Impart Problem-Solving mind-set

These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

Course Outcomes: The students will be able to experiment, innovate, and solve real-world challenges

CO-PO & PSO Mapping:

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

1 – Low Level; 2 – Moderate Level; 3 – High Level

List of Experiments

Any 10 of the following experiments are to be conducted:

TASK - 1 - Make your own parallel and series circuits using breadboard for any application of your choice.
TASK - 2 - Demonstrate a traffic light circuit using breadboard
TASK - 3 - Build and demonstrate automatic Street Light using LDR
TASK – 4 - Simulate the Arduino LED blinking activity in Tinkercad
TASK - 5 - Build and demonstrate an Arduino LED blinking activity using Arduino IDE
TASK – 6 - Interfacing IR Sensor and Servo Motor with Arduino
TASK - 7 - Blink LED using ESP32
TASK - 8 - LDR Interfacing with ESP32

TASK - 9 - Control an LED using Mobile App
TASK - 10 - Design and 3D print a Walking Robot
TASK - 11 - Design and 3D Print a Rocket
TASK - 12 - Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard
TASK – 13 - Demonstrate all the steps in design thinking to redesign a motor bike

Text Book(s):

1. **"The Art of Tinkering"**
   By: Karen Wilkinson, Mike Petrich
   - Publisher: Weldon Owen
   - A creative guide with inspiring tinkering projects using everyday materials.
2. **"Tinkering: Kids Learn by Making Stuff"**
   By: Curt Gabrielson
   - Publisher: Maker Media
   - Great for building basic to intermediate engineering models and science toys.
3. **"Make: Electronics – Learning by Discovery" (2nd Edition)**
   By: Charles Platt
   - Publisher: Maker Media
   - Practical electronics exploration; ideal for circuits, sensors, and prototypes.
4. **"Practical Electronics for Inventors" (4th Edition)**
   By: Paul Scherz and Simon Monk
   - McGraw-Hill Education
   - Excellent for understanding electronics fundamentals with applications.
5. **"Getting Started with Arduino" (3rd Edition)**
   By: Massimo Banzi, Michael Shiloh
   - Maker Media
   - Entry-level guide to Arduino for prototyping real-time systems.
6. **"Creative Confidence: Unleashing the Creative Potential Within Us All"**
   By: Tom Kelley and David Kelley
   - Publisher: Crown Business
   - Focuses on innovation mindset, very relevant for Tinkering/Idea Labs.
7. **"Design Thinking for Strategic Innovation"**
   By: Idris Mootee
   - Publisher: Wiley
   - Strategic approach to turning ideas into viable solutions.
8. **"Make: Tools – How They Work and How to Use Them"**
   By: Charles Platt
   - Excellent resource for understanding and using hand/power tools safely.
9. **"Invent to Learn: Making, Tinkering, and Engineering in the Classroom"**
   By: Sylvia Libow Martinez and Gary Stager
   - Covers curriculum design and hands-on learning pedagogy.

Students need to refer to the following links:

1) https://aim.gov.in/pdf/equipment-manual-pdf.pdf
2) https://atl.aim.gov.in/ATL-Equipment-Manual/
3) https://aim.gov.in/pdf/Level-1.pdf
4) https://aim.gov.in/pdf/Level-2.pdf
5) https://aim.gov.in/pdf/Level-3.pdf

3rd Year Semester-II

S. No.	Course code	Title	L	T	P	Credits	Internal Marks	External Marks	Total Marks
1	23EE2011	Electrical Measurements and Instrumentation	3	0	0	3	30	70	100
2	23EE2012	Microprocessors and Microcontrollers	3	0	0	3	30	70	100
3	23EE2013	Power System Analysis	3	0	0	3	30	70	100
4		**Professional Elective-II**	3	0	0	3	30	70	100
5		**Professional Elective-III**	3	0	0	3	30	70	100
6		**Open Elective – II**	3	0	0	3	30	70	100
7	23EE2509	Electrical Measurements and Instrumentation Lab	0	0	3	1.5	30	70	100
8	23EE2510	Microprocessors and Microcontrollers Lab	0	0	3	1.5	30	70	100
9	23SC6112	**Skill Enhancement course:** Applications of Soft Computing Tools in Electrical Engineering	0	1	2	2	30	70	100
10	23MC8104	**Mandatory non-credit course/ Audit Course:** Technical Paper Writing & IPR	2	0	0	0	30	---	30
11	**Activity Point Program**		During the Semester				20 Points		
		Total	20	1	8	23	300	630	930
Mandatory Industry Internship of 08 weeks duration during summer vacation									

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	ELECTRICAL MEASUREMENTS AND INSTRUMENTATION							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. To study about the working principle of electrical measuring instruments
2. To study the performance of instrumental transformers, power factor, frequency and energy meters
3. To study the functioning of DC and AC bridges
4. To study the basics of digital volt meters and transducers
5. To understand the concept of sensors and data acquisition systems

Course Outcomes:

CO 1	Understand principle and working of electrical measuring instruments L2
CO 2	Understand the principle of operation of instrument transformers, energy meters and analog instruments L2
CO 3	Understand the principle and working of various DC and AC bridges for the measurement of Resistance, Inductance and Capacitance L2
CO 4	Understand the principle and working of different digital voltmeters and transducers L2
CO 5	Understand the working of various sensors and data acquisition systems L2

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Measuring instruments & Digital Meters

Fundamentals: True Value, Errors (Gross, Systematic, Random); Static Characteristic of Instruments (Accuracy, Precision, Sensitivity, Resolution & threshold); Error Analysis- Simple problems; Statistical treatment of data-Simple problems.

Indicating Instruments: Three forces in Electromechanical indicating instrument (Deflecting, controlling & damping forces); Moving iron type (attraction and repulsion), PMMC, Electrodynamometer Type instruments: Torque equation (Expression only, no derivation), shape of scale – simple problems on torque equations; Measurement of voltage and current - Extension of Range of ammeter and voltmeter – problems on extension of range of ammeter and voltmeter.

MODULE -2: Measurement Of Power, Power Factor And Energy

Instrument transformers: Types, CT and PT – Ratio and phase angle errors; (Expression only, no derivation)

Measurement of power: Principle and Operation of Single-phase dynamometer wattmeter, expression (Expression only no derivation) for deflecting and control torques, errors and compensations.

Measurement of power factor: Principle and operation of Single-phase Electrodynamometer Power

factor meter.

Measurement of Frequency: Principle and Operation of single phase frequency meter- vibrating reed type, - ferro dynamic type meter.

Measurement of Energy: Principle and Operation of Single phase induction type energy meter, driving and braking torques (expression only no derivation), errors and compensations, testing by phantom loading

MODULE-3: D.C&A.C Bridges

Measurement of Resistance: Methods of measuring low, medium and high resistances –Sensitivity of Whetstone's bridge– Kelvin's double bridge for Measuring low resistance, Megger for measurement of high resistance.

Measurement of Inductance: Maxwell's bridge, Anderson's bridge.

Measurement of Capacitance: De Sauty bridge. Wien's bridge–Scheringbridge–Numerical problems.

MODULE-4: Digital Volt Meters And Transducers

Digital Voltmeters: Ramp type, Dual Slope integrating type, successive approximation, Potentiometric type DVMs.

Classification of transducers: Active/passive, analog/digital- Strain Gauge-gauge factor (Elementary treatment only)-applications of strain gauge, Q-Meter.

MODULE-5: Transducers, Sensors and Data Acquistion

Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle Operation of Resistor, Inductor and Capacitive Transducers; LVDT and its Applications, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Piezo Electric Transducers, Photo electric Transducers, Hall effect, Photo Diodes. Optocoupler.

Silicon based micro sensors: Pressure sensor, Gyro sensor, Accelerometer, Flow sensor, Proximity sensor, Temperature sensor, Humidity sensor. (Elementary treatment only)

Introduction to PLC and SCADA Systems: Data acquisition systems (DAS) and interfacing techniques.

Total hours:	54

Term work:

Term work shall consist of report on substation where various measuring instruments can be observed.

Content beyond syllabus:

Miscellaneous Measuring Instruments: Maximum demand indicators

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	PMMC INSTRUMENT	CO1	https://www.tutorialspoint.com/electronic_measuring_instruments/electronic_measuring_instruments_dc_voltmeters.htm
2	ENERGY METER	CO2	https://circuitglobe.com/energy-meter.html
3	DC & AC BRIDGES	CO3	https://www.tutorialspoint.com/electronic_measuring_instruments/electronic_measuring_instruments_dc_bridges.htm

	4	POTENTIOMETER	CO4	https://www.youtube.com/watch?v=i05A2sfO7Xc&list=PL227ZNwByTlTGq1atJsFst_qnEptI870O&index=33
	5	TRANSDUCERS	CO5	https://www.tutorialspoint.com/electronic_measuring_instruments/electronic_measuring_instruments_transducers.htm

Text Book(s):

1. Electrical & Electronic Measurement & Instruments by A.K. Sawhney Dhanpat Rai & Co. Publications, 2007.
2. Electrical Measurements and measuring Instruments–by E.W.Golding and F.C. Widdis, 5th Edition, Reem Publications, 2011.
3. Buckingham and Price, ―Electrical Measurements‖, Prentice – Hall

Reference Book(s):

1. Electronic Instrumentation by H.S.Kalsi,Tata Mcgrawhill, 3rd Edition, 2011.
2. Electrical Measurements: Fundamentals, Concepts, Applications–by Reissl and, M.U, New Age International (P) Limited, 2010.
3. Electrical & Electronic Measurement & Instrumentation by R.K.Rajput, 2nd Edition, S. Chand & Co., 2nd Edition, 2013.
4. Sensor Technology: Hand Book by JonS. Wilson, ELSEVIER publications,2005

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee112/preview

Web Resources:

1. https://b-ok.asia/book/2563619/2f98e0
2. https://civildatas.com/download/electronic-and-electrical-measuring-instruments-machines-by-bakshi
3. https://books.google.co.in/books?id=Q6uBCgAAQBAJ&pg=PA9&lpg=PA9&dq=measurements+for+today&source=bl&ots=oXNqMKSLxk&sig=ACfU3U2cEvMiC6pSV205CRFO3WM8vC1HMQ&hl=en&sa=X&ved=2ahUKEwjNq6Lsx4_qAhXlQ3wKHaM4DZ0Q6AEwD3oECAgQAQ#v=onepage&q=measurements%20for%20today&f=false
4. https://nptel.ac.in/courses/108/105/108105153/
5. http://www.instrumentationtoday.com/
6. https://www.youtube.com/watch?v=n1MinLtvnPY&list=PL227ZNwByTlTGq1atJsFst_qnEptI870O&index=2

NARAYANA ENGINEERING COLLEGE:GUDUR							
III-B.Tech	POWER SYSTEM ANALYSIS						R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. The use of per unit values and graph theory concepts, solving a problem using computer.
2. Formation of Ybus and Zbus of a Power System network, power flow studies by various methods.
3. Different types of faults and power system analysis for symmetrical and also unsymmetrical faults.
4. Analysis of power system for steady state and transient stability and also methods to improve stability

Course Outcomes:

CO 1	Remember and understand the concepts of per unit values, Y Bus and Z bus formation, load flow studies, symmetrical and unsymmetrical fault calculations. L1
CO 2	Apply the concepts of good algorithm for the given power system network and obtain the converged load flow solution and experiment some of these methods using modern tools and examine the results. L4
CO 3	Analyse the symmetrical faults and unsymmetrical faults and done the fault calculations, analyse the stability of the system and improve the stability. L3
CO 4	Demonstrate the use of these techniques through good communication skills. L5
CO 5	Develop accurate algorithms for different networks and determine load flow studies and zero, positive and negative sequence impedances to find fault calculations. L5

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: PER-UNIT System and Ybus Formation

Per-Unit representation of Power system elements - Per-Unit equivalent reactance network of a three phase Power System - Graph Theory: Definitions, Bus Incidence Matrix, YBus formation by Direct and Singular Transformation Methods, Numerical Problems.

MODULE -2: Formation of Zbus

Formation of ZBus: Partial network, Algorithm for the Modification of ZBus Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses - Modification of ZBusfor the changes in network
MODULE-3: Power Flow Analysis
Static load flow equations – Load flow solutions using Gauss Seidel Method: Algorithm and Flowchart. Acceleration Factor, Load flow Solution for Simple Power Systems (Max. 3-Buses): Newton Raphson Method in Polar Co-Ordinates Form: Load Flow Solution- Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods
MODULE-4: Short Circuit Studies
Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors. Symmetrical Component Theory: Positive, Negative and Zero sequence components, Positive, Negative and Zero sequence Networks. Symmetrical Fault Analysis: LLLG faults with and without fault impedance, Unsymmetrical Fault Analysis: LG, LL and LLG faults with and without fault impedance, Numerical Problems.
MODULE-5: Stability Analysis
Elementary concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical methods for solution of swing equation - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.
Total hours: 54

Term work:

Field work of load flow in power system

Content beyond syllabus:

knowledge of Multi machine stability in power system.

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Representation of power System Network Matrices	CO1	http://175.101.102.82/moodle/mod/folder/view.php?id=17046
2	Load Flow Studies	CO2	http://175.101.102.82/moodle/mod/folder/view.php?id=17046
3	Newton Raphson Method	CO3	http://175.101.102.82/moodle/mod/folder/view.php?id=17046
4	Short Circuit current and MVA Calculations	CO4	http://175.101.102.82/moodle/mod/folder/view.php?id=17046
5	Power system Stabilities	CO5	http://175.101.102.82/moodle/mod/folder/view.php?id=17046

Text Book(s):

1. Computer Methods in Power System Analysis by G.W.Stagg and A.H.El-Abiad, Mc Graw-Hill, 2006.
2. Modern Power system Analysis by I.J.Nagrath&D.P.Kothari, Tata McGraw-Hill Publishing Company, 4th Edition, 2011.

Reference Book(s):

1. Power System Analysis by Grainger and Stevenson, McGraw Hill, 1994.
2. Power System Analysis by Hadi Saadat, McGraw Hill, 1998.
3. Power System Analysis and Design by B.R.Gupta, S. Chand & Company, 2005.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee120/preview

Web Resources:

1. **http://175.101.102.82/moodle/course/view.php?id=693**
2. **http://www.acadmix.com/eBooks_Download**
3. **https://nptel.ac.in/courses/108105067/**
4. **https://nptel.ac.in/course.html**
5. **http://175.101.102.82/moodle/course/view.php?id=693**
6. **https://lecturenotes.in/subject/482/power-system-analysis-psa/note**
7. **https://www.youtube.com/watch?v=j44kQiphUB4&list=PL1XaeVNXKsvwkfUAGQiUuqWBswJ4VM3Ed**
8. **https://www.youtube.com/watch?v=-bX0k5Dlwek&list=PLgzsL8klq6DJv0G1l7ji4OI8BTXgEADfP**
9. **https://www.youtube.com/watch?v=tb3gCr9m0LU&list=PLtcRcIUOKppXWUMEVXGwwULXgzEBygOK-**
10. **https://www.youtube.com/watch?v=fBm1dr_gRBk&list=PL36A60B630E8C7B56**
11. **https://www.youtube.com/watch?v=NfnrupJ0BwY&list=PLfDaOYdi9aZyO2oYhr7G9DYMhoFmqS4A1**

NARAYANA ENGINEERING COLLEGE:GUDUR							
III-B.Tech	TECHNICAL PAPER WRITING AND INTELLECTUAL PROPER RIGHTS						R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
II	2	0	0	36	0	30	70	100

Pre-requisite:

Course Objectives:

1. To enable the students to practice the basic skills of research paper writing
2. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
3. To practice the basic skills of performing quality literature review
4. To help them in knowing the significance of real life practice and procedure of Patents.
5. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

Course Outcomes:

CO 1	Identify key secondary literature related to their proposed technical paper writing. BL2
CO 2	Explain various principles and styles in technical writing. BL2
CO 3	Use the acquired knowledge in writing a research/technical paper. BL3
CO 4	Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc. BL4
CO 5	Evaluate different forms of IPR available at national & international levels also develop skill of making search of various forms of IPR by using modern tools and techniques. BL3

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Principles of Technical Writing

Styles in technical writing; clarity, precision, coherence and logical sequence in writing-avoiding ambiguity- repetition, and vague language -highlighting your findings-discussing your limitations -hedging and criticizing -plagiarism and paraphrasing.

MODULE -2: Technical Research Paper Writing

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature- Problems and Framing Research Questions- Synopsis.

MODULE-3: Process of research: publication mechanism

Types of journals- indexing-seminars- conferences- proof reading –plagiarism style; seminar & conference paper writing; Methodology-discussion-results- citation rules

MODULE-4: Introduction to Intellectual property

Introduction, types of intellectual property, International organizations, agencies and treaties, importance of intellectual property rights **Trade Marks:** Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.
MODULE-5: Law of copy rights & Patents
Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law **Law of patents:** Foundation of patent law, patent searching process, ownership rights and transfer. Patent law, intellectual property audits.

Total hours:	36

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Logical sequence in writing	CO1	https://www.cuyamaca.edu/student-support/tutoring-center/files/student-resources/logical-flow-in-writing.pdf
2	Review of Literature	CO2	https://www.sjsu.edu/writingcenter/docs/handouts/Literature%20Reviews.pdf
3	Types of journals in Electrical	CO3	https://kcgcollege.ac.in/pdf/eee/List%20of%20E-%20Resources_EEE%20Department%20Library.pdf
4	Types of intellectual property	CO4	https://thelegalschool.in/blog/types-of-intellectual-property
5	Fundamentals of copy right law	CO5	https://www.slideshare.net/slideshow/fundamental-of-copy-right-law/239011198

Text Book(s):

1. Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013
2. Meenakshi Raman, Sangeeta Sharma. Technical Communication:Principles and practices.Oxford.

Reference Book(s):

1. R.Myneni, Law of Intellectual Property, 9th Ed, Asia law House, 2019.
2. Prabuddha Ganguli,Intellectual Property Rights Tata Mcgraw Hill, 2001
3. P.Naryan,Intellectual Property Law, 3rd Ed ,Eastern Law House, 2007.
4. Adrian Wallwork. English for Writing Research Papers Second Edition. Springer Cham Heidelberg New York ,2016
5. Dan Jones, Sam Dragga, Technical Writing Style

Online Resources:

1. https://theconceptwriters.com.pk/principles-of-technical-writing/
2. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html
3. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html
4. https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper-journal/

Web Resources:

1. https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf
2. https://lawbhoomi.com/intellectual-property-rights-notes/
3. https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LAB							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	CS	TOTAL
II	0	0	3	54	1.5	30	70	100

Pre-requisite:

Course Objectives: To make the students learn about
1. Calibration of various electrical measuring instruments
2. Accurate determination of inductance and capacitance using AC Bridges
3. Measurement of resistance for different range of resistors using bridges
4. Performance of transducers and sensors

Course Outcomes:

CO 1	Determine the unknown Resistance, Inductance and Capacitance using AC and DC bridges.-L3
CO 2	Understand the calibration of single phase energy meter.-L2
CO 3	Understand the measurement of power, power factor in a single phase circuit and real, reactive Power in a three phase circuit. -L2
CO 4	Extend the range of Ammeter and Voltmeter. -L5
CO 5	Understand the working of Transducers, Measure distance, temperature, current, voltage and humidity using sensors. -L2

CO-PO & PSO Mapping:

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

1 – Low Level; 2 – Moderate Level; 3 – High Level

List of Experiments

Any 10 of the following experiments are to be conducted:

TASK - 1 - Measurement of resistance using Wheatstone bridge and Kelvin‘s Double Bridge.
TASK - 2 - Measurement of inductance using Maxwell‘s bridge, Anderson bridge.
TASK - 3 - Measurement of capacitance using De-Sauty's bridge, Schering bridge.
TASK – 4 - Calibration of single phase energy meter using direct loading method.
TASK - 5 - Calibration of energy meter using Phantom load kit.
TASK – 6 - Measurement of Power using 3-Voltmeter and 3-Ammeter methods in a single phase Circuit.
TASK - 7 - Measurement to Real and Reactive Power in a three phase circuit.

TASK - 8 - Extension of range of given Ammeter and Voltmeter.
TASK - 9 - Measurement of displacement using LVDT.
TASK - 10 - Study of CRO: Measurement of voltage, current, frequency using lissajous patterns.
TASK - 11 - Measurement of different ranges of temperatures using i)RTD ii)Thermocouple
TASK - 12 - Measurement of strain with the help of strain gauge transducers
Additional Experiments: Measurement of 3-phase power with single wattmeter and 2 No's CT
Text Book(s): **http://www.acadmix.com/eBooks_Download**
Reference Book(s): **1. http://sreevahini.edu.in/pdf/electrical-measurements-lab.pdf** **2. http://www.eee.griet.ac.in/wp-content/uploads/2014/12/EMI-Lab-Manual.pdf**

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	APPLICATIONS OF SOFT COMPUTING TOOLS IN ELECTRICAL ENGINEERING (SEC)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	CS	TOTAL
II	0	1	2	54	2	30	70	100

Pre-requisite:

Course Objectives: The objectives of this course include:

1. Understand the basic concepts of Electrical Engineering.
2. Apply the concepts to design MATLAB models.
3. Analyse various Electrical engineering applications through MATLAB.
4. Develop real time models using MATLAB.

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

CO 1	Understand the basic concepts of Electrical Engineering. -L2
CO 2	Apply the concepts to design MATLAB models. -L4
CO 3	Analyze various Electrical engineering applications through MATLAB. L3
CO 4	Develop real time models using MATLAB. -L5
CO 5	Design virtual PMU -L5

CO-PO & PSO Mapping:

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

1 – Low Level; 2 – Moderate Level; 3 – High Level

Theory: MATLAB-Introduction, different tool boxes, creation of program files, creation of simulink files, GUI, commonly used blocks, Simpower system toolbox, control system toolbox, Sim Drive lines, Creation of functions, Project implementation through MATLAB

Any 10 of the following experiments are to be conducted:

TASK - 1 - Transient analysis of given electrical network
TASK - 2 - Simulation of 1-phase and 3-phase transformers
TASK - 3 - Study of the dynamics of second order system
TASK – 4 - Implementation of buck and boost dc-dc converters
TASK - 5 - Study on the design of PI controllers and stability analysis for a DC-DC buck Converter
TASK – 6 - Sine-PWM techniques for single-phase half-bridge, full-bridge and three-phase inverters
TASK - 7 - Economic Load Dispatch of (i) Thermal Units and (ii) Thermal Plants using Conventional

method
TASK - 8 - Transient Stability Analysis of Power Systems using Equal Area Criterion (EAC)
TASK - 9 - Reactive Power Control in a transmission system (Ferranti effect, Effect of shunt Inductor)
TASK - 10 - Fault studies using Zbus matrix
TASK - 11 - Design of virtual PMU
TASK - 12 - Wide area control of Two area Kundur system

Text Book(s):

1. **"MATLAB for Engineers"**
   By: Holly Moore
   - Pearson Education
   - Covers foundational to advanced MATLAB usage, relevant for electrical applications.
2. **"MATLAB/Simulink for Power System Simulation"**
   By: Bibhu Prasad Ganthia
   - BPB Publications
   - Tailored for electrical machines, power systems, and control applications.
3. **"Simulation of Power Electronics Converters Using MATLAB-Simulink"**
   By: Venkata Dinavahi
   - Springer
   - Real-time modeling and simulation of converters and drives.
4. **"Soft Computing with MATLAB Programming"**
   By: N.P. Padhy, S. Simon
   - Oxford University Press
   - Covers fuzzy logic, neural networks, and evolutionary algorithms with MATLAB.
5. **"Soft Computing and Intelligent Systems Design"**
   By: F. O. Karry and C. de Silva
   - Pearson
   - Excellent resource for AI/ML, fuzzy, ANN, GA with practical applications.
6. **"Artificial Intelligence Techniques in Power Systems"**
   By: Kevin Warwick, Arthur Ekwue, Raj Aggarwal
   - Institution of Engineering and Technology (IET)
   - Discusses AI/soft computing tools specifically applied to power systems.

Reference Book(s):

1. **"Phasor Measurement Units and Wide Area Monitoring Systems"**
   By: Arun Phadke, James Thorp
   a. Springer
   b. Best for understanding PMU design, architecture, and grid integration.
2. **"Power System Analysis with Design Applications"**
   By: J. Duncan Glover, Thomas Overbye, Mulukutla S. Sarma
   a. Cengage Learning
   b. Useful for modeling and system-level analysis with PMU applications.

Online Learning Resources/Virtual Labs:

1. http://vem-iitg.vlabs.ac.in/
2. https://vp-dei.vlabs.ac.in/Dreamweaver/

4th Year Semester-I

S.No.	Course code	Title	L	T	P	Credits	Scheme of Examination Max. Marks		
							Internal Marks	External Marks	Total Marks
1	23EE2014	Power System Operation and Control	3	0	0	3	30	70	100
2	23ES1003 23ES1009 23ES1015	**Management Course-II** 1.Business Ethics and Corporate Governance 2.E-Business **3.Management Science**	2	0	0	2	30	70	100
3		**Professional Elective-IV**	3	0	0	3	30	70	100
4		**Professional Elective-V**	3	0	0	3	30	70	100
5		**Open Elective-III**	3	0	0	3	30	70	100
6		**Open Elective-IV**	3	0	0	3	30	70	100
7	23SC6117	**Skill Enhancement course** Power Systems and Simulation Lab	0	1	2	2	30	70	100
8	23MC8104	**Audit Course** Gender Sensitization	2	0	0	-	30	---	30
9	23PR7502	Evaluation of Industry Internship	-	-	-	2	30	70	100
10		**Activity Point Program**	During the Semester - 20 Points						
Total			**19**	**1**	**2**	**21**	**270**	**560**	**830**

NARAYANA ENGINEERING COLLEGE:GUDUR								
IV-B.Tech	POWER SYSTEM OPERATION AND CONTROL							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

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

1. Optimal Operation of Thermal Power Stations.
2. Hydrothermal Scheduling.
3. Modelling of Turbines and Generators.
4. Load frequency control of Single Area and Two Area Systems.
5. The Shunt and Series Reactive Power Compensations in Power Systems.
6. The Key Aspects of Power System Deregulation.

Course Outcomes:

CO 1	To Understand the Thermal Station Characteristics and Economic Dispatch Problem of Thermal Units and Understand the Optimal Scheduling of Hydro-Thermal Station with minimization of cost of Thermal station– L3.
CO 2	To Develop the First Order Models of Turbine, Governor and Generator Load Model – L4.
CO 3	To Evaluate the Steady State & Dynamic Analysis of Single Area and Two Area Load Frequency Control – L3.
CO 4	To Analyse the Series & Shunt Reactive Power Compensation in Transmission and Load Systems – L3.
CO 5	To Understand the Aspects of Power System Deregulation – L2.

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Optimum Operation of Thermal Power Station

Heat Rate Curve – Cost Curve – Incremental Fuel Rate – Incremental Fuel Cost and Production Cost, Input – Output Characteristics of Thermal Power Stations and Hydro Power Stations. Optimum Generation Allocation of Thermal Units without Transmission Line Losses and Optimum Generation Allocation with effect of Transmission Line Losses. Transmission Line Loss Formula, Loss coefficients, Numerical Problems.

MODULE -2: Economic Operation of Hydro – Thermal Scheduling

Optimum Operation of Hydrothermal Power Stations: Hydrothermal Coordination Methods – Optimal power flow problem formulation for loss and cost minimization, Solution of optimal power flow problem using Newton‘s method and Linear Programming technique – Numerical problems.

MODULE-3: Load Frequency Control
Modeling of Turbine & Governor: The first order Turbine model, Block Diagram representation of Steam Turbines and approximate Linear models, Mathematical Modelling of Speed Governing Systems – Derivation of small Signal Transfer function – Block Diagram. **Single Area Load Frequency Control:** Necessity of Keeping Frequency constant, Definition of Control Area – Single Area Control – Block Diagram representation of an Isolated Power System – Steady State Analysis – Dynamic Response – Controlled & Uncontrolled case. **Two Area Load Frequency Control:** Load Frequency control of Two Area system – Controlled and Uncontrolled case, Tie – Line Bias Control. Proportional Plus Integral Control of Single Area and Its Block Diagram Representation, Steady State Response – Load Frequency Control and Economic Dispatch Control.
MODULE-4: Reactive Power Control
Overview of Reactive Power Control – Reactive Power Compensation in Transmission Systems – Advantages and Disadvantages of Different Types of Compensating Equipment for Transmission Systems; Load Compensation – Specifications of Load Compensator, Uncompensated and Compensated Transmission Lines: Shunt and Series Compensation.
MODULE-5: Power System Deregulation
Principle of economics, utility functions, power exchanges, electricity market models, market power indices, ancillary services, transmission and distribution charges, principles of transmission charges, transmission pricing methods, demand-side management, regulatory framework – Numerical problems.

Total hours:	54

Term work:

Field work of power system operation & Deregulation in Thermal power plant

Content beyond syllabus:

Knowledge of Voltage control in Power systems

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Economic Operationof Thermal power Station	CO1	http://175.101.102.82/moodle/mod/folder/view.php?id=13928
2	Hydro thermal Scheduling	CO2	http://175.101.102.82/moodle/mod/folder/view.php?id=13928
3	Load frequency single area control	CO3	http://175.101.102.82/moodle/mod/folder/view.php?id=13928
4	Load frequency two area control	CO4	http://175.101.102.82/moodle/mod/folder/view.php?id=13928
5	Deregulation of Power System	CO5	http://175.101.102.82/moodle/mod/folder/view.php?id=13928

Text Book(s):

1. Modern Power System Analysis, D.P.Kothari and I.J.Nagrath, Tata McGraw Hill Publishing Company Ltd.,

2. Electric Energy Systems Theory: An Introduction, Olle I. Elgerd, TMH Publishing Company Ltd., New Delhi, 2nd edition, 1983.

Reference Book(s):

1. Power Generation, Operation and Control, Allen J. Wood and Bruce F. Wollenberg, John Wiley & Sons, Inc., New York, 2nd edition, 1996.
2. Reactive Power Control in Electric Systems, T J E Miller, John Wiley & Sons, New York, 1982.
3. Power System Analysis Operation and Control, Abhijit Chakrabarti and Sunita Halder, PHI Learning Pvt. Ltd.,, 3rd Edition, 2010.

Online Resources:

1. https://archive.nptel.ac.in/courses/108/104/108104052/
2. http://kcl.digimat.in/nptel/courses/video/108104191/L01.html
3. https://nptel.ac.in/courses/108101040

Web Resources:

1. http://175.101.102.82/moodle/course/view.php?id=610
2. http://www.acadmix.com/eBooks_Download
3. http://175.101.102.82/moodle/course/view.php?id=610
4. https://lecturenotes.in/notes/14667-note-for-power-system-operation-and-control-psoc-by-jntu-heroes?reading=true&continue=2
5. https://lecturenotes.in/notes/17488-note-for-power-system-operation-and-control-psoc-by-sucharita-das
6. http://www.crectirupati.com/sites/default/files/lecture_notes/PSOC%20-%20%20IV%20-%21EEE_0.pdf
7. http://www.tutorialspoint.com/

NARAYANA ENGINEERING COLLEGE:GUDUR								
IV-B.Tech	POWER SYSTEMS AND SIMULATION LAB							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	CS	TOTAL
I	0	0	4	72	2	30	70	100

Pre-requisite:

Course Objectives: The objectives of this course include

1. To do the experiments (in machines lab) on various power system concepts like determination of sequence impedance, fault analysis, finding of subtransient reactance‘s.
2. To draw the equivalent circuit of three winding transformer by conducting a suitable experiment.
3. To develop the MATLAB program for formation of Y and Z buses. To develop the MATLAB programs for Gauss-Seidel and fast decoupled load flow studies.
4. To develop the SIMULINK model for single area load frequency problem.

Course Outcomes:

CO 1	Analyze and determine the sequence impedances of both cylindrical rotor and salient pole synchronous machines to understand their behavior under various fault conditions. -L3
CO 2	Conduct fault analysis (LG, LL, LLG, and LLLG) on synchronous machines and interpret the impact of these faults on system stability and performance. -L2
CO 3	Develop and simulate load flow analysis using various methods (Gauss-Seidel, Newton-Raphson, Fast Decoupled) and formulate the YBus and ZBus for power system networks. -L5
CO 4	Model load frequency control problems for single and two-area systems, employing both uncontrolled and PI-controlled approaches to evaluate system performance.- L4
CO 5	Simulate load frequency control problems for single and two-area systems, employing both uncontrolled and PI-controlled approaches to evaluate system performance.-L6

CO-PO & PSO Mapping:

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

1 – Low Level; 2 – Moderate Level; 3 – High Level

List of Experiments

Any 10 of the following experiments are to be conducted:

TASK - 1 - Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine
TASK - 2 - Determination of Sequence Impedances of salient pole Synchronous Machine

TASK - 3 - LG Fault Analysis on an un loaded alternator
TASK – 4 - LL Fault Analysis on conventional phases
TASK - 5 - L L G F a u l t A n a l y s i s
TASK – 6 - LLLG Fault Analysis
TASK - 7 - Determination of Sub transient reactance of salient pole synchronous machine
TASK - 8 - Equivalent circuit of three winding transformer.
TASK - 9 - YBus formation using Soft Tools
TASK - 10 - ZBus formation using Soft Tools
TASK - 11 - Gauss-Seidel load flow analysis using Soft Tools
TASK - 12 - Newton-Raphson load flow analysis using Soft Tools
TASK – 13 - Fast decoupled load flow analysis using Soft Tools
TASK – 14 - Solve the Swing equation and Plot the swing curve
TASK – 15 - Develop a model for a uncontrolled single area load frequency control problem and simulate the same using Soft Tools.
TASK – 16 - Develop a model for PI controlled single area load frequency control problem and simulate the same using Soft Tools.
TASK – 17 - Develop a model for a uncontrolled two area load frequency control problem and simulate the same using Soft Tools.
TASK – 18 - Develop a model for PI controlled two area load frequency control problem and simulate the same using Soft Tools.
Additional Experiments: 1. Design of kalman filter **2.** MATLAB program to find optimum loading ofgenerators neglecting transmission losses
Text Book(s): 1. POWER SYSTEM ANALYSIS – by – HADI SAADAT - Tata McGraw-Hill Education, 01-Aug-2002. 2. MATLAB for Electrical Engineers and Technologists: MATLAB Tutorial with PracticalElectrical Examples- Stephen P. Tubbs, 2010
Reference Book(s): 1. Power Systems Analysis, Grainger and Stevenson, Tata Mc Graw-hill, 2005. 2. Modern Power system Analysis 2nd edition, I.J.Nagrath & D.P.Kothari: Tata McGraw- Hill Publishing Company, 2003. 3. Kundur, P., “Power System Stability and Control”, Mc. Graw Hill inc. 1994. 4. Jim Arlow, Ila Neustadt, “UML 2 and the Unified Process: Practical Object-Oriented 5. Analysis and Design”, 2nd Edition, Pearson, (2005).

Online Learning Resource:

1. https://www.ee.iitb.ac.in/~vlabsync/template/vlab/index.html#
2. http://www.academia.edu/Documents/in/Power-System-Analysis-by-Hadi-Saadat-Electrical-Engineering
3. https://nptel.ac.in/courses/108/101/108101040/
4. https://nptel.ac.in/courses/108/104/108104052/
5. https://nptel.ac.in/courses/108/105/108105067/

4th Year Semester-II

Course Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
23PR7503	PR	Internship	--	--	12	12	4	40	60	100
23PR7504	PR	Project	--	--	12	12	8	60	140	200

PROFESSIONAL ELECTIVES

Elective Track / Group	Professional Elective-1	Professional Elective-2	Professional Elective-3	Professional Elective-4	Professional Elective-5
Modern Power Systems	Electrical Safety and Risk Management	Switchgear and Protection	Renewable and Distributed Energy Technologies	HVDC and FACTS	Electrical Distribution System
Industrial Automation	Signals and Systems	Programmable Logic Controllers	Communication Systems	Digital Signal Processing	Modern Control Theory
Green Technology	Utilization of Electrical Energy	AI & ML for Electrical Engineering	Electrical Drives	Electric Vehicle Technology	Switched Mode Power Conversion
Modern Electrical Engineering	Machine Modeling and Analysis	Electrical Machine Design	Programmable Control Devices and Applications	Hybrid Electrical Vehicles	Automotive Electrical Engineering
Sustainable Energy Systems	Advanced Power Semiconductor Devices and Protection	Solar and Fuel Cell Energy Systems	Wind andBiomass Energy Systems	Renewable Energy Conversion Systems	Energy Audit and Demand Side Management

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	SIGNALS AND SYSTEMS (PE-I)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

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

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

CO 1	Explain the basic properties of signal & systems and LTI systems. BL2
CO 2	Apply Fourier series to represent periodic signals. BL3
CO 3	Represent signals in continuous and discrete time Fourier transform. BL2
CO 4	Analyze the sampling theorem and characterize signals & systems in time & frequency domain. BL3
CO 5	Analyse the stability of systems by applying Laplace transform and Z transform. BL3

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Signals and Systems

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

MODULE -2: Fourier series representation of periodic signals

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

MODULE-3: The Continuous-Time Fourier Transform

Representation of aperiodic Signals, Continuous Time Fourier Transform, Fourier Transform for Periodic Signals, Properties of the Continuous Time Fourier Transform, Systems characterized by Linear constant coefficient differential equations, Discrete Time Fourier Transform - Representation of Aperiodic Signals, Discrete Time Fourier Transform, Frequency Response, Systems Characterized by Linear Constant-Coefficient Difference Equations.
MODULE-4: Time & Frequency Characterization of Signals and Systems
The Magnitude Phase Representation of the Fourier Transform, Magnitude Phase Representation of the Frequency Response of LTI Systems, Time-Domain Properties of Ideal Frequency Selective Filters, Time Domain and Frequency Domain Aspects of Non-ideal Filters, Examples of Continuous time filters and Discrete time filters described by differential equations, First-Order and Second-Order Continuous and Discrete-Time Systems, Examples of Time and Frequency Domain Analysis of Systems, **Sampling:** Representation of a Continuous Time Signal by Its Samples, Sampling Theorem, Reconstruction of a Signal from Its Samples Using Interpolation, Effect of under sampling: Aliasing, Discrete Time Processing of Continuous-Time Signals.
MODULE-5: Laplace and z-Transforms
The Laplace Transform, Region of Convergence for Laplace Transforms, Inverse Laplace Transform, Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot, Properties of the Laplace Transform, Some Laplace Transform Pairs, Analysis and Characterization of LTI Systems Using the Laplace Transform, System Function Algebra and Block Diagram Representations, Unilateral Laplace Transform, Z-Transform - Region of Convergence for the z-Transform, Inverse z-Transform, Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot, Properties of the z-Transform, Some Common z-Transform Pairs, Analysis and Characterization of LTI Systems Using z-Transforms, System Function Algebra and Block Diagram Representations, Unilateral z-Transforms.

Total hours:	54

Term work:
Mathematical analysis of any signal with any method

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Classification of Signals & Systems	CO1	https://www.stannescet.ac.in/cms/staff/qbank/ECE/Notes/EC8352-SIGNALS%20AND%20SYSTEMS-1296919945-EC8352.pdf
2	Exponential fourier Series	CO2	https://cpjobling.github.io/EG-247-Resources/week5/exp_fs1.pdf
3	Properties of the Continuous Time Fourier Transform	CO3	https://www.tutorialspoint.com/properties-of-continuous-time-fourier-transform-ctft
4	Frequency Domain Aspects of Non-ideal Filters	CO4	https://www.geeksforgeeks.org/computer-vision/frequency-domain-filters-and-its-types/
5	System Function Algebra and Block Diagram Representations	CO5	https://www.geeksforgeeks.org/electronics-engineering/block-diagram-algebra/

Text Book(s): 1. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky, & S. Hamid, 2nd Edition, Pearson Higher Education, 1997. 2. Principles of Linear Systems and Signals, B.P. Lathi, 2nd Edition, Oxford University Press, 2011.
Reference Book(s): 1. Signals & Systems, Simon Haykin and B. Van Veen, 2nd Edition, John Wiley, 2003. 2. Signals and systems, Narayana Iyer and K Satya Prasad, 1st Edition, CENGAGE Learning, 2011. 3. Signals, Systems and Transforms, C. L. Philips, J. M. Parr and Eve A. Riskin, 4th Edition, Pearson education, 2008.
Online Resources: https://www.tutorialspoint.com/dip/signals_and_system_introduction.htm
Web Resources: https://vemu.org/uploads/lecture_notes/04_03_2021_1450719340.pdf

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	ELECTRICAL SAFTEY and RISK MANAGEMENT (PE-I)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. **To introduce the fundamental principles of electrical safety** and create awareness about hazards, electric shock effects, and protection strategies in electrical systems.
2. **To familiarize students with the safety requirements** during the installation, operation, and maintenance of electrical equipment and plants.
3. **To provide comprehensive knowledge of safety practices** in residential, commercial, and agricultural electrical installations.
4. **To educate learners about electrical safety in hazardous environments**, including classifications of hazardous areas and appropriate safety equipment and earthing techniques.
5. **To impart understanding of electrical safety regulations**, risk management strategies, safety audits, and compliance with Indian Electricity (IE) rules and standards.

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

CO 1	Explain the objectives and precautions of Electrical Safety, effects of Shocks and their Prevention. BL2
CO 2	Summarize the Safety aspects during Installation of Plant and Equipment. BL3
CO 3	Describe the electrical safety in residential, commercial and agricultural installations. BL3
CO 4	Describe the various Electrical Safety in Hazardous Areas, Equipment Earthing and System Neutral Earthing. BL3
CO 5	State the electrical systems safety management and IE rules. BL2

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction to Electrical Safety, Shocks and Their Prevention

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

MODULE -2: Safety During Installation of Plant and Equipment

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

MODULE-3: Electrical Safety In Residential, Commercial and Agricultural Installations

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

MODULE-4: Electrical Safety in Hazardous Areas

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

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

MODULE-5: Safety Management of Electrical Systems

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

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

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

Total hours: 54

Content beyond syllabus:

1. Arc Flash Analysis and Mitigation Techniques
2. Electrical Safety Audits and Risk Assessment Frameworks

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Possibilities of getting electrical shock	CO1	https://www.youtube.com/watch?v=jYrOxOW71Xc
2	Field quality and safety during erection	CO2	https://www.youtube.com/watch?v=TMT6f3tZQSk
3	Agricultural pump installation	CO3	https://www.youtube.com/watch?v=kNRTEKzaxrs
4	Distinction between system grounding and Equipment Grounding, Equipment Earthing	CO4	https://www.youtube.com/watch?v=PMneZbpdqng
5	Ground clearances and section clearances	CO5	https://www.youtube.com/watch?v=wUnoTjJDHJY

Text Book(s): 1. S. Rao, Prof. H.L. Saluja, ―Electrical safety, fire safety Engineering and safety management‖, Khanna Publishers. New Delhi, 1988.(units-I to V) 2. www.apeasternpower.com/downloads/elecact2003.pdf (Part of unit-V)
Reference Book(s): 1. Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.
Online Resources: 1. https://study.com/learn/lesson/electrocution-concept-causes.html 2. https://safetytoolbox.in/electrical-safety/
Web Resources: 1. slideshare.net/slideshow/electrical-safety-and-risk-assessments/45837604

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	UTILIZATION OF ELECTRICAL ENERGY (PE-I)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. To impart knowledge on the selection and application of electric drives for various mechanical and industrial processes, emphasizing efficiency and control.

2. To provide a comprehensive understanding of electrical heating and welding methods, their operating principles, and industrial applications.

3. To enable students to analyze and design effective illumination systems, considering factors like luminous efficiency, lighting schemes, and economic operation.

4. To develop an understanding of electric traction systems, including braking methods, traction motors, and traction mechanics relevant to transportation.

5. **To explain the principles and industrial uses of electrolytic processes**, including electroplating, electrorefining, and electrolysis.

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

CO 1	Apply the appropriate electric drives for various industrial applications. -BL4
CO 2	Understand the different types of heating and welding techniques. -BL2
CO 3	Design an illumination system for the proper lighting system. -BL5
CO 4	Understand the basic principle and different braking techniques of electric traction. -BL2
CO 5	Understand the basic principle and applications of the electrolytic process.-BL2

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Electric Drives

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

MODULE -2: Electric Heating & Welding

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

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

MODULE-3: Illumination

Introduction - terms used in illumination - laws of illumination - sources of light. Discharge lamps – mercury vapor and sodium vapor lamps–comparison between tungsten filament lamps and fluorescent tubes–compact fluorescent lamp–LED-Basic principles of light control-Types and design of good lighting system and practice - flood lighting.
MODULE-4: Electric Traction
Traction systems: System of electric traction and track electrification - Review of existing electric traction systems in India - Special features of traction motor - Speed-time curves for different services - methods of electric braking - plugging - rheostatic braking - regenerative braking. Introduction to Magnetic Levitation vehicles.
MODULE-5: Electrolytic Process
Introduction - Basic principles - Faradays laws of electrolysis - Energy efficiency – Electrodeposition - Factors governing deposition Processes - Deposition of Alloys – Extraction and refining of metals. Fuel Cells.

Total hours:	54

Term work:
Field trip to electric locomotive limited ,Tirupati and submit report on energy consumption for different electric locomotives

Content beyond syllabus:
Energy Efficient Technologies in Electrical Systems

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Electric Drives And Traction	CO1	https://www.electronicshub.org/electric-traction-system/
2	Mechanics Of Electric Traction	CO2	https://www.engineeringenotes.com/electrical- engineering/electric-traction-electrical-engineering/train-movement-and-energy-consumption-electrical-engineering/37136
3	Illumination	CO3	https://nptel.ac.in/courses/108/105/108105060/
4	Heating And Welding	CO4	https://www.electrical4u.com/electric-heating/ **twi-global.com/technical-knowledge/faqs/what-is-arc- welding**
5	Solar & Wind Energy Conversion System	CO5	https://www.sciencedirect.com/topics/engineering/solar-collector https://www.awea.org/wind-101/basics-of-wind-energy https://www.slideshare.net/BansiKansagara/et-wind

Text Book(s):
1. C.L Wadhwa, Generation Distribution and Utilization of Electrical Energy, New age International Publishers,

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

Reference Book(s):

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

Online Resources:

1. https://nptel.ac.in/courses/108105060
2. https://nptel.ac.in/courses/112105221

Web Resources:

1. https://vssut.ac.in/lecture_notes/lecture1426861925.pdf
2. https://vpmpee.wordpress.com/uee-3340903/

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	MACHINE MODELING AND ANALYSIS (PE-1)							R2023
Semester	Hours / Week			Total	Credit	Max Marks		
	L	T	P	**hrs**	C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite: Fundamental concepts of Electrical Machines and Electro Magnetic Fields.

Course Objectives:

Able to understand the

1. Able to analyze the Basic Concepts of Modeling Electrical machines.
2. To understand Mathematical model of the DC Motor.
3. Able to analyze the dynamic modeling and phase transformation.
4. To understand the Modeling of Induction Machine.
5. To understand the Dynamic Analysis of Synchronous Machine.

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

CO 1	Understand the basic concepts of AC/ DC machine modeling. (BL-2)
CO 2	Understand the Mathematical model of the DC Machine. (BL-2)
CO 3	Analyze the Reference frame theory model of Electrical machine.(BL-3)
CO 4	Analyze the steady state and dynamic state operation of three-phase induction machine.(BL-3)
CO 5	Analyze the modeling and simulation of three phase synchronous machine .(BL-3)

CO-PO Mapping

CO	PO											PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	2	2		2						1	3
CO2	2	2	2									2	3
CO3	2	2	2			2						2	3
CO4	3	2										2	3
CO5	2	3				2						1	3

1: Low, 2-Medium, 3- High

COURSE CONTENT	
MODULE – 1	**BASIC CONCEPTS OF MODELING**
Basic Two - pole Machine representation of Commutator machines, 3-phase synchronous machine with and without damper bars and 3-phase induction machine, Kron's primitive Machine - voltage, current and Torque equations.	
MODULE -2	**MODELING OF DC MACHINES**
Mathematical model of separately excited D.C motor –Steady State analysis - Transient State analysis - Sudden application of Inertia Load - Transfer function of Separately excited D.C Motor - Mathematical model of D.C Series motor, Shunt motor - Linearization Techniques for small perturbations.	
MODULE-3	**REFERENCE FRAME THEORY**

Reference frame theory Real time model of a two phase induction machine - three phase to two phase transformation - Dynamic modeling of three phase Induction Machine - Stator reference frame model - Rotor reference frame model Synchronously rotating reference frame model.	
MODULE-4	**MODELING OF INDUCTIONMACHINES**
Three phase induction machine, equivalent circuit and analysis of steady state operation – free acceleration characteristics – voltage and torque equations in machine variables and arbitrary Reference frame variables – analysis of dynamic performance for load torque variations.	
MODULE-5	**MODELING AND ANALYSIS OFSYNCHRONOUS MACHINES**
Synchronous machine inductances – voltage equations in the rotor's dq0 reference frame - electromagnetic torque - current in terms of flux linkages - simulation of three phase synchronous machine. Dynamic performance of synchronous machine, three -phase fault, comparison of actual and approximate transient torque characteristics, Equal area criteria.	
Total hours:	**54**

Term work:

1. Compare and Contrast the Mathematical model of different types of DC Motors submit the report.
2. Compare and Contrast the 3 phase synchronous machine with and without damper bars and submit the report.
3. Analyze the two phase induction machine and three phase induction machine and submit the report.
4. Analyze the Synchronous motor and PM Synchronous motor and submit the report.

Content beyond syllabus:

1. Symmetrical Two phase Induction Machine.
2. Unsymmetrical Two phase Induction Machine.
3. Modeling of PM Synchronous motor.

Self-Study:

Contents to promote self-Learning:

SNO	Module	Reference
1	BASIC CONCEPTS OF MODELING	https://nptel.ac.in/courses/112/107/112107220/
2	MODELING OF DC MACHINES	https://nptel.ac.in/courses/108/106/108106023/
3	REFERENCE FRAME THEORY	http://nptel.vtu.ac.in/econtent/courses/EEE/06EE63/index.php
4	MODELING OF INDUCTION MACHINES	https://nptel.ac.in/courses/108/106/108106023/

5	MODELING AND ANALYSIS OF SYNCHRONOUS MACHINES	https://nptel.ac.in/courses/108/101/108101004/
6	DYNAMIC ANALYSIS OF SYNCHRONOUS MACHINES	https://nptel.ac.in/courses/108/106/108106023/

Text Book(s):

1. R. Krishnan, "Electric Motor Drives - Modeling, Analysis & Control", PHI Learning Private Ltd, 2009.
2. Paul C.Krause, Oleg Wasyzczuk, Scott S, Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley, Second Edition, 2010.
2. Sawhney, A.K., "A Course in Electrical Machine Design", Dhanpat Rai & Sons, New Delhi, 2013.

Reference Book(s):

1. P S Bimbhra, "Generalized Theory of Electrical Machines", Khanna Publishers, 5th Edition, 2014.
2. A.E, Fitzgerald, Charles Kingsley, Jr, and Stephan D, Umanx, "Electric Machinery", Tata McGraw Hill, 5th Edition, 1992.
3. Chee Mun Ong –"Dynamic simulation of Electric machinery using MATLAB / Simulink", Prentice Hall of India Publications.
4. Ramamoorthy M, "Computer Aided Design of Electrical Equipment", East-West Press.

Online Resources/ Web References:

1. https://books.google.co.in/books?id=0_D6gfUHjcEC&printsec=frontcover#v=onepage&q&f=false
2. http://nptel.ac.in/courses/108106023/
3. https://easyengineering.net/electrical-machinery-by-bimbhra/
4. https://www.hindawi.com/journals/mpe/2017/7348263/
5. https://nptel.ac.in/courses/108/106/108106023/
6. https://nptel.ac.in/courses/108/102/108102146/
7. http://www.ijrimsec.com/assoc_art/volume7_1/Ch_10.pdf
8. https://nptel.ac.in/courses/108/106/108106023/#

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	ADVANCED POWER SEMICONDUCTOR DEVICES AND PROTECTION (PE-I)							R2023
Semester	Hours / Week			Total	Credit	Max Marks		
	L	T	P	hrs	C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite: Review of introductory concepts of power semiconductor devices

Course Objectives:

OBJECTIVES:

1. To improve power semiconductor device structures for adjustable speed motor control applications.
2. To understand the static and dynamic characteristics of current controlled power semiconductordevices
3. To understand the static and dynamic characteristics of voltage controlled power semiconductordevices
4. To enable the students for the selection of devices for different power electronics Applications
5. To understand the control and firing circuit for different devices.

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

CO 1	Analyze power switching devices **(BL-4)**
CO 2	Design of current controlled devices and their parameters**(BL-3)**
CO 3	Analyze the voltage controlled devices and their parameters **(BL-2)**
CO 4	Understand new power semiconductor devices**(BL-2)**
CO 5	Design of protecting circuit**(BL-3)**

CO-PO Mapping

CO	PO											PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	3	2										2	2
CO2	3	2	2									2	2
CO3	3	2										2	2
CO4	3	2										2	2
CO5	3	2	2									2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	POWER SWITCHING DEVICES

Power switching devices overview – Attributes of an ideal switch, application requirements,circuit symbols; Power handling capability – (SOA); Device selection strategy – On-state andswitching losses – EMI due to switching - Power diodes - Types, forward and reverse characteristics, switching characteristics – rating.

MODULE -2	CURRENT CONTROLLED DEVICES
BJT's – Construction, static characteristics, switching characteristics; Negative temperaturecoefficient and second breakdown; - Thyristors – Physical and electrical principle underlyingoperating mode, Two transistor analogy – concept of latching; Gate and switchingcharacteristics; converter grade and inverter grade and other types; series and paralleloperation; comparison of BJT and Thyristor – steady state and dynamic models of BJT Thyristors- Basics of GTO, MCT, FCT, RCT	
MODULE-3	**VOLTAGE CONTROLLED DEVICES**
Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types,static and switching characteristics, steady state and dynamic models of MOSFET and IGBTs -and IGCT	
MODULE-4	**NEW SEMICONDUCTOR MATERIALS FOR DEVICES**
New semiconductor materials for devices – Intelligent power modules- Integratedgate commutated thyristor (IGCT) - Comparison of all power devices.	
MODULE-5	**FIRING AND PROTECTING CIRCUITS**
Necessity of isolation, pulse transformer, optocoupler – Gate drives circuit: SCR, MOSFET,IGBTs and base driving for power BJT. - Over voltage, over current and gate protections;Design of snubbers.Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour – phase cooling	
Total hours:	**54**

Term work:

1. Study of design of SiC MOSFETs
2. Tabulate the details of SCRs of different ratings
3. Derivation and explanation of transient thermal impedance of SCR
4. Study of thermal design of SCR with derivations
5. Study and explain paper on the state of the art and future trends of power semiconductors

Content beyond syllabus:

Protection against external & internal over voltages.

Self-Study:

Contents to promote self-Learning:

S.NO	Module	Reference
1	Power Switching Devices	https://www.youtube.com/watch?v=7XsuRUXF4wE
2	Current Controlled Devices	https://www.youtube.com/watch?v=5Jf_WWt-5vg
3	Voltage Controlled Devices	https://www.youtube.com/watch?v=lzwqcMvuYxU
4	New Semiconductor Materials For Devices	https://www.youtube.com/watch?v=88lo7MgCpNo
5	Firing And Protecting Circuits	https://www.youtube.com/watch?v=XyuY8OgMQL4

Text Book(s):

1. B.W Williams 'Power Electronics Circuit Devices and Applications'..
2. Rashid M.H., " Power Electronics Circuits, Devices and Applications ", Prentice Hall India, Third Edition, New Delhi, 2004
3. MD Singh and K.B Khanchandani, "Power Electronics", Tata McGraw Hill, 2001.
4. Mohan, Undeland and Robins, "Power Electronics – Concepts, applications and Design, John Wiley and Sons, Singapore, 2000.
5. Joseph Vithayathil, Power Electronics: Principles and Applications, Delhi, Tata McGraw-Hill, 2010.

Reference Book(s):

1. Advanced power electronics converters by Euzeli dos santos, Edison R. da silva.
2. Fundamentals of Power Semiconductor Devices by B. JayanthBaliga, Springer Press, 2008.
3. Power Semiconductor Devices and Circuits, Jaecklin, **A.A.**
4. Fundamentals of Power Semiconductor Devices, **Baliga**, B. Jayant

Online Resources/ Web References:

1. https://www.amazon.in/Power-Electronics-Drives-Advanced-Applications-ebook/dp/B086H4Z9WY
2. https://www.pdfdrive.com/25-advanced-power-semiconductor-devices-apsd-e456994.html
3. https://www.ttiinc.com/content/ttiinc/en/resources/product-types/discretes.html?utm=1267&channel=ppc&gclid=CjwKCAjw1K75BRAEEiwAd41h1AEeMfdQ65z0DUsEWQSBV_cFEI5VwuQnFLxopFizjnXDYRY4iPtUoRoCkAEQAvD_BwE
4. http://site.iugaza.edu.ps/malramlawi/files/RASHID_Power_Electronics_Handbook.pdf
5. https://www.youtube.com/watch?v=h0Y9jDKqScQ&list=PLgMDNELGJ1CaNcuuQv9xN07ZWkXE-wCGP
6. https://www.youtube.com/watch?v=m-uY4fja_Jw&list=PLOzRYVm0a65dVYOA7_3-N67Xu1NIrLnR0
7. https://www.youtube.com/watch?v=-YgHdIqkbs0
8. https://www.youtube.com/watch?v=5-uQ4rLlWPE

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	AI & ML for ELECTRICAL ENGINEERING (PE-II)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. **To introduce the fundamental concepts and architecture of Artificial Intelligence (AI)** relevant to electrical engineering applications.
2. **To impart knowledge on Artificial Neural Networks (ANN)** including their structure, learning mechanisms, and algorithmic implementation.
3. **To enable students to apply ANN techniques to solve real-world problems** in electrical engineering, such as fault detection, load forecasting, and control systems.
4. **To familiarize students with the principles of Fuzzy Logic**, fuzzy sets, membership functions, and inference systems.
5. **To equip students with the ability to design and implement Fuzzy Logic-based systems** in electrical engineering contexts such as motor control, power quality analysis, and energy management.

Course Outcomes:

CO 1	Understanding the Basics and Architecture of Artificial Intelligence -L1
CO 2	Analyzing and Applying Artificial Neural Networks (ANN) Concepts -L3
CO 3	Implementing ANN Applications in Real-World Problems -L5
CO 4	Understanding and Applying Fuzzy Logic Concepts -L2
CO 5	Designing and Implementing Fuzzy Logic Applications -L5

CO-PO Mapping

CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2			2					1	2	2	3
CO2	3	3	2	2	3				1	1	2	2	3
CO3	3	3	3	3	3		1		2	2	3	2	3
CO4	3	2	2	2	3		2		1	1	2	2	3
CO5	3	3	3	3	3	1	2		2	2	3	2	3
1: Low, 2-Medium, 3- High													

COURSE CONTENT

MODULE – 1: Introduction to Artificial Intelligence

Introduction and motivation - Approaches to AI - Architectures of AI - Symbolic Reasoning System - Rule based Systems - Knowledge Representation - Expert Systems.

MODULE -2: Overview of Machine Learning

The Motivation & Applications of Machine Learning: Learning Associations, Classification, Regression; Supervised Learning; Unsupervised Learning; Reinforcement Learning; Gradient Descent: Batch Gradient Descent, Stochastic Gradient Descent; Data pre processing; Under fitting and Over fitting issues.

MODULE-3: Artificial Neural Networks

Basics of ANN - Comparison between Artificial and Biological Neural Networks - Basic Building Blocks of ANN - Artificial Neural Network Terminologies - McCulloch Pitts Neuron Model - Learning Rules - ADALINE and MADALINE Models - Perceptron Networks (Continuous and Discrete) – Perceptron Convergence Theorem - Back Propagation Neural Networks - Associative Memories – BAM and Hopfield networks.
MODULE-4: Fuzzy Logic
Classical Sets - Fuzzy Sets - Fuzzy Properties, Operations and relations - Fuzzy Logic System - Fuzzification - Defuzzification - Membership Functions - Fuzzy Rule base - Fuzzy Logic Controller Design.
MODULE-5: Applications of AI Techniques
Load forecasting, Load flow studies, Economic load dispatch, Speed control of DC Motor, Speed Control of Induction Motors.

Total hours:	54

Term work:
MATLAB simulation with any example

Content beyond syllabus:
MATLAB tool box for projects

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	AI Rule based Systems	CO1	https://www.geeksforgeeks.org/artificial-intelligence/rule-based-system-in-ai/
2	Reinforcement Learning	CO2	https://www.geeksforgeeks.org/machine-learning/what-is-reinforcement-learning/
3	ADALINE and MADALINE Models	CO3	geeksforgeeks.org/machine-learning/adaline-and-madaline-network/
4	Fuzzy Logic System	CO4	https://www.geeksforgeeks.org/artificial-intelligence/fuzzy-logic-introduction/
5	AI based Economic load dispatch	CO5	https://www.ijareeie.com/upload/2013/july/58_%20Economic.pdf

Text Book(s):
1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Neural Networks using MATLAB", McGraw Hill Edition, 2006.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, WILEY India Edition, 2012.
3. Ethem Alpaydin, ―Introduction to Machine Learning‖, MIT Press, 3rd edition, 2014
4. Russell. S and Norvig. P, ―Artificial Intelligence - A Modern Approach‖, 4 th edition, Pearson, 2022

Reference Book(s):
1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer International Edition, 2013.
2. Yung C. Shin and Chengying Xu, "Intelligent System - Modeling, Optimization & Control, CRC Press, 2009.
3. Kevin P. Murphy, ―Machine Learning: A Probabilistic Perspective‖, MIT Press, 2012

Online Resources:
https://www.youtube.com/watch?v=NCqUYw6oNR4

Web Resources:
https://iimtu.edu.in/blog/the-future-of-electrical-engineering-with-ai-ml/

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	Electrical Machine Design (PE-II)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite: Basic Electrical Engineering, DC Machines, Induction machines, Transformers and Synchronous machines

Course Objectives:

1. To discuss the properties of electrical, magnetic and insulating materials used in the design of electrical machines.
2. To design armature and field systems for D.C. machines.
3. To design core, yoke, windings and cooling systems of transformers.
4. To design stator and rotor of induction machines.
5. To design stator and rotor of synchronous machines and study their thermal behavior.

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

CO 1	Understand the basic principles of machine design. (BL-2)
CO 2	Analyze the performance design DC motor. (BL-4)
CO 3	Analyze the performance design winding and core of transformer. (BL-4)
CO 4	Analyze the performance design winding and core of rotating electrical machine. (BL-4)
CO 5	Analyze the short circuit ratio and its effects on performance of synchronous machines. (BL-4)

CO-PO Mapping

CO	PO											PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	2												
CO2	2	3	3	3	3							3	
CO3	2	3	3	3	3							3	
CO4	2	3	3	3	3							3	
CO5	2	3	3	3	3							3	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	PRINCIPLES OF ELECTRICAL MACHINE DESIGN

Introduction, considerations for the design of electrical machines, limitations. Different types of materials and insulators used in electrical machines.

MODULE -2	DESIGN OF DC MACHINES

Output equation, choice of specific loadings and choice of number of poles, design of Main dimensions of the DC machines, Design of armature slot dimensions, commutator and brushes, magnetic circuit - estimation of ampere turns, design of yoke and poles- main and inter poles, field windings – shunt, series and inter poles.

MODULE-3	DESIGN OF TRANSFORMERS
Output Equations for single phase and three phase transformers, expression for volts/turn, Main Dimensions, Window space factor, Design of core and winding, Overall dimensions , expression for leakage reactance and voltage regulation, No load current , Temperature rise in Transformers ,Design of Tank, Methods of cooling of Transformers.	
MODULE-4	**Design of Induction Motors**
Output Equation, Choice of Specific Loadings, Main Dimensions of Stator. Design of stator slots and Winding, Choice of Length Air Gap, Estimation of Number of Slots for Squirrel Cage Rotor. Design of Rotor Bars and End Ring. Design of Slip Ring rotor. Estimation of No Load Current and Leakage Reactance of single phase and Three Phase Induction motor.	
MODULE-5	**Design of Three Phase Synchronous Machines**
Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator. Design of stator slots and Winding. Design of Salient and non- salient Pole Rotors. Magnetic Circuit and Field Winding.	
Total hours:	**54**

Term work:

1. Field trip visit at Voltactive Power Technologies Pvt Ltd Vijayawada to understand the design of transformer .
2. Develop armature winding diagram for DC and AC machines Develop a layout for substation using the standard symbols for substation equipment through Auto CADD
3. Draw sectional views of core and shell types transformers using the design data through Auto CADD
4. Draw sectional views of assembled DC machine or its parts using the design data or the sketches through Auto CADD.

Content beyond syllabus:

1. Design of small transformer
2. Modelling Of Electro Static and Magnetic Device.
3. Estimation of material and electrical installation of motor in different industry

Self-Study:

Contents to promote self-Learning:

SNO	Topic	Reference
1	Principles Of Electrical Machine Design	http://nptel.vtu.ac.in/econtent/courses/EEE/06EE63/index.php
2	Design of DC Machines	https://nptel.ac.in/courses/108/106/108106023/
3	Design of Transformers	http://nptel.vtu.ac.in/econtent/courses/EEE/06EE63/index.php
4	Design of Induction Motors	https://nptel.ac.in/courses/108/106/108106023/ https://nptel.ac.in/courses/108/106/108106023/
5	Design of Three Phase Synchronous Machines	https://nptel.ac.in/courses/108/106/108106023/

Text Book(s):

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 2011.
2. M.V.Deshpande "Design and Testing of Electrical Machine Design" Wheeler Publications, 2010.
3. V.N. Mittle and A. Mittle, "Design of Electrical Machines", 5th Edition, Standard Publications and Distributors, 2014, New Delhi.

Reference Book(s):

1. A.Shanmuga Sundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint, 2007.
2. R.K.Agarwal " Principles of Electrical Machine Design" Esskay Publications, 5th Edition Delhi, 2014.
3. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987
4. Ramamoorthy M, "Computer Aided Design of Electrical Equipment", East-West Press.
5. M. N. O. Sadiku, " Numerical techniques in Electromagnetics", CRC Press Edition-2001.
6. M.V. Deshpande, "Design and Testing of Electrical Machines"PHI learning, New Delhi.

Online Resources:

https://nptel.ac.in/courses/108/106/108106023/

Web Resources:

http://nptel.vtu.ac.in/econtent/courses/EEE/06EE63/index.php

JuhaPyrhonen, TapaniJokinen, Valeria Hrabovcova "Design of Rotating Electrical Machines", ISBN: 978-0-470-69516-6. Willey Publication Hardcover. 538 pages. February 2009. .

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	PROGRAMMABLE LOGIC CONTROLLERS (PE-II)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. The student will be able to:
2. Understand the basic functions and types of PLCs, Easy Veep software, its applications
3. Understand Classification of PLCs and applications
4. Design PLC Programming for various applications
5. Analyze PLC Troubleshooting aspects

Course Outcomes:

CO 1	Understand different types of PLCs, Its classification and the usage of Easy Veep software-L2
CO 2	Analyze the hardware details of Allen Bradley PLC -L3
CO 3	Design PLC Programming for various applications – L5
CO 4	Apply PLC programming concepts in different fields of Science and Technology -L4
CO 5	Develop Instruction using ADD and SUB functions, UP and Down counters – L5

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction to PLCs

Basic functions of PLCs, Mechanical relays versus PLC, Different types of PLC‘s – Allen-Bradley – Micrologix: ML1000, ML1100, SLC500, Compact Logix, Mitsubishi FX series, HMI‘s, Processor and I/O cards

MODULE -2: PLC Computational Tool

Introduction to Easy Veep software, Link between mechanical, electrical and programming documentation, Logic diagrams, Flip-Flop Logic, M8000, M8001 internal bits interpretation, Binary code, data table, manipulation and search engine in Mitsubishi environment Communication between PC and PLC, Communication between PC and HMI, PLC and HMI Serial Local network, Introduction to SLC500

MODULE-3: PLC Development

PLC software and applications, Boolean algebra – understanding binary code, ADD and SUB functions, UP and Down Counters, Introduction to k1Y0, MOV function, CPR and ZCP functions, SHWT and SHRD instructions, Introduction to Absolutely Drum Instruction. Allen Bradley PLC: Introduction to Rockwell Software, Hardware focus, Hardware considerations (Field wiring, Master Control Relay, VFD), Basic programming and applications, Cascade control – subroutine, Different programs.

MODULE-4: PLC Programming

Programming instructions: Instructions and binary interpretation, Bit Instruction, Timers and counters, Comparison instructions, Programming Instructions - Math instructions, Move and Logical Instructions, Discussions of programming, communications for PLC-Robotic arm, Exercise of setup and monitoring.
MODULE-5: Applications
Analog and Digital parameters by using SLC5/03-VFD-Panel Mate series 1700, Practical Troubleshooting, troubleshooting technique, Control system stability and tuning basics. Applications: Process to rewind, test, and integrate with extrusion process for wiring and fibre optic industries, Food industry – yeast, flour distribution and control. Process Medical equipment Industry – Gas analyzer, Leak tester (using CO2), plastic wrapping machines etc.

Total hours:	54

Term work:
Industrial field work based report submission

Content beyond syllabus:
Human Machine Interfacing techniques in industry

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Mitsubishi FX series	CO1	https://www.youtube.com/watch?v=a9gioBs3F1I
2	M8000, M8001 internal bits interpretation	CO2	https://plc.home.blog/2018/09/26/how-to-understand-m8000-m8001-m8002-in-mitsubishi-plc/
3	Introduction to Absolutely Drum Instruction	CO3	https://cdn.automationdirect.com/static/manuals/d1user_11_18/ch6.pdf
4	Instructions and binary interpretation	CO4	https://control.com/technical-articles/plc-programming-commands-boolean-functions-and-bit-redistribution/
5	Control system stability and tuning basics	CO5	https://www.geeksforgeeks.org/control-systems-stability/

Text Book(s):
1. Automating manufacturing systems with PLCs by Hugh Jack, 2010.
2. PLC Hand Book (Automationdirect Siemens)

Reference Book(s):
1. Programmable Logic Controllers by R. Bliesener, F Ebel, Festo. Didactic publishers, 2002.
2. Programmable Logic Controllers by W. Bolton, 4th Edition, Newnes, 2006.
3. Introduction to PLCs by Jay F. Hooper, 2nd Edition, Carolina Academic Press, 2006.

Online Resources:
https://nptel.ac.in/courses/108105088

Web Resources:
https://repository.dinus.ac.id/docs/ajar/PLC_Beginner_guide.pdf

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	SWITCHGEAR AND PROTECTION (PE-II)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives: To make the students learn about:

1. The study of different Circuit Breakers and Relays.
2. The protection of Generators and Transformers.
3. To discuss the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
4. The protection of various feeder bus bars from abnormal conditions and over voltages & importance on neutral grounding for overall protection.

Course Outcomes: After completing the course, the student should be able to do the following:

CO 1	Understand the operation of different circuit breakers and their specifications. -L2
CO 2	Analyze the concepts of different relays which are used in real time power system operation. -L3
CO 3	Apply various protective schemes for Transformers, Rotating machines. L4
CO 4	Explain different protective schemes used for Bus bars and Feeders. L3
CO 5	Understand the methods of protection against over voltages and importance of neutral grounding. L2

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Circuit Breakers

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages - Restriking Phenomenon, Average, Max. RRRV, Current Chopping and Resistance Switching - CB ratings and Specifications, Selection of CB: Types and Numerical Problems. – Auto reclosures. Description and Operation of- Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

MODULE -2: Electromagnetic, Static and Numerical Relays

Basic Requirements of Relays – Primary and Backup protection - Construction details of – Attracted armature, balanced beam, inductor type and differential relays – Universal Torque equation – Characteristics of over current, Direction and distance relays. Static Relays – Advantages and Disadvantages – Definite time, Inverse and IDMT static relays – Comparators – Amplitude and Phase comparators. Microprocessor based relays – Advantages and Disadvantages – Block diagram for over current (Definite, Inverse and IDMT), Distance Relays, Impedance Relays and Reactance Relays with their Flow Charts.

MODULE-3: Protection of Generators and Transformers

Protection of generators: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on percentage winding unprotected. Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CTs Ratio, Buchholtz relay Protection.
MODULE-4: Protection of Feeders, Transmission Lines and Busbars
Protection of Feeders (Radial & Ring main) using over current Relays. Protection of Transmission lines – 3 Zone protection using Distance Relays. Carrier current protection. Protection of Bus bars - Differential protection, Differential Pilot wire protection.
MODULE-5: Protection Against Over Voltages
Generation of Over Voltages in Power Systems. -Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL. Neutral Grounding, Grounded and Ungrounded Neutral Systems. - Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance – Arcing Grounds and Grounding Practices.
Total hours: 54

Term work:
Field work to EHV Substation / Tutorials/ Quiz's

Content beyond syllabus:

1. Carrier current protection
2. Insulation Coordination, Basic Impulse Insulation Level

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Circuit Breakers	CO1	https://www.electrical4u.com/electrical-circuit-breaker-operation-and-types-of-circuit-breaker/
2	Protective relays	CO2	https://circuitglobe.com/types-of-circuit-breaker.html
3	Electromagnetic Relays	CO3	https://www.electrical4u.com/electromagnetic-relay- working-types-of-electromagnetic-relays/
4	Generator protection	CO4	https://circuitglobe.com/differential-protection-relay.html https://circuitglobe.com/impedance-type-distance- relay.html https://www.engineeringenotes.com/electrical-engineering/comparators/amplitude-comparators-and-its-types-devices-electrical-engineering/32806
5	Neutral grounding	CO5	https://circuitglobe.com/differential-protection-of-a-generator.html https://circuitglobe.com/differential-protection-of-a-transformer.html https://circuitglobe.com/feeder-protection.html#:~:text=Feeder%20Protection,the%20vari ous%20type%20of%20fault.

Text Book(s):
1. Switchgear and Protection – by Sunil S Rao, Khanna Publishers.

2. Power System Protection and Switchgear by Badari Ram, D.N Viswakarma, TMH Publications.

Reference Book(s):

1. Protective Relaying Principles and Applications – J Lewis Blackburn, CRC Press.
2. Numerical Protective Relays, Final Report 2004 – 1009704 EPRI, USA.
3. Protective Relaying Theory and Applications - Walter A Elmore, Marcel Dekker.
4. Transmission network Protection by Y.G. Paithankar, Taylor and Francis, 2009.
5. Power System Protection- P. M. Anderson, Wiley Publishers.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee101/preview
2. http://175.101.102.82/moodle/course/view.php?id=691
3. https://subjects.ee.unsw.edu.au/elec9712/ELEC9712%20-%20Lec8%20-%20Circuit%20breakers%20Notes.pdf
4. https://b-ok.asia/book/5482781/8e4867
5. https://b-ok.asia/book/5482780/4ec690

Web Resources:

1. https://nptel.ac.in/courses/108/101/108101039/
2. https://www.youtube.com/watch?v=GSh0f94JwaA&t=54s
3. https://www.youtube.com/watch?v=dPInm2zoirA&t=40s
4. https://www.youtube.com/watch?v=OH7-NJRdDyA
5. https://www.youtube.com/watch?v=Kd_73FnTueI
6. https://www.youtube.com/watch?v=OElOqRSN0FE
7. https://www.youtube.com/watch?v=Y5dAaeLPzzk
8. https://www.youtube.com/watch?v=ODj4sWxKm9o

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	SOLAR AND FUEL CELL ENERGY SYSTEMS (PE-II)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite: Nil

Course Objectives:

1. To make students understand the fundamental theory governing the photovoltaic devise and make them carry out preliminary system design.
2. To learn the fundamental knowledge about various fuel cell technologies.

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

CO 1	Understand the need of radiation of sun and discuss the various performance characteristics of solar radiation.(BL-2)
CO 2	Discuss the photovoltaic effect, PV Cell efficiency and its limits along with the concepts of fabrication technology for solar cell (BL-2)
CO 3	Predict the performance of solar photovoltaic device and analyze its performance. (BL-2)
CO 4	Carry out the application of photovoltaic system as power system. (BL-3)
CO 5	Analyze the performance of fuel cells under different operating conditions and also defend appropriate fuel cell technology for a given application. (BL-4)

CO-PO Mapping

CO	PO										PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	3	2	1			2	2					2	1
CO2	3	3	3			2	2				2	3	2
CO3	2	2	1			2	2				2	2	2
CO4	2	2				2	2	2			2	3	3
CO5	2	3	2			2	2				2	2	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1 Solar Radiation

Sun as Energy Source, Solar Radiation at The Earth's Surface, Solar Radiation Geometry, Solar Time and Equation of Time, Sun Earth angles, Sun path diagram, Sunshine hours, Measurement of Solar Diffuse, Global and Direct Solar Radiation, Equipments, Estimation of Solar radiation on horizontal and tilted Surfaces, Global Solar radiation data, Indian Solar Radiation data analysis

MODULE -2 Solar Cells and its Fabrication

Solar Cells

Conversion of Solar energy into Electricity - Photovoltaic Effect, Equivalent Circuit of the Solar Cell, Analysis of PV Cells: Dark and illumination characteristics, Figure of merits of solar cell, Efficiency limits, Variation of efficiency with band-gap and temperature, Efficiency measurements, High efficiency cells, Recent developments in Solar Cells, Role of nano-technology in Solar cells

Fabrication Technology for Solar Cells

High efficiency multi-junction solar cell, Quantum well solar cell, Technology for the fabrication of thin film cells, Optical concentration, Effect of temperature on Cell performance, Thermo photovoltaic effect

MODULE-3 Solar Photovoltaic System

Solar Photovoltaic System Design
Solar cell array system analysis and performance prediction, Shadow analysis: Reliability, Solar cell array design concepts, PV system design, Design process and optimization: Detailed array design, Voltage regulation, Maximum tracking, Quick sizing method, Array protection.
Solar Photo Voltaic System Testing
Sun Simulator, Testing and performance assessment of Solar PV generator, Electronic Control and Regulation, Power Conditioning, Converters and inverter, Concentrating system, System design and configuration

MODULE-4	SPV Power Systems

Centralized and decentralized SPV systems, Stand alone, hybrid and, grid connected system, System installation, Operation and Maintenance, Application of PV for lighting, Water pumping. Refrigeration, Telecommunication, Cathodic Protection, Solar PV Power Plant-Status-Case Studies, Hybridization Engineering, Hybrid systems, Grid integration. Building Integrated PV Systems, PV market analysis and Economics of SPV systems.

MODULE-5	FUEL CELLS

History, Working principle of fuel cells, Fuel cell thermodynamics, fuel cell electrochemistry - Nernst equation, Electrochemical kinetics, Butler-Volmer equation, performance evaluation of fuel cells, Types of Fuel Cells: AFC, PAFC, SOFC, MCFC, DMFC, relative merits and demerits.
Fuel cell characterization In-situ and ex-situ characterization techniques, I-V curve, frequency response analyses; Fuel cell system integration
Application of Fuel Cells Fuel Cell usage for domestic power systems, large scale power generation, Automobile, environmental analysis. Future trends in fuel cells, portable fuel cells, laptops, mobiles, submarines.

Total hours:	54

Term work:
1. Field trip

Content beyond syllabus:
1. Introduction of hydrogen energy systems
2. Hydrogen production processes
3. Hydrogen storage and safety

Self Study:

SNO	MODULE	Reference
1	Indian Solar Radiation data analysis	https://www.nrel.gov/docs/fy21osti/78025.pdf
2	Role of nano-technology in Solar cells	https://www.intechopen.com/chapters/73145
3	Converters and inverter in solar energy	https://www.energy.gov/eere/solar/solar-integration-inverters-and-grid-services-basics
4	Economics of SPV systems	https://extensionpublications.unl.edu/assets/pdf/g2182.pdf
5	Types of Fuel cells with relative merits and demerits	https://www.energy.gov/eere/fuelcells/types-fuel-cells

Text Book(s):

1. Fundamentals of Solar Cells: PV Solar Energy Conversion by AL Fahrenbruch and RH Bube, Academic Press, New York.
2. Solar Photovoltaics. Fundamental Technologies and Application by Chetan Singh Solanki, PHI Publicaton.
3. Principles of Fuel Cells by Xianguo Li, Taylor & Francis.
4. Fuel cell Systems Explained by James Larminie and Andrew Dicks, John Wiley & Sons, Inc.
5. Fuel Cells: From Fundamentals to Applications by S Srinivasan, Springer.

Reference Book(s):

1. Principles of Solar Engineering by F Kreith and JF Kreider, McGraw-Hill.
2. Fuel Cell Fundamentals by O'Hayre, SW Cha, W Colella and FB Prinz, Wiley.
3. Fuel Cell Science and Technology by Basu, S. (Ed) Springer, N.Y.

Online Resources:

1. https://www.nrel.gov/docs/fy21osti/78025.pdf
2. https://www.intechopen.com/chapters/73145
3. https://www.energy.gov/eere/solar/solar-integration-inverters-and-grid-services-basics
4. https://extensionpublications.unl.edu/assets/pdf/g2182.pdf
5. https://www.energy.gov/eere/fuelcells/types-fuel-cells

Web References:

1. https://www.youtube.com/watch?v=--GfdbavEk8
2. https://www.youtube.com/watch?v=qFnAIxyPXuQ
3. https://www.youtube.com/watch?v=px239v5o6xU
4. https://www.youtube.com/watch?v=pH03Y5KwpjU
5. https://www.youtube.com/watch?v=6oeN9VDFLig

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	ELECTRIC DRIVES (PE-III)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. **To provide comprehensive knowledge about the fundamentals and classifications of electric drives**, including their steady-state and dynamic operating characteristics.
2. **To develop analytical skills in evaluating the performance of DC drives** controlled by various types of rectifiers under different modes of operation.
3. **To enable students to analyze chopper-fed DC motor drives** and understand their applications in modern electric drive systems.
4. **To impart knowledge of inverter-fed induction motor drives**, including scalar and vector control strategies under various load and speed conditions.
5. **To familiarize students with the operational principles and control of synchronous motor drives and stepper motor drives**, especially in automation and industrial applications.

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

CO 1	Explain the fundamentals of electric drives, drive dynamics, load characteristics, multi-quadrant operation, electric braking methods, and closed-loop speed control techniques.(BL-2)
CO 2	Analyze the performance and characteristics of single-phase and three-phase converter-fed DC drives under continuous and discontinuous conduction modes and multi-quadrant operations.(BL-4)
CO 3	Analyze the operation, performance, speed-torque characteristics, and braking methods of DC chopper-fed separately excited and series motor drives.(BL-4)
CO 4	Analyze various speed control techniques, inverter-fed induction motor drives, and slip power recovery schemes based on their operating characteristics and performance.(BL-4)
CO 5	Explain the operating principles, control techniques, and performance characteristics of synchronous motor, stepper motor, and BLDC motor drives.(BL-2)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction To Electric Drives

Electrical drives — block diagram, advantages of electric drive, parts of electric drives, choice of electrical drives, the status of DC and AC drives. Dynamics of electrical drives-fundamental torque equations, speed-torque conventions, and multi-quadrant operation; Equivalent values of drive parameters - loads with rotational and translational motion; Load torques — components, nature and classification. Concept of steady-state stability. Electric braking methods — regenerative, dynamic and plugging. Modes of operation of electrical drives — steady state, acceleration including starting and deceleration including stopping. Speed control and drive classifications,

closed-loop control of drives — current limit control, torque control, speed control and position control (Block diagram only).

MODULE -2: Single-Phase and Three Phase Converter Fed DC Drives

Control of DC separately excited motor by single-phase and three-phase half and full bridged converters — voltage and current waveforms for continuous and discontinuous conduction, speed-torque expressions and characteristics. Single phase half-controlled rectifier fed DC series motor — voltage and current waveforms for continuous and discontinuous conduction, speed-torque expressions and characteristics. Multi-quadrant operation of DC separately excited DC motor fed from fully controlled rectifier - mechanical reversible switch in armature, dual converter and field current reversal.

MODULE-3: DC Chopper Fed Drives

Control of DC separately excited motor by one ,two and four quadrant choppers - voltage and current waveforms for continuous conduction (motoring, regenerative and dynamic braking), speed-torque expressions and characteristics. Chopper control of DC series motor—operation, speed-torque expressions and characteristics. Closed loop chopper control of separately excited DC motor (Block diagram only).

MODULE-4: Induction Motor Drives

Three phase induction motors — Introduction, Stator variable voltage control — speed-torque characteristics, AC voltage controllers and efficiency of induction motor under voltage control. Stator variable voltage and variable frequency control — slip speed control, torque-power limitations and modes of operation. Voltage Source Inverters (VSIs) and Current Source Inverters (CSIs) fed induction motor and closed loop operation of induction motor drives (Block diagram only).Comparison of VSI and CSI fed drives. Static rotor resistance control, slip power recovery schemes – static scherbius and kramer drive, speed-torque characteristics.

MODULE-5: Synchronous and Stepper Motor Drives

Synchronous Motor Drives: Separate control and self-control of synchronous motors — operations of self-controlled synchronous motors by VSI and CSI. Load commutated CSI fed Synchronous motor—operation and speed torque characteristics. Closed loop control operation of synchronous motor drives (Block diagram only). Stepper Motor Drives: Variable reluctance and permanent magnet operation — features of stepper motor — torques Vs stepping rate characteristics and drive circuits. BLDC motor operation and control.

Total hours: 54

Term work:
MATLAB Simulation based report submission

Content beyond syllabus:
Cycloconverter fed synchronous motor drives

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Thyristor Controlled Drives	CO1	https://www.youtube.com/watch?v=-EC6q5_grM4
2	Four Quadrant Operation	CO2	https://www.youtube.com/watch?v=Tfrv9DJfVgs
3	Chopper Fed DC Motors	CO3	https://www.youtube.com/watch?v=pdjVSWSQ83w
4	AC Voltage Controller fed AC drives	CO4	https://www.youtube.com/watch?v=Pc7txXwvhBM

	5	Slip Power Recovery scheme	CO5	https://www.youtube.com/watch?v=9Z0Tn5iTYyE

Text Book(s):

1. Gopal K. Dubey, Fundamentals of Electric Drives, Narosa Publications, Alpha Science International Ltd, 2nd Edition, 2002.
2. M. H. Rashid (2003), Power Electronic Circuits, Devices and applications, 3rd edition, Prentice Hall of India, New Delhi, India.
3. Krishnan, Ramu. Electric motor drives: modeling, analysis, and control, 1st Edition, Pearson, 2015.

Reference Book(s):

1. M. D. Singh, K. B. Khanchandani (2008), Power Electronics, 2nd Edition, Tata McGraw Hill Publications, New Delhi.
2. VedamSubramanyam (2008), Thyristor Control of Electric drives, 1st Edition, Tata McGraw Hill Publications, New Delhi, India.
3. S. K. Pillai (2007), A First course on Electrical Drives, 2nd Edition, New Age International (P)
Ltd.,NewDelhi
4. P.C. Sen, Principles of Electrical Machines and Power Electronics, Wiley, 3rdEdition, 2013.

Online Resources:

1. https://web.iitd.ac.in/~amitjain/Drives_VTR.pdf
2. https://sde.uoc.ac.in/sites/default/files/sde_videos/Electrical%20Drives%20and%20Controls_0.pdf
3. https://nptel.ac.in/courses/108/104/108104140/

Web Resources:

1. https://nptel.ac.in/courses/108/102/108102046/
2. https://swayam.gov.in/nd1_noc19_ee65/preview

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	COMMUNICATION SYSTEMS (PE-III)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. To understand the fundamentals of communication systems and amplitude modulation techniques.
2. To learn about the angle modulation techniques and bandwidth considerations in communication systems.
3. To gain knowledge on pulse analog modulation and multiple access techniques used in digital communication systems.
4. To examine pulse modulation and digital modulation techniques used in modern communication systems.
5. To study wireless communication systems, cellular networks, and GSM technology.

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

CO 1	Understand the fundamentals of communication systems and amplitude modulation techniques. L1
CO 2	Learn about the angle modulation techniques and bandwidth considerations in communication systems. L2
CO 3	Gain knowledge on pulse analog modulation and multiple access techniques used in digital communication systems. L3
CO 4	Get familiar with pulse modulation and digital modulation techniques used in modern communication systems.L3
CO 5	Know about wireless communication systems, cellular networks, and GSM technology.L2

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Analog communication-I

Elements of communication systems, need for Modulation, Modulation Methods, Baseband and carrier communication Amplitude Modulation (AM), Generation of AM signals, Rectifier detector, Envelope detector, sideband and carrier power of AM, Double side band suppressed carrier (DSB-SC) modulation & its demodulation, Switching modulators, Ring modulator, Balanced modulator, Single sideband (SSB) transmission, VSB Modulation.

MODULE -2: Analog communication-II

Angle Modulation & Demodulation: Concept of instantaneous frequency Generalized concept of angle modulation, Bandwidth of angle modulated waves- Narrow band frequency modulation (NBFM); and Wide band FM (WBFM), Phase modulation, Pre-emphasis & De-emphasis, Illustrative Problems.

MODULE-3: Digital communications-I (Qualitative Approach only)

Pulse analog modulation techniques, Generation and detection of Pulse amplitude modulation, Pulse width modulation, Pulse position modulation **Multiple Access Techniques:** Introduction to multiple access techniques, FDMA, TDMA, CDMA, SDMA: Advantages and applications
MODULE-4: Digital communications-II (Qualitative Approach only)
Pulse Code Modulation, DPCM, Delta modulation, Adaptive delta modulation, Overview of ASK, PSK, QPSK, BPSK and M-PSK techniques.
MODULE-5: Wireless communications (Qualitative Approach only)
Introduction to wireless communication systems, Examples of wireless communication systems, comparison of 2G and 3G cellular networks, Introduction to wireless networks, Differences between wireless and fixed telephone networks, Introduction to Global system for mobile (GSM), GSM services and features.

Total hours:	54

Term work:
Report submission on FDMA, TDMA, CDMA, SDMA and GSM services

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Double side band suppressed carrier (DSB-SC) modulation	CO1	https://www.tutorialspoint.com/analog_communication/analog_communication_dsbsc_modulation.htm
2	Bandwidth of angle modulated waves	CO2	https://www.tutorialspoint.com/principles_of_communication/principles_of_communication_angle_modulation.htm
3	Generation and detection of Pulse amplitude modulation	CO3	https://www.geeksforgeeks.org/electronics-engineering/pulse-amplitude-modulation/
4	Adaptive delta modulation	CO4	https://www.elprocus.com/adaptive-delta-modulation-block-diagram-and-applications/
5	Wireless communication systems	CO5	https://www.geeksforgeeks.org/computer-networks/wireless-communication-set-1/

Text Book(s):

1. H Taub, D. Schilling and Gautam Sahe, ―Principles of Communication Systems‖, TMH, 2007, 3rd Edition.
2. George Kennedy and Bernard Davis, ―Electronics & Communication System‖, 4th Edition, TMH 2009.
3. Wayne Tomasi, ―Electronic Communication System: Fundamentals Through Advanced‖, 2nd edition, PHI,2001.

Reference Book(s):

1. Simon Haykin, ―Principles of Communication Systems‖, John Wiley, 2nd Edition.
2. Sham Shanmugam, ―Digital and Analog communication Systems‖, Wiley-India edition,2006.
3. Theodore. S.Rapport, ―Wireless Communications‖, Pearson Education, 2nd Edition,2002.

Online Resources:

https://www.sciencedirect.com/topics/engineering/communication-system
https://testbook.com/physics/electronic-communication-systems

Web Resources:
https://en.wikipedia.org/wiki/Communications_system

NARAYANA ENGINEERING COLLEGE:GUDUR							
III-B.Tech	RENEWABLE AND DISTRIBUTED ENERGY TECHNOLOGIES (PE-III)						R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. To This course explores each of the principal renewable energy sources in turn. Each technology is examined in terms of the relevant physical principles; the main technologies involved; environmental impact; the size of the potential renewable resource; and the future prospects of green energy.
2. This Distributed Generation course is intended to provide knowledge of the benefits of renewable energy generation, availability of distributed generation technology, electricity generation technologies, issues related to grid interconnection, and methods of analyzing the technical and economic feasibility.

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

CO 1	Comprehend the renewable energy scenario, anticipate future energy demand and to understand the abstraction concept of electrical energy from Solar Energy. -L3
CO 2	Understand the abstraction concept of electrical energy from wind, bio-mass and Tidal energy sources. -L2
CO 3	Understand electrical energy storage along with working of Green Energy.-L2
CO 4	Exemplify rudimentary idea of Distributed Generation.-L3
CO 5	Comprehend the technical impact, control, and economic aspects of Distributed Generation. -L4

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Energy Scenario and Solar Energy

Introduction: Fundamentals of renewable energy sources, Types of energy, Renewable and Non-renewable energy, SWOT analysis, Global warming and climate change, World energy transformation by 2050, Prospects of renewable energy in the world, Renewable energy availability in India.

Solar Energy Fundamentals: Solar Spectrum, propagation of solar radiation from the sun to earth; solar radiation geometry: sun-earth geometry, extra-terrestrial and terrestrial radiation.

Solar Thermal: Solar Collectors, Solar parabolic trough, Solar tower, Solar cooker, Solar water heater, Solar dryer, Solar Pond.

Solar Electric Power Generation: A Generic PV Cell, PV Materials, Equivalent Circuits for PV Cells, Modules and Arrays; I-V Curve under Standard Testing Conditions; Impact of Temperature and Insolation on I-V curves; Shading Impacts on I-V curves; Maximum Power Point Trackers (MPPT).

MODULE -2: Wind and Other Energy Systems

Wind Energy: Air, Wind, Global and Local Wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Classification of wind energy conversion system (WECS)- Horizontal axis- single, double and multiblade system. Vertical axis- Savonius and darrieus types.

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies-fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft).

Tidal Power: fundamental characteristics of tidal power, harnessing tidal energy, advantages, and limitations.

MODULE-3: Energy Storage and Green Energy

Energy Storage: Stationary Battery Storage – Basics of Lead-Acid batteries, Battery Storage Capacity, Coulomb efficiency instead of energy efficiency, Battery Sizing. Different Battery storage technologies and comparison of their performance. Introduction to Super capacitors.

Green Energy: Historical Development, Basic Operation of a Fuel Cell, Fuel Cell Thermodynamics, Entropy and the theoretical efficiency of Fuel Cells, Gibbs Free Energy and Fuel Cell efficiency, Electrical output of an Ideal Cell, Electrical Characteristics of Real Fuel Cells, Types of Fuel Cells, H2: Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy.

MODULE-4: Introduction to DG and its Grid Integration

Introduction: Need for Distributed generation, renewable sources in distributed generation, current scenario in Distributed Generation, Planning of DGs – Siting and sizing of DGs – optimal placement of DG sources in distribution systems.

Grid integration of DGs: Different types of interfaces - Inverter based DGs and rotating machine-based interfaces - Aggregation of multiple DG units. Energy storage elements: Batteries, ultracapacitors, flywheels.

MODULE-5: Technical Impact, Economic and Control aspects of DG

Technical impacts of DGs: Transmission systems, Distribution systems, De-regulation – Impact of DGs upon protective relaying – Impact of DGs upon transient and dynamic stability of existing distribution systems

Economic and control aspects of DGs: Market facts, issues, and challenges - Limitations of DGs. Voltage control techniques, Reactive power control, Harmonics, Power quality issues. Reliability of DG based systems – Steady-state and Dynamic analysis.

Total hours:	54

Term work:
Individual assignment, followed by Quiz and End semester examinations

Content beyond syllabus:
Advance energy conversion process

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Electric Energy ConversionSystems	CO1	https://www.britannica.com/technology/energy-conversion
2	solar energy conversion systems	CO2	https://www.appropedia.org/Solar_energy_conversion_sy https://www.sciencedirect.com/topics/engineering/thermasolar-energy-system-technology
3	Thermal andBio-	CO3	http://www.fao.org/3/T1804E/t1804e06.html

		energy conversion systems		
	4	Wind Energy Conversion Systems	CO4	https://www.appropedia.org/Wind_energy_conversion_sy
	5	Fuel cell technology	CO5	https://www.hydrogenics.com/technology-resources/hydrogen-technology/fuel-cells/

Text Book(s):

1. Muhammad Kamran, Muhammad Rayyan Fazal, "Renewable Energy Conversion Systems", First Edition, Elsevier Academic Press, 2021.
2. G. D. Rai, Non-Conventional Sources of Energy, Khanna Publisher, 2004

Reference Book(s):

1. G N Tiwari, Solar Energy: Fundamentals, Design, Modeling and Applications, Narosa, 2002.
2. Mukund R Patel, Wind and Solar Power Systems: Design, Analysis, and Operation, 2nd Edition, Taylor & Francis, 2006.
3. H. Lee Willis, Walter G. Scott, ―Distributed Power Generation – Planning and Evaluation‖, Marcel Decker Press, 2000.
4. Gilbert M. Masters, ―Renewable and Efficient Electric Power Systems‖, 2nd Edn., IEEE Press, Wiley, 2013.
5. N. Jenkins, J.B. Ekanayake and G. Strbac, ―Distributed Generation‖, 1st Edn, The Institution of Engineering and Technology, London, 2010.

Online Resources:

1. https://archive.nptel.ac.in/courses/121/106/121106014/#
2. https://onlinecourses.nptel.ac.in/noc22_ch27/preview
3. https://www.nptelvideos.com/lecture.php?id=8517

Web Resources:

1. https://www.youtube.com/watch?v=mpHZWYpKDJg
2. https://www.youtube.com/watch?v=GExTwRNkQBg

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	Programmable Control Devices and Applications (PE-III)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite: To Learn about Power Electronic devices, Semiconductor drives, Energy storage systems(Battery, Fuel Cell, Super Capacitor etc).

Course Objectives:

1. Understand the basic functions and types of PLCs.
2. Get exposure of Easy Veep software, its applications.
3. Classification of PLCs and applications
4. Programming using PLCs .
5. Troubleshooting aspects using PLCs.

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

CO 1	Explain the basic functions, types, architecture, processor, I/O cards, and applications of Programmable Logic Controllers (PLCs) and Human Machine Interfaces (HMIs).(BL-2)
CO 2	Interpret PLC logic diagrams, flip-flop logic, internal bits, binary codes, and data manipulation using PLC programming software.(BL-2)
CO 3	Apply PLC programming instructions, Boolean algebra, arithmetic operations, counters, data transfer, comparison, and drum instructions to develop automation applications.(BL-3)
CO 4	Develop basic PLC programs using Allen-Bradley hardware and Rockwell software by considering field wiring, master control relays, VFDs, and cascade control applications. (BL-3)
CO 5	Implement PLC programming instructions involving bit operations, timers, counters, comparison, mathematical, logical, and communication functions for industrial automation and robotic arm applications. (BL-3)

CO-PO Mapping													
CO	**PO**											**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	2						2					2	3
CO2	2											2	2
CO3	3		1									1	2
CO4	2											1	
CO5	2											2	1
1: Low, 2-Medium, 3- High													

COURSE CONTENT	
MODULE – 1	**INTRODUCTION**
Basic functions of PLCs, Mechanical relays versus PLC, Different types of PLC's – AllenBradley – Micrologix: ML1000, ML1100, SLC500, Compact Logix, Mitsubishi FX series, HMI's, Processor and I/O cards.	
MODULE -2	**Logic diagrams**
Introduction to Easy Veep software, Link between mechanical, electrical and programming documentation, Logic diagrams, Flip-Flop Logic, M8000, M8001 internal bits interpretation, Binary code, data table, manipulation.	
MODULE-3	**PLC software and applications**

PLC software and applications, Boolean algebra – understanding binary code, ADD and SUB functions, UP and Down Counters, Introduction to k1Y0, MOV function, CPR and ZCP functions, SHWT and SHRD instructions, Introduction to Absolutely Drum Instruction.	
MODULE-4	**PLC Hardware**
Allen Bradley PLC: Introduction to Rockwell Software, Hardware focus, Hardware considerations (Field wiring, Master Control Relay, VFD), Basic programming and applications, Cascade control – subroutine, Different programs.	
MODULE-5	**PLC IC applications**
Programming instructions: Instructions and binary interpretation, Bit Instruction, Timers and counters, Comparison instructions, Programming Instructions - Math instructions, Move and Logical Instructions, Discussions of programming, communications for PLC-Robotic arm, Exercise of setup and monitoring.	
Total hours:	**54**

Term work:

Term work contains minimum two group assignments followed by seminars and quiz's

Content beyond syllabus:

1. Hybridization of different energy storage devices
2. Mechanics of Electric Vehicles

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Introduction to PLC	CO1	https://www.youtube.com/watch?v=PbAGl_mv5XI
2	PLC logic circuits	CO2	https://www.youtube.com/watch?v=X3xGqdb0DAA
3	PLC software applications	CO3	https://www.youtube.com/results?search_query=PLC+software+
4	PLC Hardware applications	CO4	https://www.youtube.com/results?search_query=plc+hardware+components
5	PLC IC applications	CO5	https://www.youtube.com/watch?v=JvTCgq5vss0

Text Book(s):

1. C. Mi, M. A. Masrur and D. W. Gao, “Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives”, John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, “Hybrid Electric Vehicles: Energy Management Strategies”, Springer, 2015.
3. Electric Vehicle Technology Explained-James Larminie, John Lowry-John Wiley & Sons Ltd,-2003
4. Electric & Hybrid Vehicles-Design Fundamentals-Iqbal Hussain, Second Edition, CRCPress,2011

Reference Book(s):

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2004.
2. T. Denton, “Electric and Hybrid Vehicles”, Routledge, 2016.
3. Iqbal Husain, "Electric and Hybrid Electric Vehicles", CRC Press, 2011.
4. Wei Liu, "Hybrid Electric Vehicle System Modeling and Control", Second Edition, WILEY, 2017

Online Resources / Web References:

1. https://b-ok.asia/book/1226776/eceb4b
2. https://b-ok.asia/book/3357286/21e776
3. http://ceb.ac.in/knowledge-center/E-BOOKS/Modern%20Electric,%20Hybrid%20Electric%20&%20Fuel%20Cell%20Vehicles%20-%20Mehrdad%20Ehsani.pdf
4. https://b-ok.asia/book/3516646/6fe038
5. https://nptel.ac.in/courses/108/103/108103009/
6. https://www.youtube.com/watch?v=V004WUdpHeA&list=PLlYm0-AHZdZRLYSylFinxkspWmcgNvbtl
7. https://www.youtube.com/watch?v=11e_d3Q9jEc

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	WIND & BIOMASS ENERGY SYSTEM (PE-III)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite: Nil

Course Objectives:

1. To acquire the knowledge on wind power generation
2. To Understand the concept of wind turbine design
3. To Discuss the Current trends in worldwide applications of wind power
4. To Understand the various methods Bio- Chemical Conversion systems
5. To Discuss the various applications of biomass

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

CO 1	Understand the present wind energy scenario (BL-2)
CO 2	Explain the various wind energy technologies. (BL-3)
CO 3	Identify various applications of wind energy .(BL-2)
CO 4	Explain the various biomass conversion technologies and testing of performance of biogas. (BL-2)
CO 5	Understand the Bio-Energy Systems with Efficient Applications. (BL-2)

CO-PO Mapping

CO	PO											PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	2	2								2	1
CO2	3	1	1	2								3	2
CO3	3	3	2	1								2	2
CO4	2	2	3	2								3	3
CO5	1	2	1		2							2	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	Wind Power Generation

Introduction – Basic principles of wind energy conversion power in the wind-Forces on blades and thrust on turbines – Wind energy conversion – site selection Considerations -Basic components of WECS – Classification- Advantages and disadvantages – Power, torque and speed characteristics.

MODULE -2	WECS design

Design of wind turbine :Wind turbine design considerations; Methodology; Theoretical simulation of wind turbine characteristics; Test methods.
Aerodynamic design principles; Aerodynamic theories; Axial momentum, blade element and combine theory; Rotor characteristics; Maximum power coefficient; Prandlt's tip loss Correction.

MODULE-3	Wind Energy Applications & Measurements

Wind energy measurements: Wind speed, Wind direction, Data measurement and analysis, Performance evaluation of Wind energy system, Wind potential assessment
Wind energy application Wind pumps: Performance analysis, design concept and testing; Principle of WEG; Stand alone, grid connected and hybrid applications of WECS; Economics of wind energy. Utilization; Wind energy in India; Case studies.

MODULE-4	Biomass conversion Technologies

Bio Energy: Introduction – Biomass conversion technologies – Bio gas generation – Factors affecting bio digestion or generation of gas – Classification of bio gas plants – advantages and disadvantages –Materials used for biogas plant – selection of site for biogas plant
Thermo-chemical conversions: Direct Combustion, Technology of Biomass gasification, Pyrolysis and Liquefaction, Bio- Chemical Conversion: anaerobic digestion, alcohol production from biomass,
Chemical conversion process: hydrolysis and hydrogenation
Biomass Gasifiers: History, Principle, Design of Biomass Gasifiers, updraft gasifier, down draft gasifier, zero carbon biomass gasification plants, Gasification of plastic-rich waste, applications for cooking, electricity generation, Gasifier Engines, Operation of spark ignition and compression ignition engine with wood gas, methanol, ethanol and biogas, Biomass integrated gasification/combined cycles systems.

MODULE-5	**Bio-Energy Systems with Efficient Applications**

Traditional Stoves, Energy Efficient Cooking and Space heating Stoves, Metal Stoves Improved Gasifier Stoves, Pollution due to smoke emissions, Biogas Systems : Technology of Bio-gas production, Biogas Plants , Digester types, Digester design, Chemical kinetics and mathematical modeling of bio-methanation process, Dung, Vegetable Waste, Night Soil and Municipal Waste based Bio-gas plants, Bio gas as fuel for transportation, Lighting, Running Dual Fuel Engines, Electricity generation, Bio gas Bottling Plant Technology, Application of Bio gas slurry in agriculture , Design of Biogas for cold climates.

Total hours: 54

Term work:

1. Field trip

Content beyond syllabus:

1. Betz limit & Wind resource assessment

Self-Study:

Contents to promote self-Learning:

SNO	MODULE	Reference
1	Basic components of WECS	https://www.youtube.com/watch?v=uUzqfckAlbg
2	Prandlt's tip loss Correction	https://www.youtube.com/watch?v=F9J2BdprXOQ
3	Wind energy measurements	https://www.youtube.com/watch?v=-N-QJkY1GEM
4	Biomass conversion technologies Design of Biomass Gasifiers	https://www.youtube.com/watch?v=H1hrkC--dto https://www.youtube.com/watch?v=RrBOqjCtkk0
5	Night Soil and Municipal Waste based Bio-gas plants	https://www.youtube.com/watch?v=ehNEtJtaFR8

Text Book(s):

1. S.N.Bhadra,D.Kastha, S.Banerjee, " wind electrical systems" Oxford University Press
2. S.Rao & B.B.Parulekar, "Energy Technology", 4th edition, Khanna publishers, 2005.
3. "Energy conversion systems" by Rakosh das Begamudre, New age international publishers, New Delhi - 2000.

Reference Book(s):

1. "Renewable Energy sources & Conversion Technology" by N.K.Bansal, Manfred Kleemann, Michael Meliss. Tata Mcgraw Hill Publishers.
2. "The Electrical Energy Storage" by IEC Market Strategy Board.
3. Jim Eyer, Garth Corey, "Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report", Press, Feb 2010.

Online Resources:

1. https://www.lathamathavan.edu.in/lmgi/antiragging/WECS-%21EEE%20new.pdf
2. https://www.lathamathavan.edu.in/lmgi/antiragging/WECS-%21EEE%20new.pdf
3. https://engineering.purdue.edu/~dionysis/EE452/Lab9/Wind_Energy_Conversion.pdf
4. https://energystorage.org/why-energy-storage/technologies/
5. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118029008

Web References:

1. https://www.youtube.com/watch?v=mh51mAUexK4
2. https://www.youtube.com/watch?v=GExTwRNkQBg
3. https://www.youtube.com/watch?v=4a4XGu1mR5E
4. https://www.youtube.com/watch?v=xzY3CK43C98
5. https://www.youtube.com/watch?v=_OQtT4yhhWc

NARAYANA ENGINEERING COLLEGE:GUDUR								
IV-B.Tech	ELECTRIC VEHICLE TECHNOLOGY (PE - IV)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. **To introduce the fundamental concepts of electric vehicles**, their types, components, and comparison with conventional vehicles.
2. **To impart knowledge on electric drivetrain topologies** and their relevance to vehicle performance, control, and energy efficiency.
3. **To classify and analyze various types of electric propulsion systems** and drives used in electric vehicles.
4. **To provide insights into energy storage systems**, particularly batteries and supercapacitors, along with their characteristics and selection criteria.
5. **To familiarize students with different energy management strategies** for optimizing vehicle performance, range, and sustainability.

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

CO 1	Illustrate electric vehicles. (L2)
CO 2	Understand drive-train topologies. (L2)
CO 3	Classify various electrical drives (L2)
CO 4	Classify energy storage technologies. (L2)
CO 5	Classify different energy management strategies. (L2)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction To Electric Vehicles

History of electric vehicles, social and environmental importance of electric vehicles, impact of modern drive-trains on energy supplies.

CASE STUDY: Comparison by efficiency of Conventional, Hybrid, Electric and Fuel cell Vehicles.

MODULE -2: Electric Drive-Trains

Basic concept of electric traction, Introduction to various electric drive-train topologies, Power flow control in electric drive-train topologies.

MODULE-3: Electric Drives & Control

Introduction to electric components used in electric vehicles, Control of BLDC Motor, Control of Induction Motor Drive, Permanent Magnet (PM) motor Drive & Switched Reluctance Motor (SRM) Drive.

MODULE-4: Energy Storage

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its modeling, SOC, Different Types of Batteries, Super Capacitor based energy storage and its analysis, Fuel Cells, Hybridization of different energy storage devices.
MODULE-5: Energy Management Strategies & Charging Infrastructure
Introduction to energy management strategies used in electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies, Types of EV charging Infrastructure & Standardized Communication protocols for EV charging. **CASE STUDY:** Current issues in electric Vehicles, Thermal Protection of Battery.
Total hours: 54

Term work:
Term work contains minimum two group assignments followed by seminars and quiz's

Content beyond syllabus:

1. Hybridization of different energy storage devices
2. Mechanics of Electric Vehicles

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Introduction to Electric Vehicles	CO1	https://nptel.ac.in/content/storage2/courses/108103009/download/M1.pdf https://www.youtube.com/watch?v=KOLBGKMo3zQ
2	Hybrid Electric Drive-trains	CO2	https://www.youtube.com/watch?v=oydKVcJqPQ0 https://nptel.ac.in/content/storage2/courses/108103009/ download/M3.pdf
3	DC & AC Motor drives	CO3	https://www.youtube.com/watch?v=1AT1yuQ9awM&list= PLFW6lRTa1g83slfVY1p1xGqPGYUmXyahx
4	Energy Storage Systems & Energy Management Strategies	CO4	https://www.youtube.com/watch?v=j7RaL_XKywk https://nptel.ac.in/content/storage2/courses/108103009/ download/M10.pdf
5	Hybrid Vehicle Control Strategy	CO5	https://nptel.ac.in/content/storage2/courses/108103009/ download/M12.pdf

Text Book(s):

1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, —Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design‖, CRC Press, 2 nd Edition, 2017. (Unit-I, II)
2. Ali Emadi, —Advanced Electric Drive Vehicles (Energy, Power Electronics, and Machines)‖, CRC Press, 2015. (Unit-III)
3. John G. Hayes and A. Goodarzi, —Electric Powertrain - Energy Systems, Power electronics and drives for Hybrid, electric and fuel cell vehicles‖, Wiley, 2018. (Unit-IV & V)

Reference Book(s):

1. James Larminie, John Lowry, —Electric Vehicle Technology Explained‖, Wiley, 2 nd Edition 2012.

Online Resources:

1. https://b-ok.asia/book/1226776/eceb4b
2. https://b-ok.asia/book/3357286/21e776
3. http://ceb.ac.in/knowledge-center/E-BOOKS/Modern%20Electric,%20Hybrid%20Electric%20&%20Fuel%20Cell%20Vehicles%20-%20Mehrdad%20Ehsani.pdf
4. https://b-ok.asia/book/3516646/6fe038
5. https://nptel.ac.in/courses/108/103/108103009/
6. https://www.youtube.com/watch?v=V004WUdpHeA&list=PLlYm0-AHZdZRLYSylFinxkspWmcgNvbtl
https://www.youtube.com/watch?v=11e_d3Q9jEc

Web Resources:

1. https://nptel.ac.in/courses/108106170
2. https://onlinecourses.nptel.ac.in/noc22_ee53
3. https://onlinecourses.nptel.ac.in/noc21_ee112

NARAYANA ENGINEERING COLLEGE:GUDUR								
IV-B.Tech	DIGITAL SIGNAL PROCESSING (PE - IV)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. To get familiar with the properties of discrete time signals, systems and z-transform.
2. To learn the importance of FFT algorithm for computation of Discrete Fourier Transform and Fast Fourier Transform with decimations.
3. To understand the implementations of digital filter structures.
4. To analyse the FIR filter design using Fourier series and windowing methods.
5. To gain the knowledge on Programmable DSP Devices.

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

CO 1	Familiar with the properties of discrete time signals, systems and z-transform. L2
CO 2	Learn the importance of FFT algorithm for computation of Discrete Fourier Transform and Fast Fourier Transform with decimations. L3
CO 3	Understand the implementations of digital filter structures. L2
CO 4	Analyse the FIR filter design using Fourier series and windowing methods. L3
CO 5	Gain the knowledge on Programmable DSP Devices. L2

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction to discrete time signals and systems & Z-Transform

Introduction to discrete time signals and systems: Introduction to digital signal processing, Review of discrete-time signals and systems, Analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems.

Z–Transform: Definition, ROC, Properties, Poles and Zeros in Z-plane, the inverse Z-Transform, System analysis, Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions, Illustrative Problems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.

MODULE -2: Discrete Fourier Transform & Fast Fourier Transform

Discrete Fourier Transform: Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT.

Fast Fourier Transform: Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).

MODULE-3: IIR Filters

Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods, Frequency transformations, Basic structures of IIR Filters - Direct form-I, Direct form-II, Cascade form and Parallel form realizations.
MODULE-4: FIR Filters
Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Raised Cosine, Hanging, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations.
MODULE-5: Architectures for Programmable DSP Devices
Architecture of TMS320C5X: Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals.

Total hours:	54

Term work:
Applications on various filters with suitable analysis

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	BIBO stability	CO1	https://www.tutorialspoint.com/signals-and-systems-bibo-stability-criterion
2	Linear and Circular convolution	CO2	https://thewolfsound.com/circular-vs-linear-convolution-whats-the-difference/#google_vignette
3	Digital filters from analog filters by Impulse invariant transformation methods	CO3	https://www.sciencedirect.com/topics/engineering/impulse-invariant-method
4	Comparison of IIR & FIR filters	CO4	https://www.geeksforgeeks.org/electronics-engineering/difference-between-fir-filter-and-iir-filter/
5	On-chip peripherals	CO5	https://www.slideshare.net/slideshow/unit-ii-study-of-onchip-peripherals/46154533

Text Book(s):
1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education, 2007.
2. A.V.Oppenheim and R.W. Schaffer, Discrete Time Signal Processing ,PHI

Reference Book(s):
1. S.K.Mitra, Digital Signal Processing – A practical approach , 2nd Edition, Pearson Education, New Delhi, 2004.
2. MH Hayes, Digital Signal Processing, Schaum‘s Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using Matlab, Thomson, 2007.

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc22_ee99/preview,
2. https://nptel.ac.in/courses/108105055

NARAYANA ENGINEERING COLLEGE:GUDUR								
IV-B.Tech	HVDC AND FACTS (PE-IV)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives: To get the student exposed to

1. High voltage DC transmission systems
2. Flexible AC transmission systems
3. Various configurations of the above, Principle of operation, Characteristics of various FACTS devices

Course Outcomes:

CO 1	Explain the conventional and emerging electrical transmission networks, power-electronic switching devices, HVDC, FACTS, and the concept of virtual inertia.(BL-2)
CO 2	Analyze different HVDC link configurations, Graetz circuit operation, converter characteristics, and equivalent circuits of HVDC transmission systems.(BL-4)
CO 3	Analyze various HVDC control strategies, converter firing-angle control, frequency control, tap-changer control, and power-flow reversal techniques.(BL-4)
CO 4	Explain the operating principles of different FACTS controllers and analyze controllable shunt and series VAR compensation techniques using power-electronic converters.(BL-2)
CO 5	Analyze the operating principles, control capabilities, and applications of UPFC and IPFC for independent real and reactive power-flow control in transmission systems.(BL-4)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction

Electrical Transmission Networks, Conventional Control Mechanisms-Automatic Generation Control, Excitation Control, Transformer Tap-Changer Control, Phase-Shifting Transformers; Advances in Power-Electronic Switching Devices, Principles and Applications of Semiconductor Switches; Limitations of Conventional Transmission Systems, Emerging Transmission Networks, HVDC and FACTS. Concepts of virtual inertia

MODULE -2: High Voltage Dc Transmission – I

Types of HVDC links - Monopolar, Homopolar, Bipolar and Back-to-Back, Advantages and disadvantages of HVDC Transmission, Analysis of Graetz circuit, Analysis of bridge circuit without overlap, Analysis of bridge with overlap less than 600, Rectifier and inverter characteristics, complete characteristics of rectifier and inverter, Equivalent circuit of HVDC Link.

MODULE-3: High Voltage DC Transmission – II

Desired features and means of control, control of the direct current transmission link, Constant current control, Constant ignition angle control, Constant extinction angle control, Converter firing- angle control-IPC and EPC, frequency control and Tap changer control, Starting, Stopping and Reversal of power flow in HVDC links.
MODULE-4: Flexible AC Transmission Systems-I
Types of FACTS Controllers, brief description about various types of FACTS controllers, Operation of 6-pulse converter, Transformer Connections for 12-pulse, 24-pulse and 48-pulse operation, principle of operation of various types of Controllable shunt VAR Generation, Principle of switching converter type shunt compensator, principles of operation of various types of Controllable Series VAR Generation, Principle of Switching Converter type series compensator.
MODULE-5: Flexible AC Transmission Systems-II
Unified Power Flow Controller (UPFC) – Principle of operation, Transmission Control Capabilities, Independent Real and Reactive Power Flow Control; Interline Power Flow Controller (IPFC) – Principle of operation and Characteristics, UPFC and IPFC control structures (only block diagram description), objectives and approaches of voltage and phase angle regulators
Total hours: 54

Term work:

1. Develop HVDC Transmission system using mat lab software
2. The steady-state and transient performance of a 12-pulse, 1000 MW (500 kV-2kA) 50/60 Hz HVDC transmission system.
3. FACTS and HVDC Technologies for the Development and Enhancement of Future Power Systems.4.Use of HVDC and FACTS which can be applied in transmission and distribution systems
5. Simulation of various applications using FACTs devices.
6. AC-DC Power flow analysis using FACTS devices.

Content beyond syllabus:

1. Design of real-time industrial projects.
2. Application of various compensation techniques in power system.

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Introduction of DC power transmission	CO1	https://www.cet.edu.in/noticefiles/229_HVDC_NOTE.pdf
2	Analysis of HVDC converters	CO2	https://aits-tpt.edu.in/wp-content/uploads/2018/08/HVDC-2-Unit.pdf
3	Control of HVDC converterand systems	CO3	https://sari-energy.org/oldsite/PageFiles/What_We_Do/activities/HVDC_Training/Presentations/Day_2/3.HVDC_CONTROLS.pdf
4	Introduction To Facts	CO4	https://nptel.ac.in/courses/108/107/108107114/
5	Static Series Compensators	CO5	https://nptel.ac.in/courses/108/107/108107114/

Text Book(s):

1. Narain G. Hingorani and Laszlo Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2000.
2. E.W. Kimbark, Direct current transmission, Vol. I, Wiley Interscience, New York, 1971.

Reference Book(s):

1. K R Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International Publishers, New Delhi, 2007.
2. AnriqueAcha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Pérez and César Angeles-Camacho, FACTS: Modelling and Simulation in Power Networks, John Wiley & Sons, West Sussex, 2004.
3. R Mohan Mathur and Rajiv K Varma, Thyristor-Based FACTS Controllers for Electrical Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2002.

Online Resources:

1. https://nptel.ac.in/courses/108104013,
2. https://nptel.ac.in/courses/108107114

Web Resources:

1. https://nptel.ac.in/courses/108/104/108104013/
2. http://www.ee.uidaho.edu/ee/power/ee
3. https://www.powereng.com/our-services/power-delivery/hvdc-fact/
4. https://en.wikipedia.org/wiki/High-voltage_direct_current
5. https://www.ti.com/lit/an/sloa289a/sloa289a.pdf?ts=1592377419880&ref_url=https%253A%252F%2www.google.co.in%252F
7. https://pv-magazine-usa.com/2020/03/31/hvdc-transmission-helps-investors-but-may-not-help-solar/
8. http://www.renewableenergyfocus.com/view/3567/hvdc-transmission-from-energy-source-to-consumer/

NARAYANA ENGINEERING COLLEGE:GUDUR								
IV-B.Tech	HYBRID ELECTRICAL VEHICLES (PE-IV)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite: To Learn about Power Electronic devices, Semiconductor drives, Energy storage systems(Battery, Fuel Cell, Super Capacitor etc).

Course Objectives:

1. To understand Importance of Hybrid Electric Vehicles
2. To Know the various drive-train topologies
3. To Learn the operation and configurations of DC & AC Drives
4. To Know the importance of various Energy storage systems and Energy management strategies
5. To provide knowledge about supervisory control of EVs

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

CO 1	Understand the models to describe hybrid vehicles and their performance (BL-2)
CO 2	Classify various hybrid drive-train topologies(BL-1)
CO 3	Understand the various configurations of DC & AC Motor drives. (BL-2)
CO 4	Understand the different possible ways of energy storage and different strategies related to Energy management strategies. (BL-2)
CO 5	Understand the mode of operation and control Architecture. (BL-2)

CO-PO Mapping

CO	PO											PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	2						2					2	3
CO2	2											2	2
CO3	3		1									1	2
CO4	2											1	
CO5	2											1	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	INTRODUCTION TO ELECTRIC VEHICLES

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

MODULE -2	Hybrid Electric Drive-trains

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis

MODULE-3	Electric Propulsion unit

Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, Switch Reluctance Motor drives

MODULE-4	Energy Storage Systems and Energy Management

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery, Fuel Cell, Super Capacitor based energy storage and its analysis. Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies.	
MODULE-5	**Hybrid Vehicle Control Strategy**
HEV supervisory control - Selection of modes - power spilt mode - parallel mode - engine brake mode - regeneration mode - series parallel mode.	
Total hours:	**54**

Term work:

Term work contains minimum two group assignments followed by seminars and quiz's

Content beyond syllabus:

3. Hybridization of different energy storage devices
4. Mechanics of Electric Vehicles

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Introduction to Electric Vehicles	CO1	https://nptel.ac.in/content/storage2/courses/108103009/download/M1.pdf https://www.youtube.com/watch?v=KOLBGKMo3zQ
2	Hybrid Electric Drive-trains	CO2	https://www.youtube.com/watch?v=oydKVcJqPQ0 https://nptel.ac.in/content/storage2/courses/108103009/download/M3.pdf
3	DC & AC Motor drives	CO3	https://www.youtube.com/watch?v=1AT1yuQ9awM&list=PLFW6lRTa1g83sIfVY1p1xGqPGYUmXyahx
4	Energy Storage Systems & Energy Management Strategies	CO4	https://www.youtube.com/watch?v=j7RaL_XKywk https://nptel.ac.in/content/storage2/courses/108103009/download/M10.pdf
5	Hybrid Vehicle Control Strategy	CO5	https://nptel.ac.in/content/storage2/courses/108103009/download/M12.pdf

Text Book(s):

1. C. Mi, M. A. Masrur and D. W. Gao, “Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives”, John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, “Hybrid Electric Vehicles: Energy Management Strategies”, Springer, 2015.
3. Electric Vehicle Technology Explained-James Larminie, John Lowry-John Wiley & Sons Ltd,-2003
4. Electric & Hybrid Vehicles-Design Fundamentals-Iqbal Hussain, Second Edition, CRCPress,2011

Reference Book(s):

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2004.
2. T. Denton, “Electric and Hybrid Vehicles”, Routledge, 2016.
3. Iqbal Husain, "Electric and Hybrid Electric Vehicles", CRC Press, 2011.
4. Wei Liu, "Hybrid Electric Vehicle System Modeling and Control", Second Edition, WILEY, 2017

Online Resources / Web References:

1. https://b-ok.asia/book/1226776/eceb4b
2. https://b-ok.asia/book/3357286/21e776
3. http://ceb.ac.in/knowledge-center/E-BOOKS/Modern%20Electric,%20Hybrid%20Electric%20&%20Fuel%20Cell%20Vehicles%20-%20Mehrdad%20Ehsani.pdf
4. https://b-ok.asia/book/3516646/6fe038
5. https://nptel.ac.in/courses/108/103/108103009/
7. https://www.youtube.com/watch?v=V004WUdpHeA&list=PLlYm0-AHZdZRLYSylFinxkspWmcgNvbtl
8. https://www.youtube.com/watch?v=11e_d3Q9jEc

NARAYANA ENGINEERING COLLEGE:GUDUR								
IV-B.Tech	RENEWABLE ENERGY CONVERSION SYSTEMS (PE-IV)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	RECS	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite: Nill

Course Objectives:

1. To create awareness about various Electric Energy Conversion Systems.
2. Learn the fundamental concepts about solar energy conversion systems and devices
3. To understand the solar thermal conversion systems for high temperature applications.
4. To learn Thermal and Bio-energy conversion systems
5. To Understand the various technologies that are used in WECS
6. To Understand the Fuel cell technology

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

CO 1	Understand various Electric Energy Conversion Systems (BTL-2)
CO 2	Analyze the solar thermal conversion system (Also for high temperature applications) (BTL-4)
CO 3	Analyze the Photovoltaic & Bio-Energy Conversion Systems (BTL-4)
CO 4	Illustrate the existing Wind Energy Conversion System (BTL-2)
CO 5	Extend the knowledge about working principle of various Fuel cell technology (BTL-2)

CO-PO Mapping													
CO	**PO**											**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO 2**
CO1	3	1	1									1	
CO2	2	2										1	2
CO3	2	1										1	1
CO4	2	1	1										2
CO5	1	1	1									1	2
1: Low, 2-Medium, 3- High													

COURSE CONTENT	
MODULE – 1	**ELECTRIC ENERGY CONVERSION SYSTEM**
Generation of electricity using different sources, Transmission and distribution losses, AC to DC and DC to AC conversions, Electric motors: Types, losses, efficiency, Lightning systems, Diesel generating systems.	
MODULE -2	**SOLAR THERMAL CONVERSION SYSTEM**
Relevance of solar thermal power generation; Components of solar thermal power plant, Design and performance, characteristics of different solar concentrator types suitable for thermal power generation	

HIGH TEMPERATURE APPLICATIONS: Types of solar thermal conversion system used in high temperature application, Tracking of solar concentrators; performance characterization of solar concentrators both line focus and point focus, Comparative analysis of the both mode focus system.	
MODULE-3	**THERMAL ENERGY CONVERSION & BIO-ENERGY CONVERSION SYSTEMS**
Thermo-electric generator, Concepts and design considerations of MHD generators, Cycle analysis of MHD systems, Thermionic power conversion and plasma diodes, Thermo chemical Conversion. Bio-energy conversion, bio methanation technology.	
MODULE-4	**WIND ENERGY CONVERSION SYSTEM (WECS)**
Rotor Selection, Annual Energy Output, HAWT, VAWT, Rotor Design Considerations-Number of Blades, Blade Profile -2/3 Blades and Teetering, Coning- Upwind/Downwind, Power Regulation, Yaw System- Tower, Synchronous and Asynchronous Generators and Loads, Integration of Wind Energy Converters to Electrical Networks, Inverters.	
MODULE-5	**FUEL CELL TECHNOLOGY**
Overview of fuel cells, Fuel cell thermodynamics, fuel cell efficiency, Fuel cell characterization, Fuel cell modelling and system integration, Balance of plant, Hydrogen production from renewable sources and storage, life cycle analysis of fuel cells	
Total hours:	**54**

Term work:

Individual assignment, followed by Quiz and End semester examinations

Content beyond syllabus:

Advance energy conversion process

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Electric Energy Conversion Systems	CO1	https://www.britannica.com/technology/energy-conversio
2	solar energy conversion systems	CO2	https://www.appropedia.org/Solar_energy_conversion_system https://www.sciencedirect.com/topics/engineering/thermal-solar-energy-system-technology
3	Thermal and Bio-energy conversion systems	CO3	http://www.fao.org/3/T1804E/t1804e06.htm
4	Wind Energy	CO4	https://www.appropedia.org/Wind_energy_conversion_system

	Conversion Systems			
5	Fuel cell technology	CO5	https://www.hydrogenics.com/technology-resources/hydrogen-technology/fuel-cells/	

Text Book(s):

1. S. S. L. Chang, Energy Conversion, Prentice Hall, 1963
2. R. J. Rosa, Magneto hydrodynamic Energy Conversion, Springer, 1987.
3. V. S. Bagotsky, Fuel Cell Problems and Solutions, John Wiley & Sons, 2009

Reference Book(s):

1. Kettani, M.A., Direct energy conversion, Addison-Wesley, Reading, Mass, 1970
2. Hand book Batteries and Fuel Cells. Linden, McGraw Hill, 1984

Online Resources:

1. https://archive.org/details/energyconversion00chan
2. https://www.trine.edu/books/documents/de_text1.0.0.pdf

Web Resources:

3. https://www.youtube.com/watch?v=mpHZWYpKDJg
4. https://www.youtube.com/watch?v=GExTwRNkQBg

NARAYANA ENGINEERING COLLEGE:GUDUR								
IV-B.Tech	SWITCHED MODE POWER CONVETERS (PE-V)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives: By the end of the course, the student will be able to

1. Understand basic concepts of DC-DC converters
2. Understand the concepts of resonant converters and their classification, various types of multilevel inverters, power conditioners, UPS and filters.
3. Apply various modulation and harmonic elimination techniques over the converters.
4. Analyze the state space modelling of various types of converters.
5. Design inductor and transformer for various power electronic applications.

Course Outcomes:

CO 1	Analyze the operating principles, steady-state performance, and state-space models of Buck, Boost, Buck-Boost, and Cuk converters.(BL-4)
CO 2	Analyze the operation and state-space models of Flyback, Forward, Luo, Half-Bridge, and Full-Bridge converters with suitable control circuits and PWM techniques.(BL-4)
CO 3	Explain the classification, operating principles, and performance characteristics of resonant converters, including ZVS, series, and parallel resonant inverters.(BL-2)
CO 4	Analyze single-phase, three-phase, and multilevel inverters using various PWM techniques and harmonic elimination methods for power electronic applications.(BL-4)
CO 5	Apply the principles of power conditioners, UPS systems, and passive filters for power quality improvement and design suitable inductors, transformers, and capacitors for power electronic applications.(BL-3)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: DC-DC Converters

Principles of step-down and step-up converters – Analysis and state space modelling of Buck, Boost, Buck- Boost and Cuk converters – Numerical Examples

MODULE -2: Switching Mode Power Converters

Analysis and state space modelling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques – Numerical Examples

MODULE-3: Resonant Converters

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control – Numerical Examples
MODULE-4: DC-AC Converters
Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.
MODULE-5: Power Conditioners, UPS & Filters
Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.
Total hours: 54

Term work:
Assignments followed by quizzes

Content beyond syllabus:
Real-time Embedded Control Systems

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	state feedback controller and state observer	CO1	https://nptel.ac.in/content/storage2/courses/108103008/PDF/module9/m9_lec3.pdf
2	linear and nonlinear systems using phase plane method	CO2	https://nptel.ac.in/courses/108/106/108106162/
3	Analysis of describing functions with non-linearities	CO3	https://people.unica.it/eliousai/files/2015/10/Describing-Function-analysis-v1.pdf
4	Optimal control problem	CO4	https://nptel.ac.in/courses/108/105/108105019/#
5	Solution of Kalman Filter by duality principle	CO5	https://nptel.ac.in/content/storage2/courses/101108047/module15/Lecture%2040.pdf https://nptel.ac.in/courses/101/108/101108047/

Text Book(s):
1. Power Electronics: Essentials and Applications by L. Umanand, Wiley, 2009
2. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.
3. Course material on Switched Mode Power Conversion by V Ramanarayanan, Dept. of Electrical Engg. IISc. Bangalore.

Reference Book(s):
1. Philip T. Krein, ―Elements of Power Electronics‖, Oxford University Press, 2012

2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters, Applications and design, 3rd Edition, John Wiley and Sons, 2006
3. M.H. Rashid, Power Electronics circuits, devices and applications, 3rd Edition Prentice Hall of India New Delhi, 2007.

Online Resources:

1. https://nptel.ac.in/courses/108108036
2. https://nptel.ac.in/courses/108105180

Web Resources:

1. https://www.youtube.com/watch?v=bbm79-UcNN0&list=PLbMVogVj5nJTNkhtkCEKQHhPOr2bpS3za
2. https://www.youtube.com/watch?v=DSvBXXnZv34&list=PLUY5PVaLSLNEKzeQv13ZevTL5AhnQOkWX
3. https://b-ok.asia/book/1193802/dec93b
4. https://b-ok.asia/book/459450/7e89ab

NARAYANA ENGINEERING COLLEGE:GUDUR								
IV-B.Tech	ELECTRICAL DISTRIBUTION SYSTEM (PE-V)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives: To make the students

1. To know about fundamental aspects of distribution system, principle of distribution substations.
2. To know about classification of various loads.
3. To understand difference between conventional load flow studies of power system and distribution system load flow.
4. To know about evaluation of voltage droop and power loss calculations, distribution automation and management system, SCADA.

Course Outcomes: After completing the course, the student should be able to do the following

CO 1	Understand fundamental aspects of distribution system and various factors affecting the distribution systems. -L2
CO 2	Analysis of substations and modelling of loads. -L3
CO 3	Understand difference between conventional load flow studies of power system and distribution system load flow. -L2
CO 4	Evaluation of voltage drop and power loss calculations and capacitor location and cost analysis.-L3
CO 5	Analyse the concepts of SCADA, Automation distribution system and management. -L3

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Distribution System Fundamentals

Brief description about electrical power transmission and distribution systems, Different types of distribution sub-transmission systems, Substation bus schemes, Factors effecting the substation location, Factors effecting the primary feeder rating, types of primary feeders, Factors affecting the primary feeder voltage level, Factors effecting the primary feeder loading.

MODULE -2: Distribution System Substations and Loads
Substations: Rating of a distribution substation for square and hexagonal shaped distribution substation, Service area with ―n‖ primary feeders, K constant, Radial feeder with uniformly and non-uniformly distributed loading. Benefits derived through optimal location of substations. **Loads:** Various types of loads, Definitions of various terms related to system loading, Distribution transformer loading, feeder loading, Relationship between the Load Factor and Loss Factor, Modelling of star and delta connected loads.
MODULE-3: Distribution System Load Flow
Exact line segment model, Modified line model, approximate line segment model, Step-Voltage Regulators, Line drop compensator, Forward/Backward sweep distribution load flow algorithm – Numerical problems
MODULE-4: Voltage Drop and Power Loss Calculation
Analysis of non-three phase primary lines, concepts of four-wire multi-grounded common-neutral distribution system, Percent power loss calculation, Distribution feeder cost calculation methods, Capacitor installation types, Series and Shunt Capacitors, Types of three-phase capacitor-bank connections, Procedure for best capacitor location, Economic justification for capacitors – Numerical problems.
MODULE-5: Distribution Automation
Distribution automation, distribution management systems, distribution automation system functions, Basic SCADA system, Consumer Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR), Outage management, decision support applications, substation automation, control feeder automation.
Total hours: 54

Term work:
Report on SCADA implementation in distribution system

Content beyond syllabus:
Smart Distribution System

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Substation bus schemes	CO1	https://electricaltech.in/different-bus-bar-schemes-in-electrical-substations/
2	Radial feeder with uniformly and non-uniformly distributed loading	CO2	https://testbook.com/electrical-engineering/radial-distribution-system
3	Forward/Backward sweep distribution load flow algorithm	CO3	https://research.ijcaonline.org/icaet2017/number5/ICAET2017124.pdf
4	Series and Shunt Capacitors	CO4	https://jits.ac.in/wp-content/uploads/2020/02/EHVAC-P.BALAKISHAN-EEE-pdf.pdf

	5	Basic SCADA system	CO5	https://inductiveautomation.com/resources/article/what-is-scada

Text Book(s):

1. Distribution System Modelling and Analysis, William H. Kersting, CRC Press, Newyork, 2002.
2. Electric Power Distribution System Engineering, TuranGonen, McGraw-Hill Inc., New Delhi, 1986.

Reference Book(s):

1. Control and automation of electrical power distribution systems, James Northcote-Green and Robert Wilson, CRC Press (Taylor & Francis), New York, 2007.
2. Biswarup Das, Power distribution Automation, IET publication, 2016.
3. Dr. M. K. Khedkar, Dr. G.M. Dhole, Electric Power Distribution Automation, Laxmi Publications, First edition, 2017.

Online Resources:

https://onlinecourses.nptel.ac.in/noc22_ee126/preview

Web Resources:

https://www.youtube.com/watch?v=nlFM1q9QPJw&t=57s

NARAYANA ENGINEERING COLLEGE:GUDUR								
IV-B.Tech	AUTOMOTIVE ELECTRICAL ENGINEERING (PE-V)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	AEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite: Nil

Course Objectives:

1. To understand the various types of Batteries and their ratings
2. To understand the starting condition and its behavior
3. To understand the various charging systems in Automobiles
4. To learn different Lighting systems in Automobiles
5. To learn electronic engine management system in Automobiles
6. To understand the various electrical and non electrical sensors

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

CO 1	Compute the efficiency of Batteries through various test's
CO 2	Understand the working of different starter drive units and their maintenance and the concept of vehicle charging system with its auxiliaries
CO 3	Understand the dazzling of head light and its preventive methods
CO 4	Understand the electronic dashboard instruments & onboard diagnostic system
CO 5	Understand the various sensors used in Automobiles

CO-PO Mapping

CO	PO											PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	3		1				2					2	2
CO2	2	1	1										
CO3	2		1									1	
CO4	2	1	2									2	2
CO5	2	1	1									1	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1

BATTERIES ACCESSORIES AND CHARGING SYSTEM

Principle and construction of lead acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on batteries, maintenance and charging.

Generation of direct current, shunt generator characteristics, armature reaction, third brush regulation, cutout. Voltage and current regulators, compensated voltage regulator, alternators.

MODULE -2

STARTING SYSTEM Condition at starting, behavior of starter during starting, series motor and its characteristics, principle and construction of starter motor, working of different starter drive units, care and maintenances of starter motor, starter switches.
MODULE-3
LIGHTING Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods – Horn, wiper system and trafficator.
MODULE-4
FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS Current trends in automotive electronic engine management system, electromagnetic interference suppression, electromagnetic compatibility, electronic dashboard instruments, onboard diagnostic system, security and warning system.
MODULE-5
SENSORS AND ACTUATORS Types of sensors: sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids, stepper motors, relay.

Total hours:	**54**

Term work:

Individual Assignments, followed by Quiz's

Content beyond syllabus:

1. Advanced charging system in Automobiles

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Construction of lead acid battery	CO1	https://circuitglobe.com/lead-acid-battery.html https://www.howacarworks.com/basics/how-the-charging-system-works
2	Principle and construction of starter motor	CO2	https://www.samarins.com/glossary/starter.html
3	Lighting system	CO3	https://what-when-how.com/automobile/lighting-circuit-automobile/

4	Automotive electronic engine management system	CO4	https://www.ukessays.com/essays/engineering/electronic-control-unit-and-engine-management-system-engineering-essay.php
5	Types of sensors	CO5	https://www.my-cardictionary.com/electronics/sensors.html

Text Book(s):

1. Tom Weather Jr and Cland C.Hunter, *"Automotive Computers and Control system"*, Prentice Hall Inc., New Jersey.
2. A. Bonnick, *"Automotive Computer Controlled Systems"*, 2011.
3. Young A. P & Griffiths L, *"Automobile Electrical and Electronic Equipments"* English Languages Book Society & New Press, 1990.

Reference Book(s):

1. Santini Al, *"Automotive Electricity and Electronics"*, Cengage Learning, 2012.
2. Tom Denton, *"Automotive Electrical and Electronic System"*, SAE International, 2004.
3. William B. Ribbens, *"Understanding Automotive Electronics"*, 6th Edition, Newnes, 2003.
4. BOSCH, *"Automotive Handbook"*, 8th Edition, BENTLEY ROBERT Incorporated, 2011.
5. Norm Chapman, *"Principles of Electricity and electronics for the Automotive Technician"*, Delmar Cengage Learning, 2008.
6. Judge A.W, *"Modern Electrical Equipment of Automobiles"*, Chapman & Hall, London, 1992.

Online Resources:

1. https://b-ok.asia/book/526451/802478
2. https://b-ok.asia/book/2161298/3ad7b5

Web Resources:

1. https://www.youtube.com/watch?v=hs7bABMtOMI&list=PLyqSpQzTE6M9G2SNxKfsVEjcM9MlJau4F
2. https://www.youtube.com/watch?v=HHgPBMMZ26w

NARAYANA ENGINEERING COLLEGE::GUDUR								
IV-B.Tech	ENERGY AUDIT & DEMAND SIDE MANAGEMENT							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	EMS	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite: Nil

Course Objectives:

1. To learn about energy consumption and situation in India
2. To learn about Energy Management.
3. To learn about Energy Measuring Instruments.
4. To understand the Demand Side Management (DSM).
5. To understand the cost effectiveness for DSM.

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

CO 1	Understand the importance of energy audit and the basic ideas of conduction an energy audit (BTL-2)
CO 2	Analyze various techniques of energy management and conservation (BTL-4)
CO 3	Understand energy efficient methods and power factor improvement techniques (BTL-2)
CO 4	Analyze demand side management concepts through case study (BTL-4)
CO 5	Understand various Cost effectiveness test for demand side management programs (BTL-2)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	Basic principles of Energy Audit

Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes-Energy audit of industries-energy saving potential, energy audit of process industry, thermal power station, building energy audit

MODULE -2	Energy management

Energy management-I

Principles of energy management, organizing energy management program, initiating, planning , controlling, promoting, monitoring, reporting.

Energy management-II

Energy manger, Qualities and functions , language ,Questionnaire - check list for top management

MODULE-3	ENERGY MANAGEMENT FOR LIGHTING AND ENERGY MOTORS

Good Lighting System Design and Practice, Lighting Control, Lighting Energy Audit Energy efficient motors , factors affecting efficiency, loss distribution , constructional details , characteristics - variable speed , variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit	
MODULE-4	**INTRODUCTION TO DEMAND SIDE MANAGEMENT**
Introduction to DSM, Concept of DSM, Benefits of DSM, Different Techniques of DSM – Time of Day Pricing, Multi-Utility Power Exchange Model, Time of Day Models for Planning. Load Management, Load Priority Technique, Peak Clipping, Peak Shifting, Valley Filling, Strategic Conservation, Energy Efficient Equipment. Management and Organization of Energy Conservation Awareness Programs.	
MODULE-5	**ECONOMICS AND COST EFFECTIVENESS TESTS OF DSMPROGRAMS**
Basic payback calculations, Depreciation, Net present value calculations. Taxes and Tax Credit – Numerical Problems. Importance of evaluation, measurement and verification of demand side management programs. Cost effectiveness test for demand side management programs - Ratepayer Impact Measure Test, Total Resource Cost, Participant Cost Test, Program Administrator Cost Test	
Total hours:	**54**

Term work:

Term work contains assignments ,seminars and quiz

Content beyond syllabus:

1. Energy Instruments For Audit

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Energy Audit	CO1	http://www.opexworks.com/KBase/Energy _Management/Energy_Audit_and _Management/Energy_Audit/Energy _Audit_Types_and_Methodology.htm
2	Overview of energy management	CO2	https://beeindia.gov.in/sites/default/files/1Ch3.pdf https://www.nrcan.gc.ca/sites/oee.nrcan.gc.ca /files/files/pdf/energy-audit-manual-and-tool.pdf
3	Energy management for motors	CO3	https://www.youtube.com/watch?v=T9Vmp3Qo8Mo
4	Demand side management	CO4	http://africa-toolkit.reeep.org/modules/Module14.pdf
5	Cost effective test of DSM	CO5	https://www.youtube.com/watch?v=P4yfHQWYfLc

Text Book(s):

1. Industrial Energy Management Systems**,** Arry C. White, Philip S. Schmidt, David R. Brown, Hemisphere Publishing Corporation, New York, 1994.

2. Fundamentals of Energy Engineering - Albert Thumann, Prentice Hall Inc, Englewood Cliffs, New Jersey, 1984.

Reference Book(s):

1) Energy management by W.R. Murphy & G. Mckay Butter worth, Heinemann publications.
2) Energy management by Paul o‟ Callaghan, Mc-graw Hill Book company-1/e,1998
3) Energy efficient electric motors by John C. Andreas, Marcel Dekker Inc Ltd-2/e, 1995
4) Energy management hand book by W.C.Turner, john Wiley and sons
5). Energy management and good lighting practice: fuel efficiency- booklet12-EEO

Online Resources:

1. http://lab.fs.uni-lj.si/kes/erasmus/Energy%20Management%20Handbook.pdf
2. https://www.bsr.org/reports/bsr-energy-management-handbook.pdf

Web Resources:

1. https://freevideolectures.com/
2. https://www.academia.edu/33324894/Energy_Management_Handbook_7th_Ed_Doty_and_Turner_Fairmont_Press_2009--03-Oct-2009-.pdf?auto=download

HONOURS IN ELECTRIC VEHICLES

A student shall earn additional 18 credits for award of B.Tech. (Honours) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).

S. No.	Course Code	Course Title	L	T	P	C
1		E - Mobility	3	0	0	3
2		Battery Management Systems	3	0	0	3
3		Special Machines for Electric Vehicles	3	0	0	3
4		Grid Interface of Electric Vehicles	3	0	0	3
5		EV Charging Technologies	3	0	0	3
6		Project on Electric Vehicles	0	0	6	3

NARAYANA ENGINEERING COLLEGE:GUDUR								
	E - MOBILITY							R2023
	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. Understand the fundamental concepts and principles of Electric vehicles
2. Apply the concepts to implement battery technology
3. Apply the concepts to implement charging technology
4. Understand the future trends in EVs

Course Outcomes: The students will be able to

CO 1	Understanding the Fundamentals of Electric Vehicles and Vehicle Dynamics. Choose suitable motors and analyse different power electronics in EVs. -L2
CO 2	Analyzing Battery Technologies for Electric Vehicles. -L4
CO 3	Understanding and Evaluating Charging Technologies for Electric Vehicles. -L2
CO 4	Exploring Future Trends and Innovations in Electric Vehicles.-L5
CO 5	Understanding E-Mobility, Policy, and Integration with Smart Grids. -L2

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction

Introduction to electric vehicles: EV verses gasoline vehicles, vehicle dynamics fundamentals, e- drivetrain, Electric motor, Power electronic in electric vehicles, Regenerative braking.

MODULE -2: Battery Technology

Battery Technology for EVs: Storage technologies for EV, Battery working principles, Battery losses, Li-ion batteries, Battery pack and battery management system.

MODULE-3: Charging Technology

Charging Technology of EVs: AC charging - Type 1,2,3, DC charging, Fast charging and its limitations, Smart charging and applications, Vehicle to X(V2X), X2V technology.

MODULE-4: FUTURE TRENDS IN EVs

Future trends in e-Vehicles: Wireless charging of EV, On-road charging of EV, Battery swap technology, Solar powered EVs, Charging EVs from renewables.
MODULE-5: E-Mobility
E-mobility: electrification challenges, business, connected mobility and autonomous mobility case study in Indian Roadmap Perspective, Policy- EVs in infrastructure system, integration of EVs in smart grid, social dimensions of EVs.
Total hours: 54

Term work:
Survey report on E-bike usage

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	EV verses gasoline vehicles	CO1	https://www.nrdc.org/stories/electric-vs-gas-cars-it-cheaper-drive-ev
2	Storage technologies for EV	CO2	https://www.sciencedirect.com/science/article/pii/S2095756420300647
3	Fast charging and its limitations	CO3	https://renewablesadvice.com/battery/ev-fast-charging/
4	Wireless charging of EV	CO4	https://www.slideshare.net/slideshow/pritam-kumar-singh-75773232/75773232
5	Electrification challenges	CO5	https://www.automotive-technology.com/articles/electrification-drive-advancements-and-challenges-in-electric-vehicles

Text Book(s):
1. Iqbal Hussain, ―Electric & Hybrid Vehicles – Design Fundamentals‖, Second Edition, CRC Press, 2011.
2. James Larminie, ―Electric Vehicle Technology Explained‖, John Wiley & Sons, 2003.

Reference Book(s):
1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, ―Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals‖, CRC Press, 2010.
2. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
3. Sandeep Dhameja, ―Electric Vehicle Battery Systems‖, Newnes, 2000
4. Tariq Muneer and Irene Illescas García, ―The automobile, In Electric Vehicles: Prospects and
Challenges‖, Elsevier, 2017.

Online Resources:
https://nptel.ac.in/courses/108106170

Web Resources:
https://www.emobility-engineering.com/

NARAYANA ENGINEERING COLLEGE:GUDUR								
	BATTERY MANAGEMENT SYSTEMS							R2023
	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. Understand the basics of batteries and its parameters
2. Apply the concepts to create Battery Management System
3. Create Physical and Simulation models for Battery Management System
4. Design different Battery Management Systems

Course Outcomes: After completion of this course, student will be able to

CO 1	Understand the role of battery management system -L2
CO 2	Identify the requirements of Battery Management System. L2
CO 3	Interpret the concept associated with battery charging / discharging process.-L3
CO 4	Analyze various parameters of battery and battery pack. L4
CO 5	Design the model of battery pack. L5

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction

Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging

MODULE -2: Battery Management System

Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of charge estimation, Cell total energy and cell total power

MODULE-3: Battery State Of Charge And State Of Health Estimation

Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing

MODULE-4: Modelling and Simulation	
Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modelling approach, Simulating an electric vehicle, Vehicle range calculations, Simulating constant power and voltage, Simulating battery packs	
MODULE-5: Design Of Battery Management Systems	
Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system	
Total hours:	54

Term work:
Report submission on different types of batteries and their usage

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Cells connected in series, Cells connected in parallel	CO1	https://www.geeksforgeeks.org/physics/combination-of-cells-in-series-and-parallel/
2	Battery pack topology	CO2	https://tritekbattery.com/3-topologies-of-battery-management-system/
3	Voltage-based methods to estimate SOC	CO3	https://www.batterydesign.net/soc-estimation-techniques/
4	Simulating an electric vehicle	CO4	https://pulseenergy.io/blog/electric-vehicle-simulation-software
5	Design principles of battery BMS	CO5	https://www.monolithicpower.com/en/learning/resources/how-to-design-a-battery-management-system-bms?srsltid=AfmBOoppjr-erTC51gzOrr-IvBG4978GCIo-Yif6Vc7AxVNIPax_T-fM

Text Book(s):
1. Plett, Gregory L. Battery management systems, Volume I: Battery modelling. Artech House, 2015.
2. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods. Artech House, 2015.

Reference Book(s):
1. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L ―Battery Management Systems -Design by Modelling‖ Philips Research Book Series 2002.
2. Davide Andrea,‖ Battery Management Systems for Large Lithium-ion Battery Packs‖ Artech House, 2010
3. Pop, Valer, et al. Battery management systems: Accurate state-of-charge indication for battery- powered applications. Vol. 9. Springer Science & Business Media, 2008.

Online Resources:
https://www.sciencedirect.com/topics/engineering/battery-management-system

Web Resources:
https://www.cyient.com/blog/battery-management-system-in-electric-vehicles

NARAYANA ENGINEERING COLLEGE:GUDUR							
	SPECIAL MACHINES FOR ELECTRIC VEHICLES						R2023
	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. Understand various Motor Drives useful for EV applications
2. Apply the concepts to implement various designs
3. Analyze performance of various Motor Drives
4. Evaluate the usage of specific drive for EV application

Course Outcomes: After completion of this course, student will be able to

CO 1	Understanding the Fundamentals of Permanent Magnet (PM) Brushless Motor Drives. -L2
CO 2	Analyzing Switched Reluctance Motor (SRM) Drives. -L4
CO 3	Evaluating Stator-Permanent Magnet (PM) Motor Drives. -L4
CO 4	Understanding and Designing Magnetic-Gear Motor Drives. -L2
CO 5	Exploring Advanced Magnetless and Multiphase Motor Drives. L5

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Permanent Magnet (PM) Brushless Motor Drives

Structure of PM Brushless Machines, Principle of PM Brushless Machines Modeling of PM Brushless Machines, Inverters for PM Brushless Motors Motor Control, Design Criteria of PM Brushless Motor Drives for EVs, Design Examples of PM Brushless Motor Drives for EVs, Application, Advantages and Limitations for EVs.

MODULE -2: Switched Reluctance Motor Drive

Structure of SR Machines, Principle of SR Machines, SR Converters Topologies, SR Motor Control, Design Criteria of SR Motor Drives for EVs, Examples of SR Motor Drives for EVs, Application, Advantages and Limitations for EVs.

MODULE-3: Stator-PM Motor Drives

Doubly-Salient PM Motor Drives, Flux-Reversal PM Motor Drives, Flux-Switching PM Motor Drives, Hybrid-Excited PM Motor Drives Flux-Mnemonic PM Motor Drives, Design Criteria of Stator-PM Motor Drives for EVs, Application, Advantages and Limitations for EVs.
MODULE-4: Magnetic-Geared Motor Drives
Principle of MG Machines, Modeling of MG Machines, Inverters for MG Motors, MG Motor Control, Design Criteria of MG Motor Drives for EVs, Application, Advantages and Limitations for EVs
MODULE-5: Advanced Magnetless Motor Drives and Multiphase Motor Drives
Introduction of Advanced Magnetless technology, Synchronous Reluctance Motor Drives, Doubly- Salient DC Motor Drives, Flux-Switching DC Motor Drives, Design Criteria of Advanced Magnetless Motor Drives for EVs, Application, Advantages and Limitations for EVs. Multiphase Induction Motor drives – principle, operation and control, Multiphase PMSM machine – principle, operation and control, Fault tolerant operation of multiphase drives

Total hours:	54

Term work:
Report submission on different types of machines using in EV's

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Inverters for PM Brushless Motors Motor Control	CO1	https://www.orientalmotor.com/brushless-dc-motors-gear-motors/technology/brushless-dc-motors-servo-motors-inverter.html
2	Design Criteria of SR Motor Drives for EVs	CO2	https://iopscience.iop.org/article/10.1088/1742-6596/2070/1/012140
3	Hybrid-Excited PM Motor Drives	CO3	https://www.mdpi.com/1996-1073/14/4/916
4	Modeling of MG Machines	CO4	https://www.mdpi.com/1996-1073/16/4/1852
5	Synchronous Reluctance Motor Drives	CO5	https://www.elprocus.com/synchronous-reluctance-motor-working/

Text Book(s):
1. Mehrdad Ehsani, Yimin Gao, Sebatien Gay and Ali Emadi, ―Modern Electric, Hybrid Electric and Fuel cell vehicles: Fundamentals, Theory and Design‖, CRC Press, 2004.
2. James Larminie and John Loury, ―Electric Vehicle Technology – Explained‖, John Wiley & Sons
Ltd, 2003.



Reference Book(s):

1. Sandeep Dhameja, ―Electric Vehicle Battery Systems‖, Butterworth – Heinemann, 2002.
2. Ronald K Jurgen, ―Electric and Hybrid – Electric Vehicles‖, SAE, 2002.
3. Ron Hodkinson and John Fenton, ―Light Weight Electric/Hybrid Vehicle Design‖, Butterworth – Heinemann, 2001.
4. Iqbal Husain, ―Electric and Hybrid Vehicles- Design Fundamentals‖ CRC Press, 2011.

Web Resources:

https://www.mdpi.com/journal/machines/special_issues/KU5426H041

NARAYANA ENGINEERING COLLEGE:GUDUR							
	GRID INTERFACE OF ELECTRIC VEHICLES						R2023
	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. Understand the Grid interfacing concept of EVs
2. Analyze the EV impact on grid
3. Design new types of charging facilities for EVs
4. Evaluate the role of EV as ancillary service

Course Outcomes: After completion of this course, student will be able to

CO 1	Understanding the Fundamentals of Smart Grid and Electric Vehicle Integration Analyze Impact of EV on smart grid -L2
CO 2	Analyzing the Impact of EVs and V2G on the Smart Grid and Renewable Energy Systems -L3
CO 3	Applying Power Conversion Technologies for Smart Grids and Electric Vehicles-L4
CO 4	Designing Control and Management Strategies for PEV Parking Lots -L5
CO 5	Evaluating the Role of PEVs as Ancillary Services in Smart Grids -L4

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction to Smart Grid and PEV

Introduction to smart grid and microgrid, Impact of PEVs on Distributed Energy Resources in the Smart Grid, V2G Technology and PEVs Charging Infrastructures

MODULE -2: Impact of V2G and G2V on the Smart Grid and Renewable Energy Systems

Types of Electric Vehicles, Motor Vehicle Ownership and EV Migration, Impact of Estimated EVs on Electrical Network, Impact on Drivers and the Smart Grid, Standardization and Plug-and-Play

MODULE-3: Power Conversion Technology in the Smart Grid and EV

Impacts of EV Penetration on Grid Power Profile, Requirements of Its Control and Monitoring, Hybrid EV Powertrain Architectures, Control, Monitoring and Management Strategies of EV, V2G Communication System, System model of EV, Case study of three phase fault and its impact
MODULE-4: Planning, Control and Management Strategies for Parking Lots for PEVs
Introduction to PEV Charging Facility, Long-Term Planning for PEV Parking Lots, Control and Management of PEV Parking Lots - stages of implementation
MODULE-5: PEV as Ancillary Service in Smart Grid
Introduction to Ancillary Services, PEV Charger Optimization, PEV as ancillary source, Control Strategies for PEVs to Follow the Individual Operation Values, Systems and Control Algorithm for Smart PEV Chargers, Avoiding the Harmonic Propagation Within the Grid, Case study

Total hours:	54

Term work:
Report submission on possibilities of grid integration.

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	V2G Technology	CO1	https://www.evconnect.com/blog/what-is-vehicle-to-grid-for-electric-vehicles
2	Types of Electric Vehicles	CO2	https://e-amrit.niti.gov.in/types-of-electric-vehicles
3	Impacts of EV Penetration on Grid Power Profile	CO3	https://www.mdpi.com/2032-6653/16/5/264
4	Long-Term Planning for PEV Parking Lots	CO4	https://www.sciencedirect.com/science/article/abs/pii/S2352152X24036430
5	Introduction to Ancillary Services	CO5	https://www.drax.com/power-generation/what-are-ancillary-services/

Text Book(s):

1. Lu, J. and Hossain, J., Vehicle-to-grid: linking electric vehicles to the smart grid. Institution of Engineering and Technology, 2015.
2. Rajakaruna, S., Shahnia, F. and Ghosh, A. eds., Plug In Electric Vehicles in Smart Grids: Integration Techniques. Springer, 2014.

Reference Book(s):

1. Rajakaruna, S., Shahnia, F. and Ghosh, A. eds., Plug in electric vehicles in smart grids: charging strategies. Springer, 2014.
2. Salman, S.K., Introduction to the Smart Grid: Concepts, Technologies and Evolution (Vol. 94). IET., 2017.

Web Resources:

https://driivz.com/glossary/ev-grid-integration/

NARAYANA ENGINEERING COLLEGE:GUDUR							
	EV CHARGING TECHNOLOGIES						R2023
	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. Provide fundamental knowledge of batteries, key parameters, and battery performance characteristics in Electric Vehicles (EVs).
2. Enable students to understand and apply battery modeling and estimation techniques relevant to EV applications.
3. Familiarize students with EV charging infrastructure, protocols, grid integration, and related policy/regulatory frameworks.
4. Develop the ability to evaluate different charging techniques and their impact on battery health, performance, and energy efficiency.
5. Introduce the role of power electronic converters, control strategies, and technologies used in modern EV charging systems.

Course Outcomes:

CO 1	Understanding Battery Basics and Key Parameters-L2
CO 2	Analyzing Battery Modeling Techniques and Capacity Estimation-L3
CO 3	Exploring Charging Infrastructure and Regulatory Frameworks-L4
CO 4	Evaluating Battery Charging Techniques and Performance-L3
CO 5	Understanding Power Electronics in EV Charging Systems-L3

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Battery Basics

Battery parameters- Cell and Battery Voltages, Charge (or Amp hour) Capacity, Energy Stored, Specific Energy, Energy Density, Specific Power, Amp hour (or Charge) Efficiency, Energy Efficiency, Self-discharge Rates, Battery Geometry, Battery Temperature, Heating and Cooling Needs 35 3.2.12 Battery Life and Number of Deep Cycles Types of batteries- lead-acid, nickel based sodium based, lithium batteries, metal-air batteries. Refilled Batteries

MODULE -2: Battery Modeling
The Purpose of Battery Modelling, Electrochemical model, black box model, equivalent circuit model - Battery Equivalent Circuit, Modelling Battery Capacity, Simulating a Battery at a Set Power, Calculating the Peukert Coefficient, Approximate Battery Sizing, Battery state of charge estimation.
MODULE-3: Charging Infrastructure
EV supply equipment, charging standards, classification of charging infrastructure, connecting EVs to the electricity grid, regulatory framework for EV charging connections, communication protocols for smart charging, Battery Management System.
MODULE-4: Battery Charging Techniques
Basic Terms for Evaluating Charging Performances, Charging Algorithms for Li-Ion Batteries, Optimal Charging Current Profiles for Lithium-Ion battery, Lithium Titanate Oxide Battery with Extreme Fast Charging Capability. Super Capacitors for battery charging.
MODULE-5: Power Electronics in EV Charging
Active front end rectifiers - Forward converters, half and full bridge DC-DC converters, power factor correction converters, decreasing impact on the grid and switches, bidirectional battery chargers, wireless charging
Total hours: 54

Term work:
Report submission on EV charging technologies

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Self-discharge Rates	CO1	https://en.wikipedia.org/wiki/Self-discharge
2	The Purpose of Battery Modelling	CO2	https://www.monolithicpower.com/en/learning/mpscholar/battery-management-systems/battery-modeling/significance-of-battery-modeling?srsltid=AfmBOorUPv5dvPa4XCBD6rYUnPmc6B_92MA1mzNdui0VuOirR9U2RnIL
3	Classification of charging infrastructure	CO3	https://www.gridenpower.com/3-classifications-of-ev-charging-infrastructure-you-should-know-about.php
4	Basic Terms for Evaluating Charging Performances	CO4	https://www.qeios.com/read/JHM4V3
5	Half and full bridge DC-DC converters	CO5	https://testbook.com/electrical-engineering/half-bridge-converter

Text Book(s): 1. James Larminie, John Lowry, ―Electric Vehicle Technology Explained‖, Wiley, 2012. 2. RuiXiong, Weixiang Shen, ―Advanced Battery management Technologies for Electric Vehicle‖, Wiley, 2018
Reference Book(s): 1. Handbook of Electric Vehicle Charging Infrastructure Implementation, NITI Aayog, Government of India. 2. Chris Mi, M. AbulMasrur, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, Wiley, 2017 3. Bruno Scrosati, Jurgen Garche, Werner Tillmetz, Advances in Battery Technologies for Electric Vehicles, Wood head Publishing Series in Energy, 2015 4. Sheldon S. Williamson , Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013
Web Resources: https://pulseenergy.io/blog/ev-charging-technology

MINOR DEGREE (EEE Department)

There is no requirement of CGPA for the registration of a Minor Degree. However, students must have cleared all subjects in their first attempt up to the 2-1 Semester.

MINORS IN ENERGY SYSTEMS (EEE Department)

S. No.	Course Code	Course Title	L	T	P	C
1		Energy Audit and Management	3	0	0	3
2		Energy Management in Building	3	0	0	3
3		Energy Storage Technologies	3	0	0	3
4		Energy Scenario and Energy Policy	3	0	0	3
5		Waste Energy Management	3	0	0	3
6		Project in Energy Systems	0	0	6	3

NARAYANA ENGINEERING COLLEGE:GUDUR							
	ENERGY AUDIT AND MANAGEMENT						R2023
	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. Able to understand the basic concepts of Energy Audit and Management, Principles and objectives of Energy management and Basics of Thermal, Electrical energy management
2. Able to apply the fundamental concepts for development of energy management systems
3. Able to Design Energy Audit reports
4. Able to analyze designed energy management systems

Course Outcomes:

CO 1	Understanding the Fundamentals of Energy Auditing and Conservation. **-L2**
CO 2	Analyzing Energy Audit Concepts and Techniques **-L3**
CO 3	Designing and Implementing Energy Management Programs **-L5**
CO 4	Managing Thermal Energy and Implementing Energy Conservation Techniques **L4**
CO 5	Implementing Electrical Energy Management and Conservation **-L4**

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction

Basic elements and measurements - Mass and energy balances – Scope of energy auditing industries - Evaluation of energy conserving opportunities.

MODULE -2: Energy Audit Concepts

Need of Energy audit - Types of energy audit – Energy management (audit) approach - understanding energy costs - Bench marking – Energy performance - Matching energy use to requirement - Maximizing system efficiencies - Optimizing the input energy requirements - Duties and responsibilities of energy auditors- Energy audit instruments - Procedures and Techniques.

MODULE-3: Principles and Objectives of Energy Management

Design of Energy Management Programs - Development of energy management systems – Importance - Indian need of Energy Management - Duties of Energy Manager - Preparation and presentation of energy audit reports - Some case study and potential energy savings.
MODULE-4: Thermal Energy Management
Energy conservation in boilers - steam turbines and industrial heating systems - Application of FBC - Cogeneration and waste heat recovery - Thermal insulation - Heat exchangers and heat pumps - Building Energy Management.
MODULE-5: Electrical Energy Management
Supply side Methods to minimize supply-demand gap- Renovation and modernization of power plants - Reactive power management – HVDC - FACTS - Demand side - Conservation in motors - Pumps and fan systems – Energy efficient motors. Demand side management.
Total hours: 54

Term work:
Report submission on Energy Audit of any department class rooms and labs

Content beyond syllabus:
Energy Audit software tool

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Basic elements and measurements	CO1	https://www.slideshare.net/DrPriteeRaotole/functional-elements-of-measurement-system
2	Types of energy audit	CO2	https://www.carboncollective.co/sustainable-investing/energy-audit
3	Development of energy management systems	CO3	https://www.unido.org/stories/what-energy-management-system
4	Cogeneration and waste heat recovery	CO4	https://beeindia.gov.in/sites/default/files/2Ch7.pdf
5	Reactive power management	CO5	https://powerline.net.in/2023/01/18/reactive-power-management-2/

Text Book(s):
1. Hamies, Energy Auditing and Conservation; Methods Measurements, Management and Case study, Hemisphere, Washington, 1980.
2. Energy Management: W.R.Murphy, G.Mckay

Reference Book(s):
1. Energy Management Principles: C.B.Smith
2. Efficient Use of Energy : I.G.C.Dryden
3. Energy Economics A.V.Desai
4. Guide book for National Certification Examination for Energy Managers and Energy Auditors (Could be downloaded from www.energymanagertraining.com).

Online Resources:
https://nptel.ac.in/courses/108106022

NARAYANA ENGINEERING COLLEGE:GUDUR								
	ENERGY MANAGEMENT IN BUILDING							R2023
	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. Able to understand the significance of energy management in buildings, Ventilation and Air conditioning aspects, Climate influence, energy usage estimation and technological options for energy management
2. Able to apply the Energy management concepts for building designs
3. Able to analyze different conditions for preparation of efficient energy management system for a building
4. Able to design efficient energy management systems for buildings

Course Outcomes:

CO 1	Understanding the Fundamentals of Energy Use in Buildings Apply the Energy management concepts for building designs **-L2**
CO 2	Analyzing Indoor Environmental Requirements and Their Impact on Energy Use **-L3**
CO 3	Examining the Role of Climate and Environmental Factors in Building Energy Use **-L3**
CO 4	Evaluating Energy Utilization and Heat Transfer in Building Envelopes **L4**
CO 5	Implementing Energy Management Strategies for Buildings **-L5**

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Overview of the Significance of Energy use and Energy Processes in Building

Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications – Concepts of energy efficient building.

MODULE -2: Indoor Environmental Requirement and Management

Thermal comfort – Ventilation and air quality - Air-conditioning requirement - Visual perception – Illumination requirement - Auditory requirement – Concept of sick building syndrome – Significance in energy management in buildings.
MODULE-3: Climate
Solar radiation and their influences - The sun-earth relationship and the energy balance on the earth's surface – Climate – Wind - Solar radiation - Temperature – Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.
MODULE-4: END-USE
Energy utilization and requirements – Lighting and day lighting – End-use energy requirements – Status of energy use in buildings – Estimation of energy use in a building - Heat gain and thermal performance of building envelope – Steady and non steady heat transfer through the glazed window and the wall – Standards for thermal performance of building envelope – Evaluation of the overall thermal transfer – Concepts of window management.
MODULE-5: Energy Management Options
Energy audit and energy targeting – Technological options for energy management – Modifications for energy efficient buildings for Indian conditions. Energy Management for large tower buildings.
Total hours: 54

Term work:
Report submission on energy management planning

Content beyond syllabus:
Energy management techniques

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Internal and external factors on energy use	CO1	https://www.sciencedirect.com/science/article/abs/pii/S0378778819329391
2	Air-conditioning requirement	CO2	https://www.slideshare.net/slideshow/air-condition-requirement-in-hospitals/26890977
3	Energy impact on the shape and orientation of buildings	CO3	https://www.mdpi.com/2075-5309/15/8/1359
4	Estimation of energy use in a building	CO4	https://www.sciencedirect.com/science/article/abs/pii/S0360544223008708
5	Technological options for energy management	CO5	https://www.carbontrust.com/our-work-and-impact/guides-reports-and-tools/digital-technologies-for-energy-management-a-buyers-guide

Text Book(s):
1. 1. Heating and Cooling of Buildings – Design for Efficiency, J. Krieder and A. rabl, McGraw

Hill, 1994.
2. 2. Mechanical and Electrical Equipment for Buildings, S. M. Guinnes and Reynolds, Wiley, 1989.

Reference Book(s):
3. Energy Design for Architects, Shaw, Aee Energy Books, 1991.
4. Energy Conservation in Buildings – Royal Institute of Architecture, Canada.
5. Publication of CBRI, Roorkee – Energy Management in Buildings.

Web Resources:
https://faculty.kashanu.ac.ir/file/download/course/1680378354-keith-moss-energy-management-in-buildings-2-edition-spon-press-2005-.pdf

NARAYANA ENGINEERING COLLEGE:GUDUR								
	ENERGY STORAGE TECHNOLOGIES							R2023
	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives: The course aims to:

1. Introduce the fundamentals of energy storage technologies, especially batteries and supercapacitors.
2. Familiarize students with various primary and secondary battery chemistries and their performance parameters.
3. Explore the latest advancements in battery technologies and their integration in modern energy systems.
4. Understand the role of energy storage in supporting renewable energy systems for grid stability and load management.
5. Enable students to analyze and apply supercapacitor technologies for high-power, short-duration energy applications.

Course Outcomes:

CO 1	Understanding the Basics of Batteries and Their Performance Characteristics -L2
CO 2	Analyzing Primary Battery Types and Their Applications -L3
CO 3	Exploring Advanced Battery Technologies and Their Applications -L4
CO 4	Assessing Energy Storage for Renewable Energy Systems -L4
CO 5	Understanding and Applying Supercapacitors in Energy Storage -L4

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Batteries

Types-battery characteristics - voltage, current, capacity, volumetric energy density, specific energy density, charge rate, cycle life, internal resistance, energy efficiency, shelf life, battery management system, SoC, SoH estimation techniques. Testing of batteries, battery charging method, Factors affecting the battery performance.

MODULE -2: Primary Batteries

Fabrication, performance aspects, packing and rating of alkaline manganese, silver oxide cells. Lithium primary batteries-Lithium/Manganese Dioxide, Lithium/Carbon Monofluoride, Lithium/Thionyl chloride, Lithium/Sulfur Dioxide, Lithium/Iodine, Lithium-Aluminum/Iron Disulfide.
MODULE-3: Advanced Batteries
Advanced Lead Acid Battery -design, performance aspects, Pb-Acid batteries for transportation, nickel-metal hydride batteries, zinc- alkaline batteries, ZEBRA Battery (Na/NiCl2) -NaS Battery-Lithium-Ion Battery-Lithium- Polymer Battery, Li-air batteries, Li-S batteries, Sodium -ion batteries.
MODULE-4: Storage for Renewable Energy Systems
Solar energy, Wind energy, pumped hydro energy, Energy storage in Micro-grid and Smart grid, Energy Management with storage systems, Battery SCADA, Increase of energy conversion efficiencies by introducing energy storage. Superconducting Magnetic Energy Storage (SMES), charging methodologies, Photo galvanic cells, semiconductor solar batteries (SC-SB), thermo-ionic converter s, dye-sensitized solar cells (DSSC).
MODULE-5: Supercapacitors and Fuel Cells
Fundamentals of electrochemical Supercapacitors, electrode and electrolyte interfaces and their capacitances, charge-discharge characteristics, energy/power density, design, fabrication, operation and evaluation, thermal management. Supercapacitors for transportation applications -aqueous and organic based supercapacitors, Pseudo and asymmetric supercapacitors. Advance battery-supercapacitors hybrids for auto, space and marine applications. Fuel Cells working Principle and Construction.
Total hours: 54

Term work:
Report submission on any technology simulation.

Content beyond syllabus:
Simulation on storage technology

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Testing of batteries	CO1	https://batteryuniversity.com/article/battery-test-methods
2	Fabrication of batteries	CO2	https://www.tmaxcn.com/lithium-battery-production-plant_c190?gad_source=1&gad_campaignid=17328322451&gbraid=0AAAADObAJW0AJ45vrLfjxzKhU1Ryf00w&gclid=Cj0KCQjw64jDBhDXARIsABkk8J67PMLij0uCQdoeAz0bPMaRNBFxR8jzu1D7DinaeiJMUQTvCIt9q6UaAkLmEALw_wcB
3	Advanced Lead Acid Battery -design	CO3	https://superiorgraphite.com/applications/lead-acid-batteries/

	4	Photo galvanic cells	CO4	https://www.sciencedirect.com/science/article/abs/pii/0038092X75900523
	5	Fundamentals of electrochemical Supercapacitors	CO5	https://iopscience.iop.org/article/10.1149/2.F02081IF/pdf#:~:text=The%20very%20feature%20of%20an,devices%20compared%20to%20conventional%20capacitors.

Text Book(s):

1. Dell, Ronald M. Rand and David A. J., "Understanding Batteries", Royal Society of Chemistry, 2001.
2. Vladimir S. Bagotsky, Alexander M. Skundin, Yurij VM. Volfkovich., "Electrochemical power sources : Batteries, fuel cells, and supercapacitors", John Wiley & Sons, Inc.,2015.

Reference Book(s):

1. Lindon David, "Handbook of Batteries", McGraw Hill, 2002.
2. Kiehne H. A., "Battery Technology Handbook", Expert Verlag, Renningen Malsheim, 2003.
3. AuliceScibioh M. and Viswanathan B., "Fuel Cells – Principles and Applications", University Press, 2006.
4. A.G.Ter-Gazarian, "Energy Storage for Power Systems", The Institution of Engineering and Technology (IET) Publication, UK, 2011.

Web Resources:

https://energydigital.com/top10/top-10-energy-storage-technologies

NARAYANA ENGINEERING COLLEGE:GUDUR							
	ENERGY SCENARIO AND ENERGY POLICY						R2023
	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives: The student able to:

- Understand the basic concepts of Energy scenario and Energy policy
- Apply the concepts to strengthen energy system
- Analyze the different scenarios around the globe
- Implementation of suitable Energy policy for existing systems

Course Outcomes:

CO 1	Understanding the Global Energy Scenario and Its Impact on Economic Development-L2
CO 2	Analyzing International Energy Policies and Treaties -L3
CO 3	Understanding the Indian Energy Scenario and Policy Framework -L2
CO 4	Evaluating Global Energy Issues and Energy Security -L3
CO 5	Exploring Energy Conservation and Sustainable Development- L4

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Global Energy Scenario

Role of energy in economic development and social transformation - Energy and GDP - GNP and its dynamics - Energy sources and overall Energy demand and availability - Energy consumption in various sectors and its changing pattern - Depletion of energy sources and impact exponential rise in energy consumption on economies of countries

MODULE -2: Energy Polices

International Energy Polices of G-8 Countries - G-20 Countries - OPEC Countries - EU Countries - International Energy Treaties (Rio, Montreal, Kyoto) - INDO-US Nuclear Deal.

MODULE-3: Indian Energy Scenario

Energy resources and Sector wise energy Consumption pattern Impact of energy on economy and development - National and State Level Energy polices and Issues - Status of Nuclear and Renewable Energy and Power Sector reforms. Energy policy 2030

MODULE-4: Energy Policy	
Global Energy Issues - Energy Security - Energy Vision Energy Pricing and Impact of Global Variations Energy Productivity (National and Sector wise productivity).	
MODULE-5: Energy Conservation	
Act – 2001 and its features - Electricity Act – 2003 and its features - Energy Crisis - Future energy options - Need for use of new and renewable energy sources - Energy for Sustainable development.	
Total hours:	54

Term work:
Survey report submission on different policies and their impacts on energy

Content beyond syllabus:
Different Policies

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Global Energy Trends and Projections	CO1	https://www.iea.org/reports/world-energy-outlook-2023
2	Indian Energy Policy and Regulatory Framework	CO2	https://powermin.gov.in/en/content/policies
3	Energy Economics and Pricing Mechanisms	CO3	https://nptel.ac.in/courses/121106014
4	Sustainable Development Goals (SDG 7: Affordable and Clean Energy)	CO4	https://sdgs.un.org/goals/goal7
5	International Energy Agreements and Treaties	CO5	https://unfccc.int/process-and-meetings/the-paris-agreement

Text Book(s):
1. Energy for a sustainable World: Jose Golden berg, Thomas Johan son, AKN. Reddy, Robert Williams (Wiley Eastern).
2. Energy Policy, B.V. Desai (Wiley Eastern)

Reference Book(s):
1. Modeling approach to long term demand and energy implication, J.K.Parikh
2. Energy Policy and Planning, B.Bukhootsow
3. TEDDY Year Book Published by Tata Energy Research Institute(TERI) World Energy Resources, Charles E. Brown, 'International Energy Outlook' - EIA annual Publication
4. BEE Reference book: no. 1/2/3/4

Online Resources:
https://nptel.ac.in/courses/109106161

NARAYANA ENGINEERING COLLEGE:GUDUR								
	WASTE ENERGY MANAGEMENT							R2023
	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

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

1. Understand the classifications and characteristics of various types of waste relevant for energy recovery.
2. Learn and analyze different thermo-chemical and bio-chemical waste-to-energy conversion technologies.
3. Explore energy recovery opportunities from waste plastics and industrial waste heat.
4. Evaluate the environmental and health impacts of various waste-to-energy practices.
5. Study real-world case studies of waste-to-energy (WtE) projects and assess their feasibility and effectiveness.

Course Outcomes:

CO 1	Understanding and Characterizing Different Types of Waste -L2
CO 2	Analyzing Thermo-Chemical Waste Conversion Methods and Their Environmental Impacts -L3
CO 3	Exploring Bio-Chemical Conversion Technologies for Waste to Energy-L4
CO 4	Evaluating Energy Production from Waste Plastics and Waste Heat Recovery-L4
CO 5	Analyzing Environmental and Health Impacts of Waste-to-Energy Conversion and Case Studies-L3

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Characterization Of Wastes

Agricultural residues and wastes including animal wastes; industrial wastes; municipal solid wastes. Waste processing types and composition of various types of wastes; Characterization of Municipal Solid Waste, Industrial waste and Biomedical Waste, waste collection and transportation; waste processing-size reduction, separation; waste management hierarchy, waste minimization and recycling of Municipal solid waste.

MODULE -2: Thermo Chemical Conversion

Incineration, pyrolysis, gasification of waste using gasifiers, environmental and health impacts of incineration; strategies for reducing environmental impacts. Energy production from wastes through incineration, energy production through gasification of wastes, Energy production through pyrolysis and gasification of wastes, syngas utilization.
MODULE-3: Bio-Chemical Conversion
Anaerobic digestion of sewage and municipal wastes, direct combustion of MSW-refuse derived solid fuel, industrial waste, agro residues, anaerobic digestion biogas production, and present status of technologies for conversion of waste into energy, design of waste to energy plants for cities, small townships and villages. Energy production from wastes through fermentation and trans esterification. Cultivation of algal biomass from waste water and energy production from algae, Energy production from organic wastes through anaerobic digestion and fermentation.
MODULE-4: Energy Production From Waste Plastics, Gas Cleanup Waste, Heat Recovery
Concept of conversion efficiency, energy waste, waste heat recovery classification, advantages and applications, commercially viable waste heat recovery devices.
MODULE-5: Environmental and Health Impacts-Case Studies
Environmental and health impacts of waste to energy conversion, Industrial waste management – Hazardous waste management – E-waste management -EV Batteries – Mobile Chargers - case studies of commercial waste to energy plants, waste to energy- potentials and constraints in India, eco- technological alternatives for waste to energy conversions.

Total hours:	54

Term work:
Report submission on various techniques

Content beyond syllabus:
Industry oriented waste energy management

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Waste Classification and Energy Potential	CO1	https://www.unep.org/resources/report/global-waste-management-outlook-2024
2	Thermo-Chemical Conversion (Incineration, Pyrolysis, Gasification)	CO2	https://nptel.ac.in/courses/121106014
3	Anaerobic Digestion and Fermentation	CO3	https://www.ieabioenergy.com/publications/
4	Waste Plastic to Fuel Technology	CO4	https://www.teriin.org/article/waste-plastic-conversion-fuel
5	Environmental & Health Impacts of WtE	CO5	https://www.epa.gov/smm/sustainable-management-materials-non-hazardous-materials-and-waste-management-hierarchy

Text Book(s):

1. Parker, Colin and Roberts, “Energy from Waste – An Evaluation of Conversion Technologies”, Elsevier Applied Science, 1985.
2. Khandelwal, K. C. and Mahdi, S. S., “Biogas Technology - A Practical Hand Book”, Vol. I & amp; II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Reference Book(s):

1. Robert C. Brown, “Thermo-chemical Processing of Biomass: Conversion into Fuels, Chemicals and Power”, John Wiley and Sons, USA, 2019
2. Sergio Capareda, “Introduction to Biomass Energy Conversions”, CRC Press, USA, 2013.
3. Krzysztof J Ptasinski, “Efficiency of Biomass Energy: An Exergy Approach to Biofuels, Power, and Biorefineries, John Wiley & Sons, USA, 2013.
4. Vesilind, P.A., and Worrell W. A, “Solid Waste Engineering, 2nd Ed”, Cengage India, 2016.

Online Resources:

https://nptel.ac.in/courses/121106014

MINORS IN MICROGRID TECHNOLOGY (EEE Department)

S. No.	Course Code	Course Title	L	T	P	C
1		Futuristic Power Systems	3	0	0	3
2		Power Electronic Converters for Energy Sources	3	0	0	3
3		Microgrid Power and Control Architecture	3	0	0	3
4		Microgrid System Design	3	0	0	3
5		Analysis of Smart Grid Systems	3	0	0	3
6		Project in Micro Grid Technology	0	0	6	3

NARAYANA ENGINEERING COLLEGE:GUDUR							
	FUTURISTIC POWER SYSTEMS						R2023
	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. To explore the state of the art and future trends in power systems.
2. To understand the technical, economic and social challenges in power system evolution.
3. To realize the role and importance of Microgrids if futuristic power systems.

Course Outcomes: Upon successful completion of this course, the learner will be able

CO 1	To solicit the importance of large scale renewable energy integration with existing grid infrastructure.L1
CO 2	To understand the importance and utility of Energy storage systems in futuristic power systems. L2
CO 3	To explore large scale micro-grid deployment with RES and ESS integration. L3
CO 4	To understand the role of communication and IT Infrastructure in power system and related challenges. L2
CO 5	To explore the potential of Microgrids and its importance in Indian context. L3

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction

Present status of worldwide scenario of electricity generation, transmission and distribution; Energy infrastructure-Resilience and Security; Social, Technical and economic challenges; Major trends driving power system evolution; State of the art technologies in power system.

MODULE -2: Renewable Energy Integration

Review of renewable energy (RE) resources and systems: Solar- PV, Solar Thermal, Wind, Biomass, Micro-hydro and Fuel Cell, comparison of various RE resources; Renewable Energy Policies and present status of integration with existing grid; Large scale integration of renewable energy-Technical challenges, enabling technologies, International requirements; Renewable energy forecasting

MODULE-3: Energy Storage Systems (ESS)

Review of energy storage components: Battery, VRB, Ultra-capacitor, Fuel Cells, Pumped Hydro-Storage and flywheels, comparison of ESS technologies; Importance of ESS in futuristic power systems; Aggregated ESS, Distributed ESS; Applications of ESS: Energy Management (Load Leveling and Peak Shifting), Fluctuation Suppression (Intermittency Mitigation), Uninterruptible Power System Low-Voltage Ride Through; Placement of the ESS to Improve Power Quality, Voltage Regulation Using ESS, ESS as Spinning Reserve.
MODULE-4: Micro-grid and Smart-grid
Micro-grid evolution: Micro-grid concept, importance in futuristic power system, basic architectures and control, objectives and state of the art technologies; Microgrid as a building block of Smart-grid; Smart-grid concept, Smart Grid versus conventional electrical networks, Smart-grid infrastructure, Smart Grid communication system and its cyber security, International standard IEC 61850 and its application to Smart-grid; Microgrids /smart grid and Electric Vehicles integration. Technical, Economic, Environmental and Social Benefits of Microgrid Operation. Microgrids for Rural Electrification, Review of Microgrid Best Practices through Case Studies: Strategic Planning, Operations: Commercial and Financial Considerations; Technical and Social Context.
MODULE-5: Communication and IT infrastructure
Requirements of Communication and IT infrastructure in futuristic power systems: various communication protocols, comparison of performance; IEEE standard: IEEE 802.11 Mesh Networking, IEEE 802.15.4-Wireless Sensor Networks; Communications Technologies for Smart metering; Cyber security issues and mitigation techniques.

Total hours:	54

Term work:
Survey report submission

Content beyond syllabus:
Restructured Power system

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Large-scale Renewable Energy Integration with Grid	CO1	https://nptel.ac.in/courses/108105159
2	Energy Storage Systems (ESS) in Modern Power Grids	CO2	https://www.coursera.org/learn/energy-storage
3	Microgrids with Renewable Energy and ESS Integration	CO3	https://ieeexplore.ieee.org/courses/details/71541
4	Communication and IT Infrastructure in Smart Grids	CO4	https://nptel.ac.in/courses/108105159
5	Microgrids in the Indian Context –	CO5	https://www.teriin.org/article/microgrids-rural-electrification-india

		Policies & Case Studies		

Text Book(s):

1. Microgrids Architectures and Control Edited by Nikos Hatziargyriou, IEEE and Wiley, 2014
2. Energy Storage for Sustainable Microgrid by David Wenzhong Gao, Elsevier, 2015
3. Introduction to the Smart Grid- Concepts, Technologies and Evolution by Salman K. Salman, IET, 2017
4. Energy Storage Systems and Components by Alfred Rufer, CRC Press, 2018

Reference Book(s):

1. Energy Efficiency and Renewable Energy Handbook Edited by D. Yogi Goswami and Frank Kreith, 2nd Edition- 2016, CRC
2. Clean Energy Microgrids, Edited by Shin'ya Obara and Jorge Morel IET, 2017
3. Hybrid-Renewable Energy Systems in Microgrids- Integration, Developments and Control edited by Hina Fathimaby *et al*., Elsevier WoodHead Publishing, 2018
4. Smart Microgrids: Lessons from Campus Microgrid Design and Implementation edited by Hassan Farhangi, CRC Press 2017

Online Resources:

1. NPTEL Web Course on: DC Microgrid And Control System Prof. Avik Bhattacharya, IIT Roorkee

Web Resources:

1. NPTEL Web Course on Electronics and Distributed Generation Dr. Vinod John Department of Electrical Engineering IISc Bangalore
2. NPTEL Web Course on Introduction to Smart Grid, PROF. N.P. PADHY Department of Electrical Engineering IIT Roorkee PROF. PREMALATA JENA Department of Electrical Engineering
3. NPTEL Web Course on Electric vehicles and Renewable energy, Prof. Ashok Jhunjhunwala, Prof. Prabhjot Kaur, Prof. Kaushal Kumar Jha and Prof. L Kannan, IIT Madras

NARAYANA ENGINEERING COLLEGE:GUDUR							
	POWER ELECTRONIC CONVERTERS for ENERGY SOURCES						R2023
	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. To illustrate the design philosophies used in the domain of microgrid power converters.
2. To explore the control implementations in power converters for voltage, current and power regulation for various DC and AC energy sources

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

CO 1	Select and size various passive and active components for power converters L3
CO 2	Design power converters used with DC energy resources with their control implementation L5
CO 3	Design power converters used with AC energy resources with their control implementation L5
CO 4	Understand the design considerations of power conditioning unit for ESS, SPV and Wind applications. L2
CO 5	Understand the design and selection aspects of various auxiliary systems and components used in PCUs L2

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Selection of components for Power Electronics Converters (PEC)

Selection and Sizing of capacitors and magnetic components for PECs, design of Magnetic Components; Selection and sizing of Power Devices, Commonly used software tools for selection and sizing; Heatsink- selection and sizing.

MODULE -2: Design and Control of DC-DC Converters

Design of Buck and Boost converters, Design examples; Design of Bidirectional Converters. Design of gate driver circuits; Review of DC-DC converter modelling; Closed loop PI controller design for buck and boost converters; Current control mode and voltage control mode.

MODULE-3: Design and Control of DC-AC converters

Design of Inverter for standalone applications; Design of grid connected Inverter with different grid synchronization strategies- ZCD, PLL; Strategies for Control of voltage, current and power output.
MODULE-4: Design of PCU for SPV and Wind Application
Various topologies of Power Converter Unit (PCU) for SPV and Wind energy systems. Design considerations of PCU for SPV and Wind energy Systems and Design Examples.
MODULE-5: Design of PCU for ESS Applications and Design of Auxiliary System and Interfaces
Design consideration for BDC converter based PCU for batteries and Ultra-capacitors. Design of current and voltage sensor interfaces; Design considerations for auxiliary power supplies; Design of protection and snubber components: Introduction to Digital Signal Processors (DSP) and microcontroller interfaces.

Total hours:	54

Term work:
MATLAB Simulation based report on any converter

Content beyond syllabus:
Multilevel converters applications

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Design and Simulation of Power Converters in MATLAB/Simulink	CO1	https://matlabacademy.mathworks.com/details/simulink-onramp/getting-started
2	MPPT Techniques for PV Systems (Perturb & Observe, Incremental Conductance)	CO2	https://www.coursera.org/learn/solar-energy
3	Battery Management Systems and Power Conditioning for Energy Storage	CO3	https://www.edx.org/course/energy-storage-systems
4	Gate Driver Design and Protection for Power Electronics	CO4	https://www.ti.com/power-management/power-supply-design/seminars.html
5	IGBTs, MOSFETs and SiC Devices for High-Efficiency Converters	CO5	https://training.infineon.com/elearning

Text Book(s):

1. Power Electronic Converters for Microgrids by Suleiman M. Sharkh, Mohammad A. Abusara, Georgios I. Orfanoudakis Babar Hussain, IEEE and Wiley, 2014
2. Control Circuits In Power Electronics Practical Issues In Design And Implementation

Edited by Miguel Castilla, IET, 2016
3. Control and Dynamics in Power Systems and Microgrids by Lingling Fan, CRC Press, 2017
4. Integrated Power Electronic Converters and Digital Control, by Ali Emadi, Alireza Khaligh, Zhong Nie, and Young Joo, Lee 2009, CRC Press.

Reference Book(s):

1. Cooperative Synchronization in Distributed Microgrid Control by Ali Bidram, Vahidreza Nasirian Ali Davoudi, and Frank L. Lewis, Springer, 2017
2. Hybrid-Renewable Energy Systems in Microgrids- Integration, Developments and Control edited by Hina Fathimaby et al., Elseiver WoodHead Publishing, 2018
3. Smart Microgrids- Lessons from Campus Microgrid Design and Implementation edited by Hassan Farhangi, CRC Press 2017
4. Energy Storage Systems and Components by Alfred Rufer, CRC Press, 2018
5. Microgrids Design and Implementation edited by Antonio Carlos Zambroni de Souza and Miguel Castilla, Springer, 2019
6. Microgrids Architectures and Control Edited by Nikos Hatziargyriou, IEEE and Wiley, 2014
7. Energy Storage for Sustainable Microgrid by David Wenzhong Gao, Elsevier, 2015

Online Resources:

https://www.monolithicpower.com/en/learning/mpscholar/power-electronics/power-electronic-applications/renewable-energy-systems?srsltid=AfmBOory6c9UmTzkpXM2QvBixSuV4AiOAPei6Wl-BSdYArw3EQE_724m

NARAYANA ENGINEERING COLLEGE:GUDUR							
	MICROGRID POWER and CONTROL ARCHITECTURE						R2023
	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. To study various power and control architectures adopted in DC and AC Microgrids.
2. To explore various control strategies used in power control
3. To take insight into operations stability and protection issues related to Microgrids

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

CO 1	Understand various types Microgrids based on applications, power and control architecture. L2
CO 2	Illustrate various power control strategies adopted in DC, AC and Hybrid Microgrids L3
CO 3	Compare and contrast various control architectures used DC, AC and Hybrid Microgrids also various aspects related to stability in Microgrids L4
CO 4	Illustrate the various operational challenges in Microgrids L3
CO 5	Comprehend the various aspects related to the stability in Microgrids L4

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Microgrid Power Architecture

Types of Microgrid system, AC and DC and Hybrids Microgrids, Application based Suitability of Microgrid type; Review of power architecture of various Microgrids deployed world-wide. Comparison of various Microgrid power architectures.

MODULE -2: AC Microgrid and Control Architecture

Black-start operation, Grid Synchronisation- various Grid synchronization methods, Grid forming and grid following operations; Power Control- Real and reactive power control in AC Microgrid, simple droop control and other variants of droop control, Unit Power Flow Control, Feeder power flow control and Mixed mode control, source optimization; Centralized, decentralised, distributed and hierarchical control architecture, Local and system / supervisory level control strategies, Multi Agent System (MAS) Based Control; Control approaches used in AC Microgrids deployed worldwide. Microgrid standards IEEE 1547 series. Communication in

AC Microgrids
MODULE-3: DC Microgrid and Control Architecture
Power sharing in DC Microgrids, source optimization; Control approaches: Centralized, decentralised, distributed and hierarchical control architecture. Control approaches used in hybrid Microgrids. Communication in DC/Hybrid Microgrids
MODULE-4: Operational Control in Microgrids
Energy management in Microgrids, coordinated control, load management, grid synchronisation and islanding, Anti-islanding schemes; Various Architectural and Operational Challenges in Microgrid, Optimal operation of Microgrids.
MODULE-5: Microgrid Stability & Protection
Steady-state and dynamic stability in AC and DC Microgrids, Methods to improve the stability in Microgrids; introduction to small signal and large signal stability analysis in Microgrids. Fault scenarios in DC and AC Microgrids, Protection in DC and AC Microgrids, adaptive protection, Fault current source (FCS) based protection; Protection challenges in islanded and autonomous modes of operation and ways to mitigate.
Total hours: 54

Term work:
Report submission on various control algorithms

Content beyond syllabus:
Advanced control strategies

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Energy Management Systems in Microgrids	CO1	https://www.nrel.gov/docs/fy20osti/75414.pdf
2	Control Strategies for AC and DC Microgrids	CO2	https://ieeexplore.ieee.org/document/9397127
3	Communication Architectures in Microgrid Control	CO3	https://www.sciencedirect.com/science/article/pii/S2352484721000764
4	Modeling and Simulation of Microgrids using MATLAB/Simulink	CO4	https://www.youtube.com/playlist?list=PL3o9D2vF2tv8lgChSWhLz6iFzQ9dDRUld
5	Cybersecurity in Microgrid Control Systems	CO5	https://ieeexplore.ieee.org/document/8403806

Text Book(s):

1. Microgrids Design and Implementation edited by Antonio Carlos Zambroni de Souza and Miguel Castilla, Springer, 2019
2. Microgrids Architectures and Control Edited by Nikos Hatziargyriou, IEEE and Wiley,

2014
3. Cooperative Synchronization in Distributed Microgrid Control by Ali Bidram, Vahidreza Nasirian Ali Davoudi, and Frank L. Lewis, Springer, 2017
4. Control Circuits In Power Electronics Practical Issues In Design And Implementation Edited by Miguel Castilla, IET, 2016

Reference Book(s):

1. Control and Dynamics in Power Systems and Microgrids by Lingling Fan, CRC Press, 2017
2. Hybrid-Renewable Energy Systems in Microgrids- Integration, Developments and Control edited by Hina Fathimaby et al., Elseiver WoodHead Publishing, 2018
3. Urban DC Microgrid Intelligent Control and Power Flow Optimization by Manuela Sechilariu and Fabrice Locment, 2016 Elsevier
4. Integrated Power Electronic Converters and Digital Control, by Ali Emadi, Alireza Khaligh, Zhong Nie, and Young Joo, Lee 2009, CRC Press.
5. Island Power Systems by Lukas Sigrist, Enrique Lobato, Francisco M. Echavarren Ignacio Egido, and Luis Rouco, CRC Press, 2016

Online Resources:

1. NPTEL Web Course on: DC Microgrid and Control System Prof. Avik Bhattacharya, IIT Roorkee
2. NPTEL Web Course on Electronics and Distributed Generation Dr. Vinod John Department of Electrical Engineering IISc Bangalore

Web Resources:

1. NPTEL Web Course on Introduction to Smart Grid, PROF. N.P. PADHY Department of Electrical Engineering IIT Roorkee PROF. PREMALATA JENA Department of Electrical Engineering
2. NPTEL Web Course on Electric vehicles and Renewable energy, Prof. Ashok Jhunjhunwala, Prof. Prabhjot Kaur, Prof. Kaushal Kumar Jha and Prof. L Kannan, IIT Madras

NARAYANA ENGINEERING COLLEGE:GUDUR								
	MICROGRID SYSTEM DESIGN							R2023
	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. To illustrate the design philosophies used in the domain of Microgrid.
2. To explore the selection of power and control architecture of Microgrids
3. To study the design aspects of AC Microgrid, DC Microgrid and their auxiliary systems

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

CO 1	Select and size various Microgrid energy resources L3
CO 2	Select the power and control architecture of the Microgrid L3
CO 3	Select and design the Microgrid's communication architecture. L3
CO 4	Illustrate the design aspects DC and AC Microgrids with their control strategies. L4
CO 5	Illustrate the implementation of the Microgrid islanding detection and anti-islanding scheme/ blackstart operation L4

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Selection/ Sizing of Microgrid Energy Resources

Factors affecting the selection and sizing of energy resources for Microgrid applications, dependency on type of loads connected, Selection/ Sizing: Renewable energy resources, Energy Storage components. Hybrid combination of RES and ESS.

MODULE -2: Selection of Power and Control Architecture

Factors affecting the selection of Microgrid power and control architecture; Design Consideration for control implementation; Sensors: Selection of sensors and design of sensor Interfaces, design of control Interfaces. Design considerations for DSP/ Microcontroller interfaces.

MODULE-3: Selection and Design of Communication Architecture

Design considerations for selection of communication network for Microgrid applications; Design and implementation of communication links/ interfaces. Microg4controller programming for Data transfer on communication network. Practical design considerations for Communication networks.

MODULE-4: Design of DC and AC Microgrid	
Design DC Power Conditioning Units for RES and ESS, Unidirectional and Bidirectional Converter design, implementation of Control loop with DSP; Programming for Power sharing and Energy Management algorithms; Design of Protection system for DC Microgrid Design AC Power Conditioning Units for RES and ESS, Unidirectional and Bidirectional Converter design, implementation of Control loop with DSP; Grid Synchronization. Programming for Power sharing and Energy Management algorithms; Design of Protection system for AC Microgrid.	
MODULE-5: Islanding in Microgrids	
Selection and implementation of Islanding detection and anti-islanding scheme; Black- start and Autonomous operations in Microgrids	
Total hours:	54

Term work:
Report submission on various design techniques of microgrid

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Distributed Energy Resource (DER) Sizing and Optimization	CO1	https://nptel.ac.in/courses/108/108/108108122/
2	Microgrid Control Strategies (Primary, Secondary, Tertiary)	CO2	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-334-power-electronics-spring-2007/lecture-notes/
3	Microgrid Communication and Cybersecurity	CO3	https://nptel.ac.in/courses/108/108/108108148/
4	AC vs DC Microgrids – Architecture and Applications	CO4	https://www.youtube.com/watch?v=Va7A7mXXFeI
5	Islanding Detection and Black Start Techniques	CO5	https://ieeexplore.ieee.org/document/8465990

Text Book(s):

1. Microgrids Design and Implementation edited by Antonio Carlos Zambroni de Souza and Miguel Castilla, Springer, 2019
2. Microgrids Architectures and Control Edited by Nikos Hatziargyriou, IEEE and Wiley, 2014
3. Power Electronic Converters For Microgrids by Suleiman M. Sharkh, Mohammad A. Abusara, Georgios I. Orfanoudakis Babar Hussain, IEEE and Wiley, 2014

Reference Book(s):

1. Energy Storage for Sustainable Microgrid by David Wenzhong Gao, Elsevier, 2015
2. Cooperative Synchronization in Distributed Microgrid Control by Ali Bidram, Vahidreza Nasirian Ali Davoudi, and Frank L. Lewis, Springer, 2017
3. Energy Efficiency and Renewable Energy Handbook Edited by D. Yogi Goswami and

Frank Kreith, 2nd Edition- 2016, CRC
4. Control Circuits In Power Electronics Practical Issues In Design And Implementation Edited by Miguel Castilla, IET, 2016
5. Hybrid-Renewable Energy Systems in Microgrids- Integration, Developments and Control edited by Hina Fathimaby et al., Elseiver WoodHead Publishing, 2018
6. Urban DC Microgrid Intelligent Control and Power Flow Optimization by Manuela Sechilariu and Fabrice Locment, 2016 Elsevier
7. Integrated Power Electronic Converters and Digital Control, by Ali Emadi, Alireza Khaligh, Zhong Nie, and Young Joo, Lee 2009, CRC Press.

Online Resources:

1. https://nptel.ac.in/courses/108/108/108108122/
2. https://nptel.ac.in/courses/108/108/108108148/

Web Resources:

1. https://ieeexplore.ieee.org/document/8465990

NARAYANA ENGINEERING COLLEGE:GUDUR							
	ANALYSIS of SMART GRID SYSTEMS						R2023
	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	54	3	30	70	100

Pre-requisite:

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

1. Understand the fundamental architecture and functionalities of smart grids.
2. Learn various modeling and simulation tools for analyzing smart grid systems.
3. Study the operational strategies and performance evaluation of smart grids.
4. Investigate the role and impact of Distributed Generation (DG) in smart grid environments.
5. Explore planning and design strategies for integrating DG with smart grid infrastructure.

Course Outcomes:

CO 1	Understand the analysis and planning of smart grids L2
CO 2	Evaluate the tools for modeling and analysis of smart grid L3
CO 3	Analyze and synthesize the smart grid operation L4
CO 4	Assess the influence of distributed generation in smart grid on power systems L4
CO 5	Understand the analysis and planning of Distributed Generation in Smart Grid L2

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction

Conventional power systems and Smart grid, definition of smart grid, need for smart grid, Smart grid architecture, smart grid domains, enablers of smart grid, Communication architecture and protocols for smart grid, smart grid priority standards and regulation, smart-grid activities in India.

MODULE -2: Systems of non linear equations

Fixed point iteration, Newton Raphson Iteration, Continuation methods, Power system application: power flow, regulating transformer, Fast decoupled load flow, PV curves and continuation power flow, three phase power flow

MODULE-3: Smart Grid Security analysis

Concept of security, Security analysis and monitoring, factors affecting power system security, detection of network problems, an overview of security analysis. Contingency analysis for

generator and line outages by Interactive Linear Power Flow (ILPF) method, Fast decoupled inverse Lemma based approach, network sensitivity factors, Contingency selection, concentric relaxation and bounding.
MODULE-4: Smart Grid Operation and Planning
Economic Dispatch, Optimal Power Flow, Load forecasting, Operation of smart grid system, Load Dispatch Centre functions, preventive, Emergency and Restorative, control objectives of a smart distribution system, Operational bottlenecks in smart grid. Planning Aspects of smart grid, Planning and operation Standards.
MODULE-5: Distributed Generation in Smart Grid
Renewable-based Distributed generations, Energy Storage Technologies, Modeling, Control of energy storage system, Short- mid -long term application of energy storage system in smart grids.
Total hours: 54

Term work:
Report submission on different types of analysis in smart grid

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Smart Grid Architecture and Planning	CO1	https://nptel.ac.in/courses/108/108/108108148/
2	Modeling Tools for Smart Grids (Simulink, OpenDSS, GridLAB-D)	CO2	https://sourceforge.net/projects/electricdss/
3	Smart Grid Operation and Demand Response	CO3	https://www.coursera.org/learn/smart-grid
4	Distributed Generation (DG) Integration in Smart Grids	CO4	https://nptel.ac.in/courses/108/107/108107113/
5	Cybersecurity and Communication in Smart Grids	CO5	https://smartgrid.ieee.org/

Text Book(s):

1. Muhammad Kamran, Fundamentals of Smart Grid Systems, Academic Press, 2022
2. Mariesa L Crow, Computetional methods for Electric Power Systems, CRC Press, NW, 2016, 3rd Edition.
3. Francisco D´ıaz-Gonz´alez, Andreas Sumper and Oriol Gomis-Bellmunt, Energy Storage in Power Systems, John Wiley & Sons Ltd, 2016

Reference Book(s):

1. Prabha Kundur, Power System Stability and Control, McGraw Hill Education, 2006, 1st Edition.
2. Math H. J. Bollen, Fainan Hassan, Integration of Distributed Generation in the Power System, Wiley, 2011
3. A. Mahaboob Subahani, G. R. Kanagachidambaresan, M. Kathiresh, Integration of Renewable Energy Sources with Smart Grid, Willey, 2021
4. J. Ekanayake, N. Jenkins, K. Liyanage, J. Wu, A. Yokoyama, Smart Grid: Technology and Applications, John Wiley & Sons, 2015, 1st Edition.
5. Ali Keyhani, Design of smart power grid renewable energy systems, Wiley, 2019, 3rd Edition. Other

Online Resources:

https://nptel.ac.in/courses/108/104/108104052/

OPEN ELECTIVES (Offered by EEE to other Departments)

S. No.	Category	Course Code	Course Title	L	T	P	C
1	OE-I		Electrical Safety Practices and Standards	3	0	0	3
2	OE-II		Renewable Energy Sources	3	0	0	3
3	OE-III		Smart Grid Technologies	3	0	0	3
4	OE-IV		Electric Vehicles	3	0	0	3

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	ELECTRICAL SAFETY PRACTICES AND STANDARDS (OE-I)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. **To provide foundational knowledge of electrical hazards, shock prevention, and personal safety**, emphasizing awareness and risk mitigation techniques.
2. **To introduce various electrical safety components and protective devices**, focusing on their roles in preventing electrical accidents.
3. **To analyze grounding and bonding practices**, enabling students to design and evaluate effective earthing systems for safety assurance.
4. **To impart practical knowledge of safety procedures and practices** in residential, commercial, and industrial electrical installations and operating environments.
5. **To familiarize students with major electrical safety standards and regulations**, such as IEEE, NEC, OSHA, and Indian Electricity Rules, ensuring students understand legal and professional responsibilities.

Course Outcomes:

CO 1	Understanding the Fundamentals of Electrical Safety -L2
CO 2	Identifying and Applying Safety Components -L3
CO 3	Analyzing Grounding Practices and Electrical Bonding L3
CO 4	Applying Safety Practices in Electrical Installations and Environments- L4
CO 5	Evaluating Electrical Safety Standards and Regulatory Compliance -L5

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction To Electrical Safety

Fundamentals of Electrical safety-Electric Shock- physiological effects of electric current - Safety requirements –Hazards of electricity- Arc - Blast- Causes for electrical failure.

MODULE -2: Safety Components

Introduction to conductors and insulators- voltage classification -safety against over voltages-safety against static electricity-Electrical safety equipment‘s - Fire extinguishers for electrical safety.
MODULE-3: Grounding
General requirements for grounding and bonding- Definitions- System grounding-Equipment grounding - The Earth - Earthing practices- Determining safe approach distance-Determining arc hazard category.
MODULE-4: Safety Practices
General first aid- Safety in handling hand held electrical appliances tools- Electrical safety in train stations-swimming pools, external lighting installations, medical locations-Case studies.
MODULE-5: Standards For Electrical Safety
Electricity Acts- Rules & regulations- Electrical standards-NFPA 70 E-OSHA standards-IEEE standards-National Electrical Code 2005 – National Electric Safety code NESC-Statutory requirements from electrical inspectorate

Total hours:	54

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Physiological effects of electric current	CO1	https://www.wikilectures.eu/w/Physiological_effect_of_electric_current
2	Electrical safety equipment‘s	CO2	https://www.powerandcables.com/product/electrical-safety/
3	Earthing practices	CO3	https://www.geeksforgeeks.org/electrical-engineering/earthing/
4	Electrical safety in train stations	CO4	news.railanalysis.com/article-electrical-safety-in-railway-system/
5	National Electric Safety codes	CO5	https://en.wikipedia.org/wiki/National_Electrical_Safety_Code

Text Book(s):

1. Massimo A.G.Mitolo, ―Electrical Safety of Low-Voltage Systems‖, McGraw Hill, USA, 2009.
2. Mohamed El-Sharkawi, ―Electric Safety - Practice and Standards‖, CRC Press, USA, 2014

Reference Book(s):

1. Kenneth G.Mastrullo, Ray A. Jones, ―The Electrical Safety Program Book‖, Jones and Bartlett Publishers, London, 2nd Edition, 2011.
2. Palmer Hickman, ―Electrical Safety-Related Work Practices‖, Jones & Bartlett Publishers, London, 2009.
3. Fordham Cooper, W., ―Electrical Safety Engineering‖, Butterworth and Company, London, 1986.
4. John Cadick, Mary Capelli-Schellpfeffer, Dennis K. Neitzel, ―Electrical Safety Hand book, McGraw-Hill, New York, USA, 4th edition, 2012.

Online Resources: https://www.services.bis.gov.in/php/BIS_2.0/BISBlog/national-electrical-code-of-india-2023/
Web Resources: https://www.esfi.org/workplace-safety/industry-codes-regulations/the-national-electrical-code-nec/

NARAYANA ENGINEERING COLLEGE:GUDUR								
III-B.Tech	RENEWABLE ENERGY SOURCES (OE-II)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. **To introduce the fundamental principles and operating mechanisms** of various renewable energy sources such as solar, wind, geothermal, biomass, ocean, and fuel cells.
2. **To provide knowledge on resource assessment and site selection criteria** for effective deployment of renewable energy systems.
3. **To analyze the influencing factors affecting energy conversion and measurement** in different renewable technologies.
4. **To enable students to design and evaluate solar PV and wind energy systems**, including the orientation, configuration, and turbine types.
5. **To encourage the application of renewable energy technologies** in power generation and to promote sustainability and energy security.

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

CO 1	Understand principle operation of various renewable energy sources. L1
CO 2	Identify site selection of various renewable energy sources. L2
CO 3	Analyze various factors affecting on solar energy measurements, wind energy conversion techniques, Geothermal, Biomasss, Tidal Wave and Fuel cell energies L3
CO 4	Design of Solar PV modules and considerations of horizontal and vertical axis Wind energy systems. L5
CO 5	Apply the concepts of Geo Thermal Energy, Ocean Energy, Bio mass and Fuel Cells for generation of power. L4

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Solar Energy

Solar radiation - beam and diffuse radiation, solar constant, Sun at Zenith, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

MODULE -2: PV Energy Systems

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Solar PV modules from solar cells, mismatch in series and parallel connections design and structure of PV modules, Electrical characteristics of silicon PV cells and modules, Stand-alone PV system configuration, Grid connected PV systems.
MODULE-3: Wind Energy
Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades; wind data and energy estimation and site selection considerations.
MODULE-4: Geothermal Energy
Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.
MODULE-5: Miscellaneous Energy Technologies
Ocean Energy: Tidal Energy-Principle of working, Operation methods, advantages and limitations. Wave Energy-Principle of working, energy and power from waves, wave energy conversion devices, advantages and limitations. **Bio mass Energy:** Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration **Fuel cell:** Principle of working of various types of fuel cells and their working, performance and limitations.
Total hours: 54

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Sun at Zenith angle	CO1	https://sacs.aeronomie.be/info/sza.php
2	The PV effect in crystalline silicon basic principles	CO2	https://www.geeksforgeeks.org/physics/photovoltaic-cell/
3	Basic components of wind energy conversion systems	CO3	https://www.herofutureenergies.com/blog/wind-energy-systems/
4	Advantages, disadvantages and application of geothermal energy	CO4	https://www.greenmatch.co.uk/blog/2014/04/advantages-and-disadvantages-of-geothermal-energy
5	Biogas generation plants in INDIA	CO5	https://www.globalmethane.org/documents/16.Ag2.1.Dhussa.pdf

Text Book(s):

1. G. D. Rai, ―Non-Conventional Energy Sources‖, 4th Edition, Khanna Publishers, 2000.

2. Chetan Singh Solanki ―Solar Photovoltaics fundamentals, technologies and applications‖ 2nd Edition PHI Learning Private Limited. 2012.

Reference Book(s):

1. Stephen Peake, ―Renewable Energy Power for a Sustainable Future‖, Oxford International Edition, 2018.
2. S. P. Sukhatme, ―Solar Energy‖,3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.
3. B H Khan , ― Non-Conventional Energy Resources‖, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
4. S. Hasan Saeed and D.K.Sharma,―Non-Conventional Energy Resources‖,3rd Edition, S.K.Kataria& Sons, 2012.
5. G. N. Tiwari and M.K.Ghosal, ―Renewable Energy Resource: Basic Principles and Applications‖, Narosa Publishing House, 2004.

Online Resources:

1. https://nptel.ac.in/courses/103103206

Web Resources:

1. https://nptel.ac.in/courses/108108078

NARAYANA ENGINEERING COLLEGE:GUDUR								
IV-B.Tech	SMART GRID TECHNOLOGIES (Open Elective- III)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives:

1. **To introduce the concept, need, and evolution of smart grids** in the context of modern power systems.
2. **To impart knowledge on wide-area monitoring systems (WAMS)** and synchrophasor technologies for enhanced grid situational awareness.
3. **To explain smart metering and Advanced Metering Infrastructure (AMI)** for efficient energy management and consumer participation.
4. **To analyze the role of Information and Communication Technology (ICT)** in the development and operation of smart grids.
5. **To enable students to design and implement smart grid applications** with a focus on cybersecurity, interoperability, and automation.

Course Outcomes:

CO 1	Understanding the Concept and Evolution of Smart Grids. L2
CO 2	Analyzing Wide Area Monitoring System and Synchrophasor Technology. L4
CO 3	Applying Smart Metering and Advanced Metering Infrastructure (AMI) Concepts. L3
CO 4	Evaluating Information and Communication Technology (ICT) Systems in Smart Grids. L5
CO 5	Designing Smart Grid Applications and Cybersecurity Measures. L6

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction to Smart Grid

Evolution of Electric Grid – Need for Smart Grid – Difference between conventional & smart grid – Overview of enabling technologies – International experience in Smart Grid deployment efforts – Smart Grid road map for India – Smart Grid Architecture.

MODULE -2: Wide Area Monitoring System

Fundamentals of Synchro phasor Technology – concept and benefits of Wide Area Monitoring System – Structure and functions of Phasor Measuring Unit (PMU) and Phasor Data Concentrator (PDC) – Road Map for Synchrophasor applications (NAPSI) – Operational experience and Blackout analysis using PMU - Case study on PMU.
MODULE-3: Smart Meters
Features and functions of Smart Meters – Functional specification – category of Smart Meters – Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) drivers and benefits – AMI protocol – Demand Side Integration: Peak load, Outage and Power Quality management.
MODULE-4: Information and Communication Technology
Overview of Smart Grid Communication system – Modulation and Demodulation Techniques: Radio Communication – Mobile Communication – Power Line Communication – Optical Fibre Communication – Communication Protocol for Smart Grid.
MODULE-5: Smart Grid Applications and Cyber Security
Applications : Overview and concept of Renewable Integration – Introduction to distributed generation - Role of Protective Relaying in Smart Grid – House Area Network – Advanced Energy Storage Technology: Flow battery – Fuel cell – SMES – Super capacitors – Plug – in Hybrid electric Vehicles - Cyber Security: Security issues in DG, Distribution Automation, AMI, Electric Vehicle Management Systems – Approach to assessment of smart grid cyber security risks – Methodologies. Cyber Security requirements – Smart Grid Information Model.

Total hours:	54

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Difference between conventional & smart grid	CO1	https://www.tutorialspoint.com/difference-between-conventional-grid-and-smart-grid
2	Structure and functions of Phasor Measuring Unit	CO2	https://en.wikipedia.org/wiki/Phasor_measurement_unit
3	Category of Smart Meters	CO3	https://www.vvdntech.com/blog/understanding-smart-meters-global-standards-types-benefits-and-challenges/
4	Overview of Smart Grid Communication system	CO4	https://www.nist.gov/programs-projects/smart-grid-communications-0
5	Role of Protective Relaying in Smart Grid	CO5	https://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1003&context=ece_present

Text Book(s):

1. James Momoh, "SMART GRID : Fundamentals of Design and Analysis", John Wiley and Sons, New York, 2012.

2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & Sons, New Jersey, 2012.

Reference Book(s):

1. Power Grid Corporation of India Limited, "Smart Grid Primer", 1st Edition, Power Grid Corporation of India Limited, Bangalore, India, 2013.
2. Fereidoon.P.Sioshansi, "Smart Grid – Integrating Renewable, Distributed and Efficient Energy", 1st Edition, Academic Press, USA, 2011.
3. Stuart Borlase, "Smart Grids: Infrastructure, Technology and Solutions", 1st Edition, CRC Press Publication, England, 2013.
4. Phadke A G, Thorp J S, "Synchronized Phasor Measurements and Their Applications", 1st Edition, Springer, Newyork, 2012.

Online Resources:

https://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1003&context=ece_present

Web Resources:

https://www.ti.com/video/6044129349001

NARAYANA ENGINEERING COLLEGE:GUDUR								
IV-B.Tech	ELECTRIC VEHICLES (Open Elective -IV)							R2023
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	54	3	30	70	100

Pre-requisite:

Course Objectives: To make the student

1. Remember and understand the differences between conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs.
2. Analyze various EV configurations, parameters of EV systems and Electric vehicle dynamics.
3. Analyze the basic construction, operation and characteristics of fuel cells and battery charging techniques in HEV systems.
4. Design and analyze the various control structures for Electric vehicle.

Course Outcomes: Student will be able to

CO 1	To understand and differentiate between Conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs. -L2
CO 2	Understand Various dynamics of Electric Vehicles. -L2
CO 3	To remember and understand various configurations in parameters of EV system and dynamic aspects of EV. -L1
CO 4	To analyze fuel cell technologies in EV and HEV systems. -L3
CO 5	To analyze the battery charging and controls required of EVs. -L3

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1: Introduction to EV Systems and Energy Sources

Past, Present and Future of EV - EV Concept- EV Technology- State-of-the Art of EVs- EV configuration- EV system- Fixed and Variable gearing- Single and multiple motor drive- In-wheel drives- EV parameters: Weight, size, force and energy, performance parameters. Electro mobility and the environment- History of Electric power trains- Carbon emissions from fuels- Green houses and pollutants- Comparison of conventional, battery, hybrid and fuel cell electric systems.

MODULE -2: EV Propulsion and Dynamics

Choice of electric propulsion system- Block diagram- Concept of EV Motors- Single and multi-motor configurations- Fixed and variable geared transmission- In-wheel motor configuration-Classification - Electric motors used in current vehicle applications - Recent EV Motors- Vehicle load factors- Vehicle acceleration.
MODULE-3: Fuel Cells
Introduction of fuel cells- Basic operation- Model - Voltage, power and efficiency- Power plant system – Characteristics- Sizing - Example of fuel cell electric vehicle - Introduction to HEV-Brake specific fuel consumption - Comparison of Series-Parallel hybrid systems- Examples.
MODULE-4: Battery Charging and Control
Battery charging: Basic requirements- Charger architecture- Charger functions- Wireless charging- Power factor correction. **Control:** Introduction- Modeling of electro mechanical system- Feedback controller design approach- PI controller‘s designing- Torque-loop, Speed control loop compensation-Acceleration of battery electric vehicle.
MODULE-5: Energy Storage Technologies
Role of Energy Storage Systems- Thermal- Mechanical-Chemical- Electrochemical- Electrical - Efficiency of energy storage systems- Super capacitors-Superconducting Magnetic Energy Storage (SMES)- SOC- SoH -fuel cells - G2V- V2G- Energy storage in Micro-grid and Smart grid- Energy Management with storage systems- Battery SCADA

Total hours:	54

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	State-of-the Art of EVs	CO1	https://www.mdpi.com/2079-9292/13/17/3578
2	Choice of electric propulsion system-Block diagram	CO2	https://www.sciencedirect.com/topics/engineering/electric-propulsion
3	Introduction of fuel cells	CO3	https://www.cedengineering.com/userfiles/Introduction%20to%20Fuel%20Cells.pdf
4	Wireless charging-Power factor correction	CO4	https://www.sciencedirect.com/science/article/pii/S2772671124003450
5	Role of Energy Storage Systems- Thermal-Mechanical-Chemical-Electrochemical-Electrical	CO5	https://www.sciencedirect.com/topics/engineering/electrochemical-energy-storage

Text Book(s):

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001,1st Edition
2. Ali Emadi, ―Advanced Electric Drive Vehicles‖, CRC Press, 2017,1st Edition



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