GOVERNMENT OF INDIA
MINISTRY OF
PARLIAMENTARY AFFAIRS

Azadi Ka Amrit Mahotsav

mygov मेरी सरकार

PREAMBLE TO THE CONSTITUTION

PREAMBLE

WE, THE PEOPLE OF INDIA,

having solemnly resolved to constitute India into a SOVEREIGN SOCIALIST SECULAR DEMOCRATIC **REPUBLIC** and to secure to all its citizens:

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity;

and to promote among them all

FRATERNITY assuring the dignity of the individual and the unity and integrity of the Nation;

IN OUR CONSTITUENT ASSEMBLY this 26th day of November, 1949, do HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.

I have read the Preamble

[redacted]

Signature

23-01-2022

SRI SIDDHARTHA ACADEMY OF HIGHER EDUCATION

("Deemed to be University u/s 3 of the UGC Act, 1956")
Accredited 'A+' Grade by NAAC
Agalakote, B.H.Road, Tumkur – 572 107.KARNATAKA, INDIA.

No. SSAHE/ACA-S&C/ 28/UG(BE)/2024 Date: 15/07/2024

NOTIFICATION

Sub: - Ordinance pertaining to Curriculum of Undergraduate Programme Bachelor of Engineering (4th Year Electrical and Electronics Engineering)

Ref: Proceedings of the Academic Council meeting held on 10/07/2024 vide agenda No. SSAHE/AC/XXVIII-12/2024

In exercise of the powers vested under section 6 of 6.05 of MoA / Rules of SSAHE, the Revised Ordinance pertaining to Curriculum of Undergraduate Programme Bachelor of Engineering (4th Year Electrical and Electronics Engineering) is notified herewith as per Annexure.

By Order,

REGISTRAR

REGISTRAR
Sri Siddhartha Academy of Higher Education
TUMKUR - 572 107, Karnataka.

To,
Dean / Principal, Sri Siddhartha Institute of Technology,

Copy to
1) Office of the Chancellor, SSAHE, for kind information,
2) PA to Vice-Chancellor / PA to Registrar / Controller of Examinations / Finance Officer, SSAHE
3) All Officers of the Academy Examination Branch / Academic Section
4) Guard File / Office copy.

S.S.A.H.E TUMKUR

SRI SIDDHARTHA
INSTITUTE OF TECHNOLOGY, TUMAKURU
Nurturing Young Minds
A Constituent College of Sri Siddhartha Academy of Higher Education
Department of Electrical and Electronics Engineering
(Accredited by NBA, New Delhi in Tier-1)

Scheme & Syllabus for Fourth Year-2024-25

Department of Electrical & Electronics Engineering

Under Graduate courses where students and faculty can pursue knowledge without boundaries, a place where theory and practice combine to produce a better understanding of our world and ourselves. The objective of department is to equip students with techniques to become providers of innovative and indigenous solutions. The discipline of E&EE has been striving towards providing a vibrant atmosphere for students in diverse areas of Electrical Engineering. Its programs are designed to prepare students for technical excellence.

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
(Accredited by NBA, New Delhi for Three Years 2023-26)

Department Vision:

To impart value based education in the field of Electrical and Electronics Engineering which provides a great learning experience and be an outstanding part of the community.

Department Mission:

- To impart fundamental knowledge of science and technology.
- To instill managerial, entrepreneurial and soft skills.
- To make significant contribution to meet societal needs.
- To develop a knowledge-based information system in the Electrical Engineering domain which can be updated regularly for future learning and cater to the needs of the society.

Department Program Educational Objectives (PEOs):

- To mould Electrical and Electronics Engineering graduates with fundamental Knowledge of engineering and sciences to excel in professional career.
- To work in a team, exhibit leadership qualities and provide solutions to Electrical Engineering problems and demonstrate the importance of professional integrity.
- To produce graduates who will continue to enhance their knowledge and are able to take up confidently diverse career paths with professional ethics and meet the societal needs.

Program Specific Outcomes (PSOs)

- Identify, formulate, analyze, design and implement electrical and electronic circuits, Control Systems, Drives, Power Systems and Power Electronic Systems.
- Understand and apply the impact of engineering solutions by using modern tools to solve problems in diverse and multidisciplinary environment and a commitment to maintain professional ethics and lifelong learning.
- Demonstrate the ability to effectively work in a team, communicate appropriately, develop a fair attitude and concern for society & environment.

Program Outcomes (POs)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, tomanage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Department of Electrical and Electronics Engineering
NBA accredited for Three years (2023-2026)

Scheme of Teaching and Examination

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

VII SEMESTER B.E **Academic Year: 2024-25**

SI No	Course Code		Course Title	Teaching Dept.	L	P	Credits	CIE Marks	SEE Marks	Total Marks	Exam Hrs.
1	PC	EE7TH1	Power Systems II	EE	3	-	3	50	50	100	3
2	PC	EE7TH2	AC and DC Drives	EE	3	-	3	50	50	100	3
3	PE	EE7PE3x	**Professional Elective-III** 31. Electric Vehicle Technology 32. Testing and Commissioning of Electrical Equipments 33. Internet of Things	EE	3	-	3	50	50	100	3
4	PE	EE7PE4x	**Professional Elective-IV** 41. Over Voltages in Power Systems 42. Electrical Power Quality 43. Sensor Technologies	EE	3	-	3	50	50	100	3
5	PE	22EE7PE5X	**Professional Elective-V** 51. Industrial Management, Electrical Estimation & Economics 52. HVDC and FACTS 53. Artificial Intelligence Applications to Power System.	EE	3	-	3	50	50	100	3
6	PE	EE7LB1	Power System Simulation Lab	EE	-	3	1.5	50	50	100	3
7	PE	EE7LB2	AC and DC Drives Lab	EE	-	3	1.5	50	50	100	3
8	PW	EE7PW1	Project Phase-I	EE	-	-	2	50	-	50	-
L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination				Total	15	06	20	400	350	750	-

Department of Electrical and Electronics Engineering
NBA accredited for Three years (2023-2026)

Scheme of Teaching and Examination

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

VIII SEMESTER B.E **Academic Year: 2024-25**

SI No	Course Code		Course Title	Teaching Dept.	L	P	Credits	CIE Marks	SEE Marks	Total Marks	Exam Hrs.
1	PE	EE8PE1x	**Professional Elective-VI** 11. Electromagnetic Compatibility 12. Power System Operation and Control 13.Fuzzy Logic and Its Applications	EE	3	-	3	50	50	100	3
2	PE	EE8PE2x	**Professional Elective-VII** 21. Energy Auditing & Demand Side Management 22. Smart Grid Technology 23. Embedded Systems	EE	3	-	3	50	50	100	3
3	PC	EE8TS1	**Technical Seminar**	EE	-	-	2	50	--	50	-
4	PW	EE8PW2	**Project Phase-2**	EE	-	-	8	50	50	100	3
L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination				**Total**	**06**	**-**	**16**	**200**	**150**	**350**	**-**

Syllabus for the Academic Year – 2024 – 2025

Department: Electrical & Electronics Engineering
Semester: VII
Subject Name: POWER SYSTEMS-II
Subject Code: EE7TH1 **L-P-C: 3-0-3**

Course Objectives:

1. To explain the concept in formulation of network matrices, power flow and stability studies.
2. To apply the different methods to formulate network matrices, solving load flow problems andeconomic generation scheduling.
3. To analyze the power flow and stability of the system.
4. To assess the voltages at different buses using iterative techniques and economic generation scheduling.

UNIT	Syllabus	Hours
I	**Network Topology**: Introduction, Elementary graph theory – oriented graph, tree, co-tree, basic cut-sets, basic loops; Incidence matrices – Element-node, Bus incidence, Tree-branch path, Basic cut-set, Basic loop incidence matrix, Primitive network – impedance form and admittance form.	**07**
II	**Network Matrices:** Formation of Y_{BUS} – by method of inspection (including transformer off-nominal tap setting), by method of singular transformation ($Y_{BUS} = A^T yA$), formation of Bus Impedance Matrix by step by step building algorithm (without mutual coupling elements).	**08**
III	**Load Flow Studies:** Introduction, Power flow equations, Classification of buses, Operating constraints, Data for load flow; Gauss-Seidal Method – Algorithm and flow chart for PQ and PV buses ,Acceleration of convergence; Newton Raphson Method – Algorithm and flow chart for NR method in polar coordinates. (numerical problems on GS method for one iteration only),	**09**
IV	**Economic Operation of Power System:** Introduction, Performance curves, Economic generation scheduling neglecting losses and generator limits, Economic generation scheduling including generator limits and neglecting losses, Economic Dispatch including transmission losses – approximate penalty factor, Derivation of transmission loss formula.	**08**
V	**Stability Studies:** Steady state and Transient stability, rotor dynamics and Swing equation, Power angle equations, Equal area criterion on stability and its applications, derivation of critical clearing angle, Numericals only on rotor dynamics.	**08**

Course Outcome:

After completion of course, student will be able to:

1. Explain the concept to formulate the network matrices, power flow and stability studies.
2. Apply the different methods to formulate network matrices, solving load flow problems and economic generation scheduling.
3. Analyze the power flow and stability of the system.
4. Evaluate the voltages at different buses using iterative techniques and economic generation scheduling.

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3		3							2	1	2	
CO2	2	2	2		3						2	2	2	2	
CO3	3	3	3		3							2	2		
CO4	1	1	1		1						2	2			

Learning Resources:

Sl.	Title	Author	Publishers
Text Book:			
1	Computer Methods in Power System Analysis	Stag, G. W., and El-Abiad, A. H	International Student Edition, re-print 2019
2	Computer Techniques in Power System Analysis	Pai	M. A, 2nd edition, 2006.
Reference Books:			
1	Modern Power System Analysis	Nagrath I J and Kothari D. P	2003
2	Advanced Power System Analysis and Dynamics	Singh L P	2001
3	Computer Aided Power System Operations and Analysis	Dhar R N	1984
4	Power System Analysis	Haadi Sadat	2nd edition , 12th reprint, 2007
NPTEL: https://nptel.ac.in/courses/108/107/108107127			

Syllabus for the Academic Year – 2024 – 2025

Department: Electrical & Electronics Engineering
Semester: VII
Subject Name: AC and DC Drives
Subject Code: EE7TH2 **L-P-C: 3-0-3**

Course Objectives:

1. To extract the structure of a drive system and the mutli-quadrant operation of a drive system.
2. To articulate the concept of switching converters for AC and DC drives**.**
3. To relate the functions of drive components and operating principles for AC drives, DC drives and special machine drives.
4. To Design drive system for given specification.

UNIT	Description	Hours
I	**Introduction to Electrical drives:** Introduction, advantages of electrical drives, parts of electrical drives, speed-torque conventions and multi-quadrant operation. **Rectifier control of DC motors:** Fully controlled rectifier fed dc drives, Half controlled rectifier fed dc drives, multi-quadrant operation of rectifier controlled dc drives.	**08**
II	**Chopper Control of DC motors:** Types of choppers – review, chopper controlled dc drives – motoring and braking operation, multi-quadrant operation of chopper controlled dc drives.	**08**
III	**AC Drives:** Basic Concepts: Speed-Torque characteristics of induction motors. Concept of induction motor starting. Concept of induction motor braking. Methods of braking - regenerative, plugging, dynamic braking. (Excluding Problems). (Sinusoidal Pulse Width Modulation, Space Vector Modulation)	**08**
IV	**Speed control techniques:** Rotor resistance control, Stator voltage control, stator frequency control, V/f control. Static converter control of induction motors: ac voltage regulator control, voltage source inverter control, cyclo converter control.	**08**
V	**Special Machine Drives:** DC brushless motors: Construction, speed-torque characteristics, brushless DC motor controllers. Stepper Motor Drives: Principle of operation of stepper motor, speed-torque characteristics, control of stepper motors.	**08**

Course Outcomes:

After completion of course, student will be able to:

1. Extract the structure of a drive system and analyze the mutli-quadrant operation of a drive system.
2. Articulate the concept of switching converters for AC and DC drives.
3. Relate the functions of drive components and operating principles for AC drives, DC drives and special machine drives.
4. Design parameters for a given drive system specification.

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	2	1							2	2	2	
CO2	3	2	2	2								2	2	2	
CO3	3	2	2	2								2	2	1	
CO4	2	2		2					2					1	

Learning Resources:

Sl.	Title	Author	Publishers
Text Book:			
1	Fundamentals of Electrical Drives	G.K Dubey	Narosa publishing house Chennai, 2nd Edition, 2020.
2	Power Electronics	M.H.Rashid	Pearson Education, 3rd Edition, 2011.
Reference Books:			
1	Electrical Drives	N.K De and P.K. Sen	PHI, 2007
2	Fundamentals of Electrical Drives	Mohamed A. El-Sharkawi	Thomson Learning, 2002
NPTEL: https://nptel.ac.in/courses/108/108/108108077 https://nptel.ac.in/courses/108/104/108104140			

Syllabus for the Academic Year – 2024 – 2025
Department: Electrical & Electronics Engineering
Semester: VII
Subject Name: ELECTRIC VEHICLE TECHNOLOGY
Subject Code: EE7PE31 **L-P-C: 3-0-3**

Course Objectives:

1. To understand the basics of electric vehicle technology.
2. To apply the concept of switching devices for a specific type of electric vehicle.
3. To analyze different energy storage devices.
4. To design and modeling of controller for electric vehicles.

UNIT	Syllabus	Hours
I	**Introduction:** A Brief History– Early Days, Developments towards the End of the TwentiethCentury and the Early Twenty-First Century. **Electric Vehicles and the Environment -** Energy Saving and Overall Reduction of Carbon Emissions, Reducing Local Pollution, Reducing Dependence on Oil. **Types of Electric Vehicles – EV Architecture** Battery Electric Vehicles, The IC Engine/Electric Hybrid Vehicle, Fuelled EVs, EVs using Supply Lines, EVs which use Flywheels or Super capacitors, Solar-Powered Vehicles, Vehicles using Linear Motors EVs for the Future.	**08**
II	**Batteries, Flywheels and Super capacitors:** Introduction, Battery Parameters, Types of batteries, Super capacitors and Flywheels, Battery Charging, Charge Equalization, Batteries which are Currently Available Commercially, Use of Batteries in Hybrid Vehicles.	**08**
III	**Electric Machines and their Controller:** The "Brushed" DC Electric Motor- Operation of the Basic DC Motor, Torque- Speed Characteristics, Controlling the Brushed DC Motor, DC Motor Efficiency, Electric Motors as Brakes, DC Regulation and Voltage Conversion. Switching Devices, Step-Down or "Buck" Regulators, Step-Up or "Boost" Switching Regulator, Single-Phase Inverters, Three-Phase inverters.	**08**
IV	**Electric Vehicle Modelling:** Introduction, Tractive Effort - Rolling Resistance Force, Aerodynamic Drag,Hill Climbing Force, Acceleration Force , Total Tractive Effort. Modelling of Electric Vehicle Range- Range Modelling of Battery Electric Vehicles, Range Modelling of Hybrid Electric Vehicles.	**08**
V	**Electric Vehicles and the Environment:** Introduction, Vehicle Pollution – The Effects, Vehicle Pollution in Context, TheRole of Regulations and Lawmaker **The Future of Electric Vehicles:** Introduction, The Tesla S, The Honda FCXClarity, Maglev Trains, Electric Road–Rail Systems	**08**

Course Outcome:

After completion of course, student will be able to:

1. Understand the basics of electric vehicle technology.
2. Apply the concept of switching devices for a specific type of electric vehicle..
3. Analyze different energy storage devices.
4. Design and modeling of controller for electric vehicles.

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1											1	1		
CO2		2	1			2					2			1	
CO3															1
CO4															

Learning Resources:

Sl.	Title	Author	Publishers
Text Book:			
1	Electric Vehicle Technology	UK John Lowry Consultant Engineer	James Larminie Oxford Brookes University,UK, John Wiley & Sons Ltd 2nd edition., 2012.
2	Modern Electric Vehicle Technology	C.C. Chan and K.T. Chau	Oxford University Press, 2011.
Reference Books:			
1	Electric and Hybrid Vehicles	Iqbal Hussein	Second edition 2011
2	Electric Vehicle Technology	James Larminie	John Wiley & Sons, 2003
3	Modern Electric, Hybrid Electric and Fuel Cell Vehicles	Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi	CRC Press Taylor & Francis Group, 2004, Taylor & Francis Group, 2004.
4	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles	Mehrdad Ehsani, Yimin Gao, Ali Emadi	CRC Press, 2010
NPTEL: https://nptel.ac.in/courses/108/102/108102121 https://nptel.ac.in/courses/108/106/108106182			

Syllabus for the Academic Year – 2024 – 2025

Department: Electrical & Electronics Engineering
Semester: VII
Subject Name: TESTING & COMMISSIONING OF ELECTRICAL EQUIPMENTS
Subject Code: EE7PE32 **L-P-C: 3-0-3**

Course Objectives:

1. To recognize the basic specifications, tests conducted before and after commissioning of transformers, induction motors, synchronous generator & switchgear
2. To transfer the knowledge of protections schemes for electrical equipments like Transformers, Induction motors, Synchronous machine and switchgears.
3. To categorize requirement for civil and electrical work before commissioning of electrical equipments.
4. To prioritize the maintenance schedule for various electrical equipments afterinstallation.

UNIT	Syllabus	Hours
I	**Specifications:** Power and distribution transformers as per BIS standards. Erection and Commissioning: Dispatch, Inspection upon arrival atsite, Handling, Installation: Location and site preparation, Oil filling, Drying of transformers, Commissioning: Checks before commissioning. Testing of Power Transformers: **a. Preliminary tests:** **b. Routine tests:** Measurement of winding resistance, measurement of voltage ratio and check of voltage vector relationship, Measurement of impedance voltage and load loss, measurement of no load loss and current, measurement ofinsulation resistance Separate source voltage withstand test, Induced over- voltage withstand test Type test: Temperature rise test **Impulse Testing:** Lightning impulse test circuit, Switching impulse test, Measurement and recording of impulses, Fault detection and short circuit testingof Power Transformers Transformer auxiliaries: Gas operated relay, Temperature indicators, Pressurerelief valve	**08**
II	**Induction Motor:** Specifications: Site conditions, Enclosures, Cooling, Rated conditions of voltage, frequency and output of motors, Duty, I.P. protection, dimensions, Performance values, overload, temperature rise, efficiency and power factor, tolerance, markings, information to be given at the stage of enquiry and placingorder for supply. **Installation and commissioning:** Location of the motors (including the foundation details) & its control apparatus, Foundation and leveling, Insulationresistance, Alignment, fitting of pulleys & coupling Checks before commissioning, Commissioning of motor, Temperature rise.	**08**

III	**Tests on Induction motor:** Insulation resistance test, High voltage test,resistance test, reduced voltage running up test Performance characteristics: No load test, Open circuit test, Locked rotor test,Pull up and Pull out torque, Speed-torque and speed-current curves, Load test.Temperature-rise test. Maintenance Schedule: Maintenance schedule of induction motor	**08**
IV	**Synchronous Machines:** Specifications: As per BIS standards Installation: Physical inspection, foundation details, alignments, excitation systems, cooling and control gear, drying out. Tests: Measurement of Insulation resistance, tests for short circuited field turns, Polarity test for field poles, Resistance of windings, High voltage test. Checking of shaft current and bearing insulation resistance, Determination of irregularities of voltage waveform, Overspeed test, Line charging capacity, Measurement of open-circuit and short-circuit characteristics, Zero power factor characteristics, Determination of synchronous machine quantities from tests, Temperature-rise tests, Instantaneous short-circuit withstand test	**08**
V	**Switchgear & Protection Devices:** Standards, types, specification of circuit breaker, tests on circuit breaker, commissioning tests, installation, selection of circuit breakers, maintenance ofcircuit breakers , HVDC circuit breakers. fuses, types & contactor	**08**

Course Outcome:

After completion of course, student will be able to:

1. Recognize the standards for manufacturing of transformers, induction motors, synchronous generators and switchgear.
2. Transfer the knowledge of protections schemes for electrical equipments
3. Categorize the requirement for civil and electrical work required.
4. prioritize maintenance schedule for various electrical equipments after installation.

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3		1					1	1		2	1		
CO2	3	2		2		1	1					2	2		
CO3	3	2	2						2			2	2		
CO4	2	2	2					1				2	2		

Learning Resources:

Sl.	Title	Author	Publishers
Text Book:			
1	Testing & Commissioning of electrical equipment	S. Rao	Khanna publications, 6th edition, 2004
2	Testing & Commission of electrical equipment	B.V.S. Rao	Volume 1, 1963
Reference Books:			
1	Relevant Bureau of Indian Standards.		
2	Transformers	BHEL.TMH	2nd edition, 2003.
3	J&P transformer		Elsevier publication, 2011
NPTEL: https://nptel.ac.in/courses/108/102/108102146 https://nptel.ac.in/courses/108/102/108102146 https://nptel.ac.in/courses/108/104/108104048			

Syllabus for the Academic Year – 2024 – 2025

Department: Electrical & Electronics Engineering
Semester: VII
Subject Name: INTERNET OF THINGS
Subject Code: EE7PE33 **L-P-C: 3-0-3**

Course Objectives:

1. To provide foundation of IoT networks leading to new architectural models.
2. To compare and contrast the development of smart objects and the technologies to connect them to network.
3. To illustrate physical devices and end points.
4. To apply the knowledge of IoT in Industry.

UNIT	Syllabus	Hours
I	**Overview of IoT**: What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Comparing IoT Architectures, A Simplified IoT Architecture.	**08**
II	**Smart Objects:** The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.	**08**
III	**Network Layer :** IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT.	**08**
IV	**IoT Physical Devices and Endpoints:** Arduino UNO: Introduction to Arduino, Arduino UNO, IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Remote access to RaspberryPi	**08**
V	**Application:** Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples..	**08**

Course Outcomes:

After completion of course, student will be able to:

1. Identify different types of IoT networks and architectural models.
2. Understand the development of smart objects and technologies connected to the network
3. Illustrate different physical devices and end points.
4. Apply the knowledge of IoT in industry.

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1												3	2	1
CO2		2											3	2	1
CO3					2					3			3	2	3
CO4				3		3						2	3	2	3

Learning Resources:

Sl.	Title	Author	Publishers
	Text Book:		
1	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry	1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)
2	Internet of Things	Srinivasa K G	CENGAGE Leaning India, 2017
	Reference Books:		
1	Internet of Things (A Hands-on-Approach)	Vijay Madisetti and Arshdeep Bahga	1st Edition, VPT, 2014. (ISBN: 978-8173719547)
2	Internet of Things: Architecture and Design Principles	Raj Kamal	1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)
3	J&P transformer		Elsevier publication, 2011
NPTEL: https://nptel.ac.in/courses/106/105/106105166			

Syllabus for the Academic Year – 2024 – 2025

Department: Electrical & Electronics Engineering
Semester: VII
Subject Name: OVER VOLTAGES IN POWER SYSTEM
Subject Code: EE7PE41 **L-P-C: 3-0-3**

Course Objectives:

1. To understand the phenomena of over votage in Power system and analyse lightning and switching over voltages.
2. To analyze the analysis for different line termination for resistance, inductance and capacitance
3. To apply the Behavior of equipments, line insulation and surge arrestors.
4. To study the performance & characteristics of grounding rods, counter poise,origin and characteristics of switching over voltages and temporary over voltages.

UNIT	Syllabus	Hours
I	**Introduction to over voltages phenomenon in power system:** Transient ontransmission lines: infinite line definition and its transient behavior	**08**
II	**Finite line analyses:** Analysis for different line terminations & problems,Bewely lattice diagram & problems	**08**
III	**Use of transients network analyzer**: Digital and hybrid computers for solving large scale problems, characteristics of lightning discharges, theory of cloud formation origin of lightning, iso-Keronic level, leader development, return stroke, different types of lightning interaction & back flash over.	**08**
IV	**Shielding angle calculation for line:** Grounding rods, counter poise, problems. Origin and characteristics of switching over voltages and temporary overvoltages & problems on switching surges.	**08**
V	**Behavior of apparatus:** Behavior of apparatus and line insulation under all types of over voltages, concept of BIL, protection of apparatus against over voltages, surge arresters & insulation Co-ordination	**08**

Course Outcome:

After completion of course, student will be able to:

1. Able to understand the origin, classification and characteristics of over voltages.
2. Able to analysis different line terminations of over voltages.
3. Able to understand the transient network analyzer, Behavior of equipments, line insulation and surge arrestors.
4. Able to design protection schemes against over voltages

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2		2												
CO2	1	2			3				2				2	2	1
CO3	2					1		1			1		2	1	2
CO4										2		2	1	1	1

Learning Resources:

Sl.	Title	Author	Publishers
	Text Book:		
1	Electrical Transients in Power systems	Allan Greenwood	2nd edition, Wiley India, 2010
2	High Voltage Engineering	R. S. Jha	Dhanpat Rai and Sons, First edition, 1977
	Reference Books:		
1	High Voltage Engineering	M. S. Naidu and V. Kamaraju	3rd edition, Tata McGraw Hill, 1995
2	Extra High Voltage AC Transmission Engineering	Rakosh Das Begamudre	Wiley Eastern Limited, 1987.
NPTEL: https://nptel.ac.in/courses/108/104/108104048			

Syllabus for the Academic Year – 2024 – 2025
Department: Electrical & Electronics Engineering
Semester: VII
Subject Name: ELECTRICAL POWER QUALITY
Subject Code: EE7PE42 **L-P-C: 3-0-3**

Course Objectives:

1. To understand the basic power quality issues in power systems.
2. To analyze the voltage sag and interruption in power system apparatus.
3. To analyze the transient over voltage in power systems.
4. To able to study the harmonics in power systems. To study the power quality monitoring.

UNIT	Description	Hours
I	**INTRODUCTION:** Power Quality-Voltage Quality, Power Quality Evaluation Procedures Term And Definitions general classes of power quality problems, Transients, long duration voltage variation, short duration voltage variations, voltage imbalance, waveform distortion & power quality terms.	**08**
II	**VOLTAGE SAGS AND INTERRUPTIONS:** Sources of sags and interruptions, estimating voltage sag performance, fundamental principles of protection & monitoring sags.	**08**
III	**TRANSIENTS OVER VOLTAGES:** Sources of transient over voltages, principles of over voltages protection, utility capacitor switching transients, Fundamentals of harmonics: Harmonic distortion, voltage versus transients, harmonic indexes, harmonic sources from commercial loads, harmonic sources from Industrial loads, effects of harmonic distortion & intraharmonics	**08**
IV	**APPLIED HARMONICS:** Harmonic distortion evaluations, principles for controlling harmonics, harmonic studies, devices for controlling harmonic distortion, harmonic filters, standards of harmonics **POWER QUALITY BENCHMARK:** introduction, benchmark process, power quality contract, power quality state estimation, including power quality in distribution planning, Interface to utility system, power quality issues & interconnection standards	**08**
V	**POWER QUALITY MONITORING:** Monitoring considerations, power quality measurement equipments, assessment of power quality measurement data, application of intelligent systems & power quality monitoring standards.	**08**

Course Outcomes:

After completion of course, student will be:

1. Able to understand the basic power quality issues in power systems.
2. Analyze the voltage sag and interruption in power system apparatus.
3. Analyze the transient over voltage in power systems.
4. Able to study the harmonics in power systems. To study the power quality monitoring.

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2					1		1					2		
CO2	2					1		1					2		
CO3	2					1		1					1		
CO4	2					1		1					1		

Learning Resources:

Sl.	Title	Author	Publishers
	Text Book:		
1	Electric Power Quality	Dugan, Roger C, Santoso, Surya, McGranaghan, Mark F/ Beaty,H. Wayne	McGraw-Hill professional publication, 2003
	Reference Books:		
1	Electric Power Quality	G.T.Heydt	stars in a circle publications, 1991
2	Modern Power Electronics	M.H.Rashid	TATA McGraw Hill, 200
NPTEL:https://onlinecourses.nptel.ac.in/noc21_ee103/preview			

Syllabus for the Academic Year – 2024 – 2025
Department: Electrical & Electronics Engineering
Semester: VII
Course Name: Sensor Technologies
Course Code: EE7PE43 **L-P-C: 3-0-3**
Course Objectives:

1. To understand the basic knowledge of sensors and transducers.
2. To apply better familiarity with the Theoretical and Practical concepts of Transducers.
3. To analyze different sensors and their application in real life.
4. To design various models with physical and electrical parameters.

UNIT	Description	Hours
I	**Introduction to measurement systems:** General concepts and terminology, measurement systems, sensor classifications: Analog Input and Output, Digital Input and Output, general input-output configuration, methods of correction. **Passive Sensors:** **Resistive Sensors**: Potentiometers, Strain Gages, Resistive Temperature Detectors (RTDs), Thermistors, Light-dependent Resistors (LDRs), Resistive Hygrometers. **Capacitive Sensors**: Variable capacitor and Differential capacitor. **Inductive Sensors**: Reluctance variation sensors, Eddy current sensors, Linear variable differential transformers (LVDTs), Magneto elastic sensors, Electromagnetic sensors -Sensors based on Faraday"s law of Electromagnetic induction, Touch Sensors: Capacitive, Resistive, Proximity Sensors.	08
II	**Self-generating Sensors or active sensors:** **Thermo electric Sensors**: Thermocouples, Thermo electric effects, Common thermocouples, Practical thermo couple laws, Cold junction compensation inthermocouples circuits. **Piezoelectric Sensors**: Piezoelectric effect, piezoelectric materials, applications	08
III	**Velocity and Acceleration Measurement:** **Relative velocity** –Translational and Rotational velocity measurements – Revolution counters and Timers -Magnetic and Photoelectric pulse countingstroboscopic methods. Accelerometers-different types, Gyroscopes-applications. **Density measurements** –Strain Gauge load cell method –Buoyancy method –Air pressure balance method –Gamma ray method –Vibrating probe method.	08
IV	**Density, Viscosity and Other Measurements:** Units of Viscosity, specific gravity scales used in Petroleum Industries, DifferentMethods of measuring consistency and Viscosity –Two float viscorator –Industrial consistency meter. Sound-Level Meters, Microphones, HumidityMeasurement.	08
V	**Calibration and Interfacing:** Calibration using Master Sensors, Interfacing of Force, Pressure, Velocity,Acceleration, Flow, Density and Viscosity Sensors.	08

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

1. Understand the concept of sensors and transducers.
2. Apply theoretical concepts into working models.
3. Analyze the applications to engineering modules and practices.
4. Design engineering solution with physical and electrical parameters.

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1			2	1				2	2	2	2	1
CO2	3	2	1			2	1				2	2	2	2	1
CO3	3	2	1			2	1				2	2	2	2	1
CO4	3	2	1			2	1				2	2	2	2	1

Learning Resources:

Sl.	Title	Author	Publishers
	Text Book:		
1	Measurement Systems – Applications and Design	Doeblin E.O.	4/e, McGraw Hill International, 1990.
2	Principles of Industrial Instrumentation	Patranabis D	TMH. End edition 1997
	Reference Books:		
1	Sensors and Transducers	D. Patranabis	TMH 20032
2	Sensors and Transducers	Wiley & Sons	(2006)
3	Sensor Technology	Jon Wilson	Newness 2004
NPTEL:https://nptel.ac.in/courses/108/105/108105064			

Syllabus for the Academic Year – 2024 - 2025
Department: Electrical & Electronics Engineering
Semester: VII
Course Name: INDUSTRIAL MANAGEMENT, ELECTRICAL ESTIMATION & ECONOMICS
Course Code: EE7PE51 **L-P-C: 3-0-3**

Course Objectives:

1. To discuss scientific management, types of organization and various behavioral approaches.
2. To identify the need for Personnel and Production management.
3. To Deduce different tariffs and decision making tools.
4. To design and estimate interior wiring and power circuits.

UNIT	Syllabus	Hours
I	**Introduction:** Historical prospective, concept of scientific management and itsrelevance in the Indian Context. **Management Functions**: Planning, organizing, staffing, directing, controlling. **Organization:** Types of organization, merits and demerits	08
II	**MANAGEMENT AND BEHAVIORAL APPROACH:** Contribution of Eltor Mayo and Skinner and others to behavioral science. Maslow"s hierarchy o needsand satisfaction, Hawthorn"s studies and its finding, theory X and Y.	08
III	**PERSONNEL MANAGEMENT:** Recruitment and selection, training o personnel employer and employee relationship, causes and settlement o disputes. **PRODUCTION MANAGEMENT:** Plant location, plant lay-out, CPM and PERT, line balancing, automation, statistical quality control, control chart & motion study.	08
IV	**TARIFFS:** Aim and objectives of Tariffs, factors governing the Tariffs, components of Tariffs, Choice of electrical power supply, Worked examples. Depreciation and valuation of machinery, inventory, economic order quantity	08
V	**INTERIOR WIRING SYSTEM:** Wiring system, earthing, and estimation ofwiring installation **POWER INSTALLATION:** Load calculation, wire size selection, wiring materials for power circuits, and the estimate for motor installation, pump setworkshop, theater etc.,	09

Course Outcomes:

After completion of course, student will be able to

1. Discuss scientific management, types of organization and various behavioral approaches.
2. Identify the need for personnel and production management.
3. Deduce different tariffs and decision making tools.
4. Design and estimate interior wiring and power circuits.

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2					2			2					1	
CO2									2		3	1		1	
CO3		3		3					2				2		3
CO4	2	2		3			2		2				2		3

Learning Resources:

Sl.	Title	Author	Publishers
	Text Book:		
1	Introduction to Management	S. S. Chatterjee	The World Press, 1993
2	Industrial organization and Engineering Economics	T.R. Banga & S.C. Sharma	Khanna Publishers, 2003.
	Reference Books:		
1	Engineering Economics and Management	N. Narasimhaswamy	Dynaram Publications
2	Industrial Management, Electrical Estimation & Economics	Prof. P.M. Chandrashekaraiah	Rajeshwari Publications
NPTEL:https://nptel.ac.in/courses/122/108/122108038			

Syllabus for the Academic Year –2024 - 2025

Department: Electrical & Electronics Engineering
Semester: VII
Course Name: HVDC and FACTS
Course Code: EE7PE52 **L-P-C: 3-0-3**

Course Objectives:

1. To realize HVDC Technology, Power Electronics devices and FACTS Controllers.
2. To apply the knowledge to develop HVDC systems and associated controls.
3. To analyze converters, associated controllers, harmonics and filters of HVDC systems.
4. To design a HVDC system and associated controls

UNIT	Description	Hours
I	**General Aspects of DC Transmission and Comparison with AC Transmission**: Historical sketch, Types of DC links, Comparison of AC and DC transmission, Applications of DC links, Description of DC transmission systems.	08
II	**Analysis of The Bridge Converter**: Analysis with Grid control without overlap, Analysis with Grid control and overlap less than 60^0. Complete characteristics of rectifier & inversion.	08
III	**Control Strategies**: Basic means of control, power reversal, limitations ofmanual control, constant voltage versus constant current control, desired features of control, constant current control, stability of control, power control and current limits and MTDC systems.	08
IV	**Protection:** General aspects, DC reactors, prevention of consequent commutation failures, converter faults, DC circuit breakers, clearing line faultsand re-energizing the line. **Harmonics and Filters**: Characteristics and uncharacteristic harmonic, telephone interference, troubles caused by harmonics, means of reducingharmonics and harmonic filters.	08
V	**FACTS Concept and General System Consideration:** Transmission Interconnections, Flow of Power in an AC System, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Relative Importance of Controllable Parameter, Basic Types of FACTS Controllers,Brief Description and Definitions of FACTS Controllers	08

Course outcome:

After completion of course, student will be able to

1. Realize HVDC Technology, Power Electronics devices and FACTS Controllers.
2. Apply the knowledge to develop HVDC systems and associated controls.
3. Analyze converters, associated controllers, harmonics and filters of HVDC systems, .
4. Design a HVDC system and associated controls

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2				2	3					2	2	2	
CO2	3	2				2	2					2	2	2	
CO3	2	2				2	2					2	2		
CO4	2					2	2								

Learning Resources:

Sl.	Title	Author	Publishers
	Text Book:		
1	HVDC Power Transmission Systems	K.R. Padiyar	Technology and system interactions, Wiley Eastern Limited, 1992.
2	Understanding facts Concepts And technology Of Flexible AC Transmission Systems	Narain G Hingorani and Laszlo Gyugyi	2000, The Institute of Electrical & Electronics Engineers, Inc., Newyork, ISBN 0-7803-3455-8, IEEE order no. PC 5713Direct Current Transmission, E.W. Kimbark, Wiley Futerscience, 1971
	Reference Books:		
1	Direct Current Transmission	E.W. Kimbark	Wiley Futerscience, 1971
NPTEL:https://nptel.ac.in/courses/108104013			

Syllabus for the Academic Year – 2024 - 2025

Department: Electrical & Electronics Engineering
Semester: VII
Course Name: Artificial Intelligence Applications to Power System
Course Code: EE7PE53 **L-P-C: 3-0-3**

Course Objectives:

1. To understand the importance of artificial intelligence Vs human intelligence.
2. To apply intelligent algorithms to problem solving/search processes.
3. To analyze various cases of knowledge based expert systems, structured representation of knowledge etc.
4. To evaluate intelligent algorithms for solving power system problem through knowledge based expert systems.

UNIT	Description	Hours
I	**Introduction:** AI definitions, history and evolution of AI, essential abilities of intelligence and AI applications.	08
II	**Problem Solving:** Problem characteristics, problem search strategies, forward and backward reasoning, AND-OR graphs – goal trees, game trees, Search methods – informed and uninformed search, breadth first search and depth first search methods.	08
III	**Knowledge Representation:** Logical formalisms, prepositional and predicate logic, syntax and semantics, WFFs, clause form expressions, resolution – use of RRTs for proofs and answers, examples from electric power systems, Non-monotonic logic: TMS, modal, temporal and fuzzy logic.	08
IV	**Structured Representation of Knowledge:** ISA/ISPART trees, associative/ semantio nets, frames and scripts, examples from electric power systems.	08
V	**Expert System Architecture:** Basic components, rule based systems, forward and backward chaining, ES features, ES development, ES categories, ES tools and examples from electric power systems.	08

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

1. Understand the importance of artificial intelligence Vs human intelligence.
2. Apply intelligent algorithms to problem solving/search processes.
3. Analyze various cases of knowledge based expert systems, structured representation of knowledge etc.
4. Evaluate intelligent algorithms for solving power system problem through knowledge based expert systems.

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3													2	
CO2		2	3											2	
CO3		3	2		2	2			2				2		
CO4		2	3		2	2			2				2		

Learning Resources:

Sl.	Title	Author	Publishers
	Text Book:		
1	Neural Networks	Rajashekran, S. and Vijaylaksmi Pai, G.A.	Fuzzy Logic and Genetic Algorithm Synthesis and Applications, Prentice Hall of India Private Limited 2004.
2	Power System Stability	Taylor, C.W.	McGraw Hill, 2007
	Reference Books:		
1	Neural Fuzzy Systems	Lin, C., Lee, G.	Prentice Hall International Inc. 2000
2	Neural Networks and Fuzzy Systems: a Dynamical systems Approach to Machine Intelligence	Kosko, B.	Prentice Hall of India Private Limited, 1992.
3	C++ Neural Networks and Fuzzy Logics	Zurda, J.M.	BPS Publication , 2001
NPTEL:nptelvideos.in/2012/11/intelligent-systems-and-control.html			

Syllabus for the Academic Year – 2024 – 2025
Department: Electrical & Electronics Engineering
Semester: VII
Subject Name: POWER SYSTEM SIMULATION LABORATORY
Subject Code: EE7LB1 **L-P-C: 0-3-1.5**

Course Objectives:

1. To formulate bus admittance matrix by Rule of Inspection and Singular transformation methodusing MATLAB.
2. To evaluate the transmission line performance and power angle characteristics of synchronousmachines using MATLAB
3. To analyze power system faults, load flow and Perform economic load dispatch of thermal powerplant using Software package

SL.	Description
	PART-A (MATLAB Simulation)
I	Formation of Y_{Bus} for the given power system by Rule of Inspection Method
II	Formation of Y_{Bus} for the given power system using Singular transformation method
III	Formation of Y_{Bus} for the given power system using Singular Transformation method (withmutual coupling)
IV	Determination of bus currents, bus power & line flows for a specified system voltage (bus)profile.
V	Determination of ABCD Parameters, Regulation & Efficiency of equivalent T/Pi Configuration for Short, Medium & Long transmission lines and also to verify AD-BC =1.
VI	Determination of power angle diagrams for salient and non-salient pole synchronousmachines, reluctance power, excitation emf & regulation.
VII	Solution of swing equation.
	PART-B (Mi-Power Package)
VIII	Fault studies on a given power system.
IX	Load flow analysis using Gauss- Siedel method, N-R method, Fast Decoupled flow methodfor both PQ and PV buses.
X	Optimal generator scheduling of thermal power plants.

Course Outcomes:

After completion of course, student will be able to:

1. Formulate bus admittance matrix by Rule of Inspection and Singular transformation methodusing MATLAB.
2. Evaluate the transmission line performance and power angle characteristics of synchronousmachines using MATLAB
3. Analyze power system faults, load flow and Perform economic load dispatch of thermalpower plant using Software package

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2			3							2	2		
CO2		2			2							2	2	2	
CO3	2	2			2							2	2	2	

Syllabus for the Academic Year – 2024 – 2025

Department: Electrical & Electronics Engineering
Semester: VII
Subject Name: AC AND DC DRIVES LAB
Subject Code: EE7LB2 **L-P-C: 0-3-1.5**

Course Objectives:

1. To understand the use software tools for simulation of dc motor drives and ac motor drives
2. To develop and conduct experiments to study the performance of dc/ac motor drives andinfer appropriate conclusions from the results of the experiments
3. To develop code to automate the simulation process and accumulate the simulation results

SL.	Description
I	Realization of basic logic gates.
II	Construct and develop PLC ladder diagram to control lamp.
III	Construct and develop PLC ladder diagram to control motor.
IV	Realization of timers and counters.
V	Demonstration of water bottle filler and elevator using PLC.
VI	Speed control of DC motor using IGBT based chopper
VII	Speed control of three phase induction motor.
VIII	Speed control of BLDC motor.
IX	Simulation of Buck, Boost and Buck-Boost converter
X	Simulations of three phase Inverter using MATLAB/SIMULINK package. i) Perform FFT analysis to determine THD. ii) Perform FFT analysis to determine THD with sinusoidal PWM. iii) Perform FFT analysis to determine THD with Space vector PWM

Course Outcomes:

After completion of course, student will be able to:

2. Understand the use of software tools for simulation of dc motor drives and ac motor drives
3. Develop and conduct experiments to study the performance of dc/ac motor drives and inferappropriate conclusions from the results of the experiments
4. Develop code to automate the simulation process and accumulate the simulation results

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2		2				2			2	2	2	
CO2	2		2		2				2			2	2	2	
CO3	2	2	2		2				2			2	2	2	

Department of Electrical and Electronics Engineering
NBA accredited for Three years (2023-2026)

Scheme of Teaching and Examination

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

VIII SEMESTER B.E **Academic Year: 2024-25**

SI No	Course Code		Course Title	Teaching Dept.	L	P	Credits	CIE Marks	SEE Marks	Total Marks	Exam Hrs.
1	PE	EE8PE1x	**Professional Elective-VI** 14. Electromagnetic Compatibility 15. Power System Operation and Control 16. Fuzzy Logic and Its Applications	EE	3	-	**3**	50	50	100	3
2	PE	EE8PE2x	**Professional Elective-VII** 24. Energy Auditing & Demand Side Management 25. Smart Grid Technology 26. Embedded Systems	EE	3	-	**3**	50	50	100	3
3	PC	EE8TS1	**Technical Seminar**	EE	-	-	**2**	50	--	50	-
4	PC	EE8PW2	**Project Phase-2**	EE	-	-	**8**	50	50	100	3
L: Lecture, T-Tutorial, P-Practical/Drawing, CIE: Continuous Internal Evaluation, SEE: Semester End Examination				**Total**	**06**	**-**	**16**	**200**	**150**	**350**	**-**

Syllabus for the Academic Year – 2024 - 2025
Department: Electrical & Electronics Engineering
Semester: VIII
Course Name: ELECTROMAGNETIC COMPATIBILITY
Course Code: EE8PE11 **L-P-C: 3-0-3**

Course Objectives:

1. To Summarize the concept of electromagnetic compatibility to the electronic devices.
2. To apply the different techniques to solve noise problems
3. To analyze the inductive and capacitive coupling
4. To assess the noise voltage in cables.

UNIT	Syllabus	Hours
I	**INTRODUCTION:** Designing of electromagnetic compatibility, EMC regulation, typical noise path, use of network theory, method of noise coupling, miscellaneousnoise sources, and methods of eliminating interference.	**08**
II	**CABLING:** Capacitive coupling, effect of shield on magnetic coupling, mutual inductance calculations, magnetic coupling between shield and inner conductor, shielding to prevent magnetic radiation, shielding a receptor against magnetic fields, shield transfer impedance, example of selective shielding, co-axial cable versus shielded twisted pair braided shields.	**08**
III	**GROUNDING:** Safety grounds, signal grounds, single point ground systems, hybrid grounds, multipoint ground systems, functional ground layout, practical low frequency grounding, hardware grounds, single ground reference for a circuit amplifier shields, grounding of cable shields, ground loops, low frequency analysis of common mode choke, high frequency analysis of common mode choke, differential amplifiers.	**08**
IV	**BALANCING AND FILTERING:** Balancing, power supply decoupling, decoupling filters, amplifier decoupling driving capacitive loads, high frequency filtering, system bandwidth, modulation and coding.	**08**
V	**SHIELDING:** Near field and far fields, characteristic and wave impedance's shielding effectiveness, absorption loss, reflection loss, composite absorption and reflection loss summary of shielding equation, shielding with magnetic material. **ELECTROSTATIC DISCHARGE:** Static generation, human body model, static discharge, ESD protection in equipment design.	**08**

Course Outcome:

After completion of course, student will be able to:

1. Summarize the concept of electromagnetic compatibility to the electronic devices.
2. apply the different techniques to solve noise problems
3. analyze the inductive and capacitive coupling
4. assess the noise voltage in cables

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1			2		2	2	3	3	2	2	3	2	2	
CO2	2			2		2	3	3	3	2	3	3	2	2	
CO3	1			3			2	2	2	2	2	2	2	2	
CO4	1			2		1	3	2	2	3	2	2	2	2	

Learning Resources.

Sl.	Title	Author	Publisher
Text Books:			
1	Noise reduction techniques in electronic systems	Henry W. Ott, John Wiley	2nd edition, 1988
	Reference Books:		
1	Electromagnetic Compatibility	Reinaldo Perez	Science Direct Publications, ISBN: 978-0-12-550710-3
2	Applied Electro Magnetic and Electromagnetic Compatibility	Dipak L. Sengupta, Valdis V. Liepa	Wiley India Pvt Ltd.
NPTEL:https://nptel.ac.in/courses/108/106/108106138			

Syllabus for the Academic Year – 2024 - 2025
Department: Electrical & Electronics Engineering
Semester: VIII
Course Name: POWER SYSTEM OPERATION AND CONTROL
Course Code: EE8PE12 **L-P-C: 3 -0-3**

Course Objectives:

1. To understand the SCADA system & central operation control of power system
2. To apply the methods of control speed governing system & area load frequency
3. To analyze the operation of power plants for hydel & thermal plants & unitcommitment in substation
4. To assess the security, analysis, states of power system & contingency.

UNIT	Description	Hours
I	**CONTROL CENTER OPERATION OF POWER SYSTEMS:** Introduction to SCADA, control center, digital computer configuration, automatic generation control, area control error, expression for tie-line flow andfrequency deviation, parallel operation of generators.	**08**
II	**AUTOMATIC GENERATION AND CONTROL:** Automatic voltage regulator, automatic load frequency control, AVR control loops of generators, performance of AVR, ALFC of single area systems, concept of control area, multi-area systems.	**08**
III	**CONTROL OF VOLTAGE AND REACTIVE POWER:** Introduction, generation and absorption of reactive power, relation between voltage, power and reactive power at a node, single machine infinite bus systems, methods of voltage control, sub synchronous resonance, voltage stability, voltage collapse.	**08**
IV	**UNIT COMMITMENT**: Statement of the Unit Commitment problem, need and importance of unit commitment, methods-priority lists method, dynamicprogramming method, constraints, spinning reserve, and examples. **STATE ESTIMATION OF POWER SYSTEMS:** Introduction, Linear Least Square Estimation	**08**
V	**POWER SYSTEM SECURITY**: Introduction, factors affecting power system security, power system contingency analysis, detection of network problems, network sensitivity methods, calculation of network sensitivity factor, contingency ranking	**08**

Course Outcomes:

After completion of course, student will be able to

1. To understand the SCADA system & central operation control of power system
2. To apply the methods of control speed governing system & area load frequency
3. To analyze the operation of power plants for hydel & thermal plants & unit commitment in substation
4. To assess the security, analysis, states of power system & contingency.

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2		1	1		2							1	1	
CO2	2	2	3			2							2	1	
CO3	2	2		1	1	3							2		
CO4	2	2	2	1										2	

Learning Resources.

Sl.	Title	Author	Publisher
Text Books:			
1	Power System: Operation & Control	Dr. K. Uma Rao	Dr. K. Uma Rao
2	Modern Power System Analysis	I J Nagarath and D P Kothari	TMH, 3rd Edition, 2003
	Reference Books:		
1	Power generation, operation and control	John Wiley and Sons	Wood & B A J F Woollenberg, 1984
2	Power System Operation	Robert H Miller, James H Malinowski	TMH, 3rd Edition, 2009.
3	Power System SCADA and Smart Grid	Mini S Thom and John D. McDonald	CRC Press 2015
4	Power System Stability and Control	Kundur McGraw Hill	8 th Reprint, 2009
NPTEL:https://nptel.ac.in/courses/108/104/108104052			

Syllabus for the Academic Year – 2024 - 2025
Department: Electrical & Electronics Engineering
Semester: VIII
Course Name: FUZZY LOGIC AND ITS APPLICATIONS
Course Code: EE8PE13 **L-P-C: 3-0-3**

Course Objectives:

1. To understand the basics of Fuzzy rule.
2. To apply the concept of membership functions, Fuzzy rules and Fuzzy relations
3. To analyze the Fuzzy rule based system and deduce decision making of systems.
4. To design the control system using Fuzzy rule for different application.

UNIT	Description	Hours
I	**Introduction:** Background, Uncertainty and imprecision, statistics and random processes, Uncertainty in information, Fuzzy sets and membership, chance versus ambiguity. **Classical Sets:** Operations on classical sets, properties of classical sets, Mapping of classical sets to functions, **Fuzzy sets**: Fuzzy set operations, Properties of Fuzzy sets.	**08**
II	**Classical relations and fuzzy relations**: Cartesian product, **Classical Relations:** Cardinality of Crisp Relation, Operations on Crisp Relation,Properties of Crisp Relations, Composition. **Fuzzy relations**- cardinality of fuzzy relations, operations on fuzzy relations, propertiesof fuzzy relations, Fuzzy Cartesian product and composition. **Tolerance and equivalence relations-**crisp equivalence relation, crisp tolerance relation,fuzzy tolerance, value assignments-Cosine amplitude, Max-min Method.	**08**
III	**Membership functions:** Introduction, Features of Membership Function, Classification of Fuzzy Sets Fuzzification, Membership Value Assignments- Intuition, Inference, Rank Ordering, and Angular Fuzzy Sets. **Defuzzification:** Introduction, Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods.	**08**
IV	**Fuzzy rule based system:** Introduction, Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules, Properties of Set of Rules, Fuzzy Inference System. **Fuzzy Decision Making:** Introduction, Fuzzy Ordering, Individual Decision Making, Multi-Person Decision Making, Multi-Objective Decision Making, Fuzzy Bayesian Decision Method.	**08**

V	**Applications of Fuzzy Logic: Fuzzy Logic in Control**- Fuzzy Logic Controller,Automatic Generation Control Using Fuzzy Logic Controllers **Fuzzy Logic Applications in Power Systems**-Introduction to Power System Control **Fuzzy Logic in Power Plants**-Fuzzy Logic Supervisory Control for Coal Power Plant. **Fuzzy Logic in Industrial and Control Applications**- Fuzzy Logic Enhanced Controlof an AC Induction Motor with a DSP, Analysis of Environmental Data for TrafficControl, Application of Fuzzy Control for Optimal Operation of Complex Chilling Systems **Fuzzy Logic in Automotive Applications**-Fuzzy Antilock Brake System, Antilock-Braking System and Vehicle Speed Estimation Using Fuzzy Logic.	**08**

Course Outcomes:

After completion of course, student will be able to:

1. Understand the basics of Fuzzy rule.
2. Apply the concept of membership functions, Fuzzy rules and Fuzzy relations
3. Analyze the Fuzzy rule based system and deduce decision making of systems.
4. Design the control system using Fuzzy rule for different application.

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3								3	3	3
CO2	3	3	3	2	2				2			2	3	3	3
CO3	3	3	3	2	2							2	3	3	3
CO4		2	3	2	2				2				3	3	3

Learning Resources.

Sl.	Title	Author	Publisher
Text Books:			
1	Introduction to Fuzzy Logic using MATLAB	S. N. Sivanandam, S. Sumathi and S. N. Deepa	Springer Berlin Heidelberg 2007.
	Reference Books:		
1	Fuzzy Logic With Engineering Applications	Timothy J. Ross B	3rd Edition, John Wiley and Sons, Ltd., Publication 2010.
2	Neural networks and fuzzy systems: A dynamical system approach	Kosko	Pearson Edu. 1991.
3	Fuzzy sets Uncertinity and information	George J. Klir and Tina A. Folger	PHI, 2003.
4	An introduction to fuzzy logic for practical applications	Kazao Tanaka Springer-verlag,	New York, 1997.
NPTEL:https://nptel.ac.in/courses/108/104/108104157 https://nptel.ac.in/courses/127/105/127105006 https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ge07			

Syllabus for the Academic Year – 2024 – 2025
Department: Electrical & Electronics Engineering
Semester: VIII
Course Name: ENERGY AUDITING & DEMAND SIDE MANAGEMENT
Course Code: EE8PE21 **L-P-C: 3-0-3**

Course Objectives:

1. To Interpret the basic knowledge of energy situation in the world.
2. To articulate the need of energy auditing and its types.
3. To devise the need of system optimization and power factor.
4. To re frame & design demand side management models.

UNIT	Description	Hours
I	**INTRODUCTION**: Energy situation – world and India, energy consumption, conservation, Codes, Standards. **ENERGY ECONOMIC ANALYSIS:** The time value of money concept, developing cash flow models, payback analysis, depreciation, taxes and tax credit – numerical problems.	**08**
II	**ENERGY AUDITING:** Introduction, Elements of energy audits, energy use profiles,measurements in energy audits, presentation of energy audit results. Energy Management Programs-Organization Structure, Energy policy & Planning.Energy Conservation Act-2001 **ELECTRICAL SYSTEM OPTIMIZATION:** The power triangle, motor horsepower,power flow concept.	**08**
III	**ELECTRICAL EQUIPMENT AND POWER FACTOR** – Methods to improve- Correction & location of capacitors bank, energy efficient motors, lighting basics,Electrical tariff, Concept of Availability Based Tariff (ABT).	**08**
IV	**DEMAND SIDE MANAGEMENT- I :** 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,	**08**
V	**DEMAND SIDE MANAGEMENT- II:** Load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, energy efficient equipment. Management and Organization of Energy Conservation awareness Programs.	**08**

Course Outcomes:

After completion of course, student will be able to:

1. Interpret the basic knowledge of energy situation in the world.
2. articulate the need of energy auditing and its types.
3. devise the need of system optimization and power factor improvements.
4. Re frame & design demand side management models.

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2							2			2	2		
CO2	2	2							1			2	2		
CO3	2	1		1								2	1		
CO4	1	1		2									1		

Learning Resources.

Sl.	Title	Author	Publisher
Text Books:			
1	Energy Management Handbook	Wayne C Turner & Steve Doty	Sixth Edition-2007-The Fair Mont Press
2	Fundamentals of Energy Engineering	Albert Thumann, Prentice Hall Inc	Englewood Cliffs, New Jersey, 1984
3	Electrical Power Distribution	A.S. Pabla	TMH, Fifth Edition, 2004
	Reference Books:		
1	Recent Advances in Control and Management of Energy Systems	D.P.Sen, K.R.Padiyar, Indrane Sen, M.A.Pai	First Edition, 1993, Interline Publisher, Bangalore
2	Energy Demand – Analysis, Management and Conservation	Ashok V. Desai	Wiley Eastern Ltd., 1990
3	Demand Side Management	Jyothi Prakash	TMH Publishers,1995
4	Handbook on Energy Auditig		Tata Energy Research Institute (TERI),2000
NPTEL:https://nptel.ac.in/courses/108/106/108106022			

Syllabus for the Academic Year – 2024 – 2025
Department: Electrical & Electronics Engineering
Semester: VIII
Course Name: SMART GRID TECHOLOGY
Course Code: EE8PE22 **L-P-C: 3-0-3**

Course Objectives:

1. To Understand different communication and measurement technology used in smart grid.
2. To Apply concept of cyber security to smart grid.
3. To Analyze various tools for the design and stability of smart grid.
4. To Design different computational techniques for smart grid

UNIT	Description	Hours
I	**Introduction:** **smart grid:** Working definition of the smart grid based on performance, Functions of smart grid components. **Smart Grid Communications and Measurement Technology:** Communication and measurement, smart meters, and measurements technologies, GIS and google mapping tools, Micro grid and smart grid comparison.	**08**
II	**Performance Analysis Tools for Smart Grid Design:** Introduction to load flow studies, Challenges to load flow in Smart Grid, Weaknesses of the present load flow methods, Load flow for smart grid design, self study cyber security for smart grid.	**08**
III	**Stability Analysis Tools for Smart Grid:** Introduction to stability, Strengths and weaknesses of existing voltage stability analysis tools, Voltage stability assessment techniques, Voltage stability indexing, Analysis techniques for steady- state voltage stability studies, Voltage stability assessment.	**08**
IV	**Computational Tools for Smart Grid Design:** Introduction to computational tools, Decision Support tools (DS), Optimization techniques, Classical optimization method, Heuristic optimization, Evolutionary computational techniques, Adaptive dynamic programming techniques, Hybridizing optimization techniques and applications to the smart grid, Computational challenges.	**08**
V	**Interoperability, Standards, and Cyber Security:** Introduction, Interoperability, Standards, smart grid cyber security, cyber security and possible operation for improving methodology for other users.	**08**

Course Outcomes:

After completion of course, student will be able to:

1. Understand different communication and measurement technology used in smart grid.
2. Apply concept of cyber security to smart grid.
3. Analyze various tools for the design and stability of smart grid.
4. Design different computational techniques for smart grid

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1			2	1				2	2	2	2	1
CO2	3	2	1			2	1				2	2	2	2	1
CO3	3	2	1			2	1				2	2	2	2	1
CO4	3	2	1			2	1				2	2	2	2	1

Learning Resources.

Sl.	Title	Author	Publisher
Text Books:			
1	SMART GRID- Fundamentals of Design and Analysis	James Momoh	IEEE-press,Wiley Publishers, 2012
	Reference Books:		
1	Smart Grids :Security and Privacy Issues	K G Boroojeni	Springer Publication, 2017
2	Fundamentals of Electrical Drives	Mohamed A. El-Sharkawi	Thomson Learning, 2002
3	Fundamentals of smart grid Technology	Bharat modi, Anu prakash and yogesh kumar	
NPTEL: https://nptel.ac.in/courses/108/107/108107113			

Syllabus for the Academic Year – 2024- 2025

Department: Electrical & Electronics EngineeringSemester: VIII
Course Name: Embedded Systems
Course Code: EE8PE23 **L-P-C: 3-0-3**

Course Objectives:

1. To analyze the concepts of embedded system hardware, ARM processors and realtime operating systems.
2. To apply the concept of memory and interfacing processor with I/O devices usingdifferent communication methods.
3. To analyze real time operating systems to manage different process
4. To design basic real time operating systems to control and monitor the system operation.

UNIT	Description	Hours
I	**INTRODUCTION TO EMBEDDED SYSTEMS:** An Embedded System, Processor in the System, Other Hardware Units, Software Embedded into a System, Exemplary Embedded Systems, Embedded System-On-Chip (SOC) and in VLSI Circuit, Complex System design and Processors, Design Process and design Example, Classification of Embedded System, Skill required for an Embedded system designer.	**08**
II	**ARM PROCESSORS AND PERIPHERALS:** ARM Design Philosophy, Registers, Program Status Register, Instruction Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families. Application specific instruction-set processors (ASIP's), Timers, Counters, and Watchdog timers.	**08**
III	**MEMORY AND INTERFACING:** Memory write ability and storage permanence, Composing memories, Memory hierarchy and cache, Communication basics, Microprocessor interfacing: I/O addressing, interrupts, Direct memory access, Arbitration. Serial Protocols, Parallel protocols, Wireless protocols.	**08**
IV	**INTER-PROCESS COMMUNICATION AND SYNCHRONISATION OF PROCESSES, TASKS AND THREADS:** Multiple Processes in an Application, Tasks, Task states, task and data, Semaphores, Shared data, Interposes communication, Signal function, Queue function, and pipe function.	**08**
V	**REAL TIME OPERATING SYSTEMS:** Operating System Services, Process management, Timer function, Event Function, Memory management, Device File and I/O management, Real Time Operating Systems, Basic design using RTOS.	**08**

Course Outcomes:

After completion of course, student will be able to:

1. Analyze the concepts of Embedded system hardware , ARM processors and real time operating systems.
2. Apply the concept of memory and interfacing processor with I/O devices using differentcommunication methods.
3. Analyze real time operating systems to manage different process
4. Design basic real time operating systems to control and monitor the system operation

Course Articulation Matrix

PO/PSO CO	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2		2		1		2					2		1	
CO2	2	1	1				2					1		1	
CO3	2	2	3	1			2					2			
CO4		2	2		2							1			

Learning Resources.

Sl.	Title	Author	Publisher
Text Books:			
1	Embedded System, Architecture, Programming and Design	Raj Kamal	TMH, 2nd Edition 2008.
	Reference Books:		
1	Embedded Microcomputer Systems: Real time interfacing	Valvano	J.W,2nd impression, Pearson education, 2007, 5th edition.
2	ARM Systems Developer‟s Guides- Designing & Optimizing System software	Andrew N. Sloss, Dominic Symes, Chris Wright	Elsevie.2008
NPTEL: https://nptel.ac.in/courses/108/102/108102045			