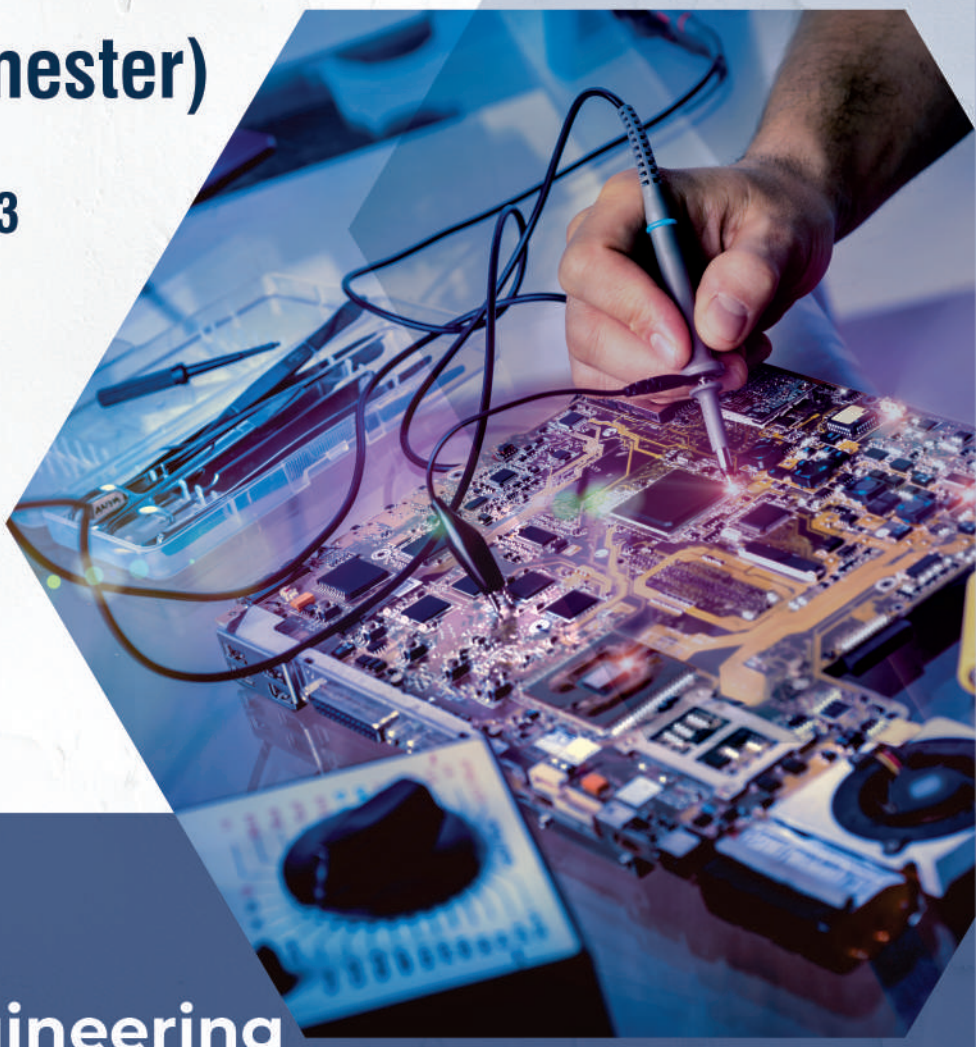
BE SCHEME & SYLLABUS

Fourth Year
(VII and VIII Semester)

With effect from 2022-23



Electrical and Electronics Engineering

ST JOSEPH ENGINEERING COLLEGE

AN AUTONOMOUS INSTITUTION

Vamanjoor, Mangaluru - 575028

MOTTO

Service & Excellence

VISION

To be a global premier Institution of professional education and research.

MISSION

- Provide opportunities to deserving students of all communities, the Christian students in particular for quality professional education.
- Design and deliver curricula to meet the national and global changing needs through student-centric learning methodologies.
- Attract, nurture and retain the best faculty and technical manpower.
- Consolidate the state-of-art infrastructure and equipment for teaching and research activities.
- Promote all round personality development of the students through interaction with alumni, academia and industry.
- Strengthen the Educational Social Responsibilities (ESR) of the institution.

ST JOSEPH ENGINEERING COLLEGE

An Autonomous Institution
Vamanjoor, Mangaluru - 575028

Affiliated to VTU – Belagavi & Recognized by AICTE New Delhi
NBA – Accredited: B.E.(ECE,EEE, ME and CIV) & PG (MBA and MCA)
NAAC – Accredited with A+

B.E. SCHEME & SYLLABUS
(With effect from 2022-23)

Electrical & Electronics Engineering

FOURTH YEAR

(VII and VIII Semester)

AUTONOMY AND ACCREDITATION

St Joseph Engineering College (SJEC) is an Autonomous Institute under Visvesvaraya Technological University (VTU), Belagavi, Karnataka State, and is recognized by the All-India Council for Technical Education (AICTE), New Delhi. SJEC is registered under the trust "Diocese of Mangalore, Social Action Department".

The SJEC has been conferred Fresh Autonomous Status from the Academic Year 2021-22. The college was granted autonomy by the University Grants Commission (UGC) under the UGC Scheme for Autonomous Colleges 2018 and conferred by VTU. The UGC Expert Team had visited the college on 28-29 November 2021 and rigorously assessed the college on multiple parameters. The fact that only a handful of engineering colleges in the state have attained Autonomous Status adds to the college's credibility that has been on a constant upswing. Autonomy will make it convenient for the college to design curricula by recognizing the needs of the industry, offering elective courses of choice and conducting the continuous assessment of its students.

At SJEC, the Outcome-Based Education (OBE) system has been implemented since 2011. Owing to OBE practised at the college, SJEC has already been accredited by the National Board of Accreditation (NBA). Four of the UG programs, namely Mechanical Engineering, Electronics and Communication Engineering, Electrical & Electronics Engineering and Civil Engineering and two of the PG programs, namely, MBA and MCA programs, have accreditation from the NBA.

Also, SJEC has been awarded the prestigious A+ grade by the National Assessment and Accreditation Council (NAAC) for five years. With a Cumulative Grade Point Average (CGPA) of 3.39 on a 4-point scale, SJEC has joined the elite list of colleges accredited with an A+ grade by NAAC in its first cycle. The fact that only a small percentage of the Higher Education Institutions in India have bagged A+ or higher grades by NAAC adds to the college's credibility that has been on a constant upswing.

The college is committed to offering quality education to all its students, and the accreditation by NAAC and NBA reassures this fact. True to its motto of "Service and Excellence", the college's hard work has resulted in getting this recognition, which has endorsed the academic framework and policies that the college has been practicing since its inception. The college has been leveraging a flexible choice-based academic model that gives students the freedom to undergo learning in respective disciplines and a transparent and continuous evaluation process that helps in their holistic development.

CONTENTS

ABOUT THE DEPARTMENT

The Department of Electrical & Electronics Engineering (EEE) was established in the year 2002. The Department has a team of well qualified and dedicated faculty with wide range of specialization. The BE programme offers a unique mix of electrical, electronics and computer related courses enabling the students to take up a professional career/higher studies in any of these areas. Subjects on Electric Circuit Analysis, Control Systems, EV Technologies, Protection and Power Systems, Electric Power Generation, Transmission and Distribution give the basic exposure to electrical fundamentals, whereas Analog and Digital Electronics, Microcontrollers, Digital Signal Processing, Embedded Systems, Hardware Description Languages(HDL), Advanced CMOS VLSI Design, Advanced Programming Languages make attractive blend of Electrical & Electronics Engineering concepts thereby creating excellent placement opportunities in various fields such as Construction, Power Distribution, Automobile, Aeronautical, Information Technology, Healthcare sectors, Semiconductor Device Design and Fabrication. The students of EEE branch are placed in Electrical & Electronics Engineering related Organizations and Software Companies. With the objective of making graduates Industry ready, Computer labs with modern Software and Hardware labs on Transformers, Motors, Power System Protective Relays, Power Electronics and Drive Systems have been operational and have helped students to improve their Technical Knowledge and Skills. The Department of Electrical & Electronics Engineering at SJEC is one of the few Departments in the region to secure NBA Accreditation since 2013.

DEPARTMENT VISION

Excel in Electrical Engineering Education and Research

DEPARTMENT MISSION

- Provide and maintain an environment designed to ensure quality Electrical and Electronics Engineering education.
- Design and deliver curriculum to ensure compatibility with national and global needs.
- Provide holistic personality development of the students through interaction with Industry, academia and alumni.
- Consolidate state-of-art laboratories for teaching and research activities.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. Prepare students in scientific and engineering skills to design effective solutions to complex engineering problems.
2. Instill professionalism, ethics, communication, teamwork and the ability to relate engineering issues to broader social contexts.
3. Develop leadership abilities in graduates to drive progress in the engineering field.
4. Develop essential skills for successful careers through rigorous education and a commitment to inculcate lifelong learning for maintaining competency.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1to WK4 respectively to develop to the solution of complex engineering problems.
2. **PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
3. **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. (WK5)
4. **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. (WK8).
5. **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. (WK2 and WK6)
6. **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. (WK1, WK5, and WK7).
7. **PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
8. **PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
9. **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
10. **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.
11. **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. (WK8)

PROGRAM SPECIFIC OUTCOMES (PSOs)

Electrical & Electronics Engineering Graduates will be able to:

1. **PSO1:** Apply the concepts of Electronic circuits, signal processing and automation to develop engineering solutions
2. **PSO2:** Develop sustainable solutions through the integration of power systems and electric drives.

KNOWLEDGE AND ATTITUDE PROFILE (WK)

1. **WK1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
2. **WK2:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
3. **WK3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
4. **WK4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
5. **WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
6. **WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
7. **WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
8. **WK8:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
9. **WK9:** Ethics, inclusive behaviour and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

VII Semester (B.E. – Electrical and Electronics Engineering)													
SI. No.	**Course and Course Code**		**Course Title**	**Teaching Department**	**Paper Setting Board**	**Teaching Hours/Week**			**Examination**				**Credits**
						Theory Lecture	**Tutorial**	**Practical/ Drawing**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total**	
						L	**T**	**P**					
1	IPCC	22EEE71	Computer Techniques in Power System	EEE	EEE	2	2	2	03	50	50	100	4
2	IPCC	22EEE72	Power System Protection	EEE	EEE	3	-	2	03	50	50	100	4
3	PCC	22EEE73	Fundamentals of VLSI Design	EEE	EEE	2	2	-	03	50	50	100	3
4	PEC	22EEE74X	Professional Elective - III	EEE	EEE	3	-	-	03	50	50	100	3
5	PRJ	22EEE75	Major Project – Phase II	EEE	EEE	-	-	6	03	50	50	100	6
					Total	**10**	**04**	**10**	**15**	**250**	**250**	**500**	**20**

22EEE74X: Professional Elective III			
22EEE741	Power System Operation & Control	22EEE743	Advanced Power Electronics
22EEE742	Energy Auditing & Demand Side Management	22EEE744	Industrial Drives & Applications

VIII Semester (B.E. – Electrical and Electronics Engineering)														
SI. No.	**Course and Course Code**		**Course Title**	**Teaching Department**	**Paper Setting Board**	**Teaching Hours/Week**			**Examination**				**Credits**
						Theory Lecture	**Tutorial**	**Practical/ Drawing**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total**	
						L	T	P					
1	PEC	22EEE81	Professional Elective IV (Online Course)	Any MOOC topic (Choices are given by respective Department) with minimum 12 weeks to be completed before the end of 8th semester								100	3
2	OEC	22EEE82	Open Elective – II (Online)	Any MOOC topic (Choices are given by respective Department) with minimum 12 weeks to be completed before the end of 8th semester.								100	3
3	INT	22EEE83	Research / Industry Internship (14 to 16 weeks)			-	-	-	03	50	50	100	10
Total						-	-	-	**03**	**50**	**50**	**300**	**16**

Note: a. Professional Elective IV: These are ONLINE courses suggested by the respective Board of Studies (Department).
b. Open Elective -II: These are ONLINE courses suggested by the respective Board of Studies (Department).
c. During 4th year of the program i.e., after VII semester, students shall take up the **Research Internship /Industrial Internship for 14-16 weeks**. Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centre of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

VII Semester

Computer Techniques in Power System			
Course Code	**22EEE71**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:2	SEE Hours	03
Total Hours	40 hours Theory + 10 Lab slots	Credits	04

Course Learning Objectives: The objective of the course is to

- Explain formulation of network models and bus admittance matrix for solving load flow problems.
- Solve power flow problem for simple power systems using numerical methods.
- Explain symmetrical fault analysis and algorithm for short circuit studies.
- Discuss optimal operation of generators on a bus bar and optimum generation scheduling.
- Explain unit commitment of thermal power plants.

Module-1 Network Topology **8 hours**

Introduction and basic definitions of Elementary graph theory - Tree, cut-set, loop, Incidence Matrices. Primitive network- Impedance form and admittance form, Formation of Y Bus by Singular Transformation and Inspection Method. Illustrative examples.

Module-2 Basic of Load Flow Studies **8 hours**

Introduction, Classification of buses. Power flow equation, Operating Constraints, Data for Load flow, Gauss Seidal iterative method. Illustrative examples.

Module-3 Load Flow Techniques **8 hours**

Newton-Raphson method derivation in Polar form, Fast decoupled load flow method. Comparison of Load Flow Methods. Illustrative examples.

Module-4 Economic Operation of Power System **8 hours**

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, Derivation of transmission loss formula. Illustrative examples.

Module-5 Unit Commitment & Symmetrical Fault Analysis **8 hours**

Unit Commitment: Introduction, Constraints and unit commitment solution by priority list method and dynamic forward Programming approach (Flow chart and Algorithm only).

Symmetrical Fault Analysis: Z Bus Formulation by Step by step building algorithm without mutual coupling. Illustrative examples. Short Circuit analysis using Z bus excluding numerical.

PRACTICAL MODULE

Experiments using MATLAB

1. Y Bus Formation for Power Systems with and without Mutual Coupling by Singular Transformation.
2. Y Bus Formation for Power Systems without Mutual Coupling by Inspection Method.
3. Formation of Z Bus (without mutual coupling) using Z-Bus Building Algorithm.
4. Load Flow Analysis using Gauss Seidel Method for the system with PQ buses only.
5. Formation of Jacobian for a system not exceeding 4 Buses in Polar Coordinates.
6. Determination of Bus Currents, Bus Power and Line Flow for a Specified System Voltage.
7. To obtain Swing Curve and to Determine Critical Clearing Time, Regulation, Inertia Constant/Line Parameters /Fault Location/Clearing Time/Pre-Fault Electrical Output for a Single Machine connected to Infinite Bus through a Pair of identical Transmission Lines Under 3-Phase Fault On One of the two Lines.
8. Optimal Generation Scheduling for Thermal power plants by simulation.

Experiments using ETAP software

9. Load Flow Analysis using Gauss Seidel Method, NR Method and Fast Decoupled Method for Both PQ and PV Buses using ETAP software.

10. To Determine Fault Currents and Voltages in a Single Transmission Line System at a Specified Location for different types of faults by simulation using ETAP software.

Course Outcomes: At the end of the course the student will be able to:	
22EEE71.1	Apply the knowledge of Gauss Seidel method to solve problems related to power flow.
22EEE71.2	Apply the knowledge of Newton Raphson method to solve problems related to power flow.
22EEE71.3	Develop the bus admittance matrix for a given power system using singular and inspection method.
22EEE71.4	Develop an optimal schedule for thermal plants with and without considering losses.
22EEE71.5	Develop the unit commitment of generating plants using different unit commitment algorithms.
22EEE71.6	Develop short circuit analysis algorithm using Thevenins theorem and bus impedance matrix.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Computer Techniques and Models in Power Systems	K Uma Rao	I K International	2nd Edition 2014
2	Modern Power System Analysis	I J Nagrath and D P Kothari	Tata McGraw-Hill Education India	4th Edition, 2011
3	Computer Methods in Power Systems Analysis	Glenn W. Stagg, Ahmed H Ei - Abiad	Scientific International	1st Edition 2019
Reference Books				
1	Computer Techniques in Power System Analysis	M A Pai	McGraw-Hill	2nd Edition, 2012
2	Power System Analysis	Hadi Saadat	McGraw-Hill	2nd Edition, 2002
3	Power Generation Operation and Control	Allen J Wood etal	Wiley	2nd Edition, 2016

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/108107028 (Computer Aided Power System Analysis, IIT Roorkee)
- https://nptel.ac.in/courses/108105067 (Power System Analysis, IIT Kharagpur)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
22EEE71.1	-	3	-	-	3	-	-	-	-	-	-	-	-
22EEE71.2	-	3	-	-	3	-	-	-	-	-	-	-	-
22EEE71.3	2	-	-	-	-	-	-	-	-	-	-	-	2
22EEE71.4	-	2	-	-	-	-	-	-	-	-	-	-	2
22EEE71.5	2	-	-	-	-	-	-	-	-	-	-	-	2
22EEE71.6	-	2	-	-	-	-	-	-	-	-	-	-	1

1: Low 2: Medium 3: High

Power System Protection			
Course Code	**22EEE72**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:2	SEE Hours	03
Total Hours	40 hours Theory + 10 Lab slots	Credits	04

Course Learning Objectives: The objective of the course is to:

- Understand why power system protection is needed and how faults affect the system.
- Learn how different types of relays work and where they are used.
- Study how to protect power system components using overcurrent, distance, and differential methods.
- Know how circuit breakers operate and how they interrupt faults.
- Learn how electrical materials break down under high voltage in gases, liquids, and solids.

Module-1 Introduction to High Voltage Engineering **8 hours**

Introduction to HVAC and HVDC transmission system: Advantages and Limitations, Dielectric: Solid liquid gaseous and Vacuum dielectrics.

Generation of High DC Voltages: Rectifiers Circuits, Cockroft- Walton Voltage Multiplier Circuit, Electrostatic Generator.

Generation of High AC Voltages: Cascaded Transformers, Resonant transformers, Generation of High frequency AC high Voltages: Types of DC Links.

Module-2 Introduction to Power System Protection **8 hours**

Introduction to Power System Protection: Need for protective schemes, Nature and Cause of Faults, Types of Faults, Effects of Faults, Fault Statistics, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection.

Relay Construction and Operating Principles: Introduction, Electromechanical Relays, Static Relays – Merits and Demerits of Static Relays, Numerical Relays, Comparison between Electromechanical Relays and Numerical Relays.

Module-3 Overcurrent & Distance Protection **8 hours**

Overcurrent Protection: Introduction, Time – current Characteristics, Current Setting, Time Setting. Overcurrent Protective Schemes, Reverse Power or Directional Relay, Protection of Parallel Feeders, Protection of Ring Mains, Earth Fault and Phase Fault Protection, Combined Earth Fault and Phase Fault Protective Scheme, Phase Fault Protective Scheme, Directional Earth Fault Relay, Static Overcurrent Relays, Numerical Overcurrent Relays.

Distance Protection: Introduction, Impedance Relay, Reactance Relay, Mho Relay, Angle Impedance Relay, Effect of Arc Resistance on the Performance of Distance Relays, Reach of Distance Relays.

Module-4 Differential Protection **8 hours**

Pilot Relaying Schemes: Introduction, Wire Pilot Protection, Carrier Current Protection

Differential Protection: Introduction, Differential Relays, Simple Differential Protection, Percentage or Biased Differential Relay, Differential Protection of 3 Phase Circuits, Balanced (Opposed) Voltage Differential Protection.

Rotating Machines Protection: Introduction, Protection of Generators.

Transformer and Buszone Protection: Introduction, Transformer Protection, Buszone Protection.

Module-5 Circuit Breakers **8 hours**

Introduction, Fault Clearing Time of a Circuit Breaker, Arc Voltage, Arc Interruption, Restriking Voltage and Recovery Voltage, Current Chopping, Interruption of Capacitive Current, Classification of Circuit Breakers, Air – Break Circuit Breakers, Oil Circuit Breakers, Air – Blast Circuit Breakers, SF6 Circuit Breakers, Vacuum Circuit Breakers, High Voltage Direct Current Circuit Breakers, Rating of Circuit Breakers, Testing of Circuit Breakers.

PRACTICALMODULE

1. Over Current Relay: (a) Inverse Definite Minimum Time (IDMT) Non - Directional Characteristics (b) Directional Features (c) IDMT Directional
2. IDMT Characteristics of Over Voltage or Under Voltage Relay (Solid State or Electromechanical type).
3. Operation of Negative Sequence Relay.
4. Operating Characteristics of Microprocessor Based (Numeric) Over –Current Relay.
5. Operating Characteristics of Microprocessor Based (Numeric) Distance Relay.
6. Operating Characteristics of Microprocessor Based (Numeric) Over/Under Voltage Relay.
7. Measurement of Breakdown Strength of Transformer Oil as per IS 1876 :2005
8. Spark Over Characteristics of Air subjected to High Voltage AC with Spark Voltage Corrected to Standard Temperature and Pressure for Uniform [as per IS1876: 2005]and Non-uniform [as per IS2071(Part 1): 1993] Configurations: Sphere – Sphere, Point – Plane, Point – Point and Plane – Plane.
9. Spark Over Characteristics of Air subjected to High voltage DC.

Course Outcomes: At the end of the course the student will be able to:	
22EEE72.1	Apply electrical engineering fundamentals to analyze and design protective schemes and high-voltage systems.
22EEE72.2	Analyze power system faults and interpret protective device responses using engineering principles.
22EEE72.3	Assist in designing protection schemes and high-voltage test setups for simple power systems.
22EEE72.4	Use relay test kits and tools to evaluate power system protection and high-voltage equipment performance.
22EEE72.5	Work effectively in teams to conduct protection experiments and interpret results.
22EEE72.6	Recognize the need for lifelong learning and adapt to emerging technologies in power system protection.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Power System Protection and Switchgear	Badri Ram,D.N. Vishwakarma	McGraw Hill	2nd Edition, 2011
2	High Voltage Engineering	M S Naidu, V Kamaraju	McGraw Hill	5th Edition, 2013
3	Power System Protection and Switchgear	Bhuvanesh Oza etal	McGraw Hill	1st Edition, 2010
Reference Books				
1	Protection and Switchgear	Bhavesh etal	Oxford	1st Edition, 2011
2	Power System Switchgear and Protection	N. Veerappan S.R. Krishnamurthy	S. Chand	1st Edition, 2009
3	Fundamentals of Power System Protection	Y.G.Paithankar S.R. Bhide	PHI	1st Edition, 2009

Web links and Video Lectures (e-Resources):

- https://youtu.be/WPmOB31UTkI?feature=shared (Lecture 01: Faults in Power System Lecture 01: Faults in Power System)
- https://youtu.be/oC5VmIGxsGA?feature=shared (Lecture 26 Protection of Transformers)
- https://youtu.be/NEXWcOgqZOI?feature=shared (Lecture 1 Fundamentals of Protective Relaying-I)
- https://youtu.be/ZXyq-xxRLnQ?feature=shared (Lecture 28 Protection of Generators-I)
- https://youtu.be/GjJFRtgWhCM?feature=shared (Lecture 18: Introduction to Distance Relay)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
22EEE72.1	3	-	-	-	-	-	-	-	-	-	-	-	-
22EEE72.2	-	2	-	-	-	-	-	-	-	-	-	-	-
22EEE72.3	-	-	1	-	-	-	-	-	-	-	-	-	-
22EEE72.4	-	-	-	-	2	-	-	-	-	-	-	-	-
22EEE72.5	-	-	-	-	-	-	-	2	-	-	-	-	-
22EEE72.6	-	-	-	-	-	-	-	-	-	-	1	-	-

1: Low 2: Medium 3: High

Fundamentals of VLSI Design			
Course Code	**22EEE73**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	2:2:0	SEE Hours	03
Total Hours	40 Hours	Credits	03

Course Learning Objectives: The objective of the course is to:

- Understand the MOS transistor theory and CMOS fabrication technologies.
- Understand the design rules and layout of CMOS technology.
- Know the circuit design and CMOS logic structures.
- Understand the basic circuit concepts and scaling CMOS structures.
- Apply the knowledge to design CMOS subsystems and know the working of semiconductor memory circuits.

Module-1 Review of Microelectronics and Introduction to MOS Technology	**8 hours**
Introduction to Integrated Circuit Technology, MOS and related VLSI technology, Moore's law, speed power performance, nMOS fabrication, CMOS fabrication: n-well, p-well, twin-tub process, Comparison of bipolar and CMOS technology.	
Module-2 Basic Electrical Properties of MOS Circuits	**8 hours**
Drain to source current versus voltage characteristics, threshold voltage, transconductance**,** nMOS inverter, Determination of pull up to pull down ratio, nMOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, Latch-up in CMOS circuits.	
Module-3 Circuit Design Processes	**8 hours**
Stick diagrams, design, symbolic diagrams of nMOS in nMOS design style and CMOS in CMOS design style. Importance of Lambda based rules. **Basic Circuit Concepts**: Sheet resistance, area capacitance calculation, Delay unit, inverter delay, estimation of CMOS inverter delay, driving of large capacitance loads, super buffers.	
Module-4 Scaling of MOS circuits and subsystem design	**8 hours**
Scaling of MOS Circuits: scaling factors for device parameters, limitations of scaling. **Subsystem Design and Layout-1**: Architectural issues, Switch logic pass transistor, Gate logic: inverter, NAND gates, NOR gates.	
Module-5 Subsystem Design and Layout	**8 hours**
Forms of CMOS Logic: pseudo nMOS, Dynamic CMOS, clocked CMOS, CMOS domino logic, n-p CMOS logic, Example of structured design: -Parity generator, Bus arbitration, multiplexers, logic function block, four-line Gray code to Binary code converter, two phase clocking, dynamic shift register element, dynamic shift register.	

Course Outcomes: At the end of the course the student will be able to:	
22EEE73.1	Analyze MOS, and CMOS technologies and their electrical properties for use in VLSI systems.
22EEE73.2	Design and evaluate MOS inverters, buffer circuits considering performance parameters and layout constraints.
22EEE73.3	Apply VLSI design principles using stick diagrams, design rules, and scaling techniques for layout and fabrication.
22EEE73.4	Assess the suitability of subsystem designs such as logic blocks and shift registers in real-world digital systems.
22EEE73.5	Collaborate effectively to design and simulate VLSI subsystems while documenting the process clearly and professionally.
22EEE73.6	Demonstrate the need for continuous learning to keep pace with advances in VLSI design technologies and practices.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Basic VLSI Design	Douglas A Pucknell & Kamran Eshragian	PHI	3rd Edition, 2005
2	CMOS Digital Integrated Circuits: Analysis and Design	Sung Mo Kang, Yosuf Leblebici	Tata McGraw-Hill	3rd Edition, 2002
3	VLSI Technology	S.M. Sze	Tata McGraw Hill	2nd Edition, 2003
Reference Books				
1	Principles of CMOS VLSI Design	Neil H. E. Weste and Kamaran Eshraghian	Addison- Wesley	2nd Edition, 2004
2	CMOS VLSI Design- A Circuits and Systems Perspective	Neil H. E. Weste and David Money Harris	Pearson Education India	4th Edition, 2011

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/108107129 (CMOS Digital VLSI Design, IIT Roorkee)
- https://nptel.ac.in/courses/117101105 (CMOS Analog VLSI Design, IIT Bombay)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
22EEE73.1	3	2	2	1	1	-	-	-	-	-	-	-	-
22EEE73.2	3	2	3	2	2	-	-	-	-	-	-	2	-
22EEE73.3	3	-	3	2	1	-	-	-	-	-	-	2	-
22EEE73.4	2	2	2	2	1	-	-	-	-	-	-	-	-
22EEE73.5	-	-	1	-	1	-	-	2	2	-	-	-	-
22EEE73.6	-	-	-	-	-	-	-	-	-	-	2	-	-

1: Low 2: Medium 3: High

Power System Operation and Control			
Course Code	**22EEE741**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory (Professional Elective)	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE Hours	03
Total Hours	40 Hours	Credits	03

Course Learning Objectives: The objective of the course is to:

- Describe various levels of controls in power systems and the vulnerability of the system.
- Explain components, architecture and configuration of SCADA.
- Explain basic generator control loops, functions of Automatic generation control, speed governors and mathematical models of Automatic Load Frequency Control
- Explain automatic generation control, voltage and reactive power control in an interconnected power system.
- Explain reliability and contingency analysis, state estimation and related issues.

Module-1 Supervisory Control and Data acquisition **8 hours**

Introduction: Operating States of Power System, Objectives of Control, Key Concepts of Reliable Operation, Preventive and Emergency Controls, Energy Management Centers.

Supervisory Control and Data acquisition (SCADA): Introduction, components, application in Power System, basic functions and advantages. Building blocks of SCADA system, components of RTU, communication subsystem, IED functional block diagram, Classification of SCADA system.

Module-2 Automatic Generation Control (AGC) **8 hours**

Automatic Generation Control (AGC): Introduction, Schematic diagram of load frequency and excitation voltage regulators of turbo generators, Load frequency control (Single area case), Turbine speed governing system, Model of speed governing system, Turbine model, Generator load model, Complete block diagram of representation of load frequency control of an isolated power system, Steady state analysis, Control area concept, Proportional plus Integral Controller.

Module-3 Automatic Generation Control in Interconnected Power system **8 hours**

Automatic Generation Control in Interconnected Power system: Two area load frequency control, Optimal (Two area) load frequency control by state variable, Automatic voltage control, Load frequency control with generation rate constraints (GRCs), Speed governor dead band and its effect on AGC, Digital LF Controllers, Decentralized control.

Module-4 Control of Voltage and Reactive Power **8 hours**

Control of Voltage and Reactive Power: Introduction, Generation and absorption of reactive power, Relation between voltage, power and reactive power at a node, Methods of voltage control: i. Injection of reactive power, Shunt capacitors and reactors, Series capacitors, Synchronous compensators, Series injection. ii. Tap changing transformers. Combined use of tap changing transformers and reactive power injection, Booster transformers, Phase shift transformers, Voltage collapse.

Module-5 Power System Security **8 hours**

Power System Security: Introduction, Factors affecting power system security, Security levels of system, Functions of power system security, Contingency Analysis, Linear Sensitivity Factors, AC power flow methods, Contingency Selection and Ranking.

Course Outcomes: At the end of the course the student will be able to:	
22EEE741.1	Analyze the various levels of controls in power systems and functions of energy management center.
22EEE741.2	Analyze the architecture, configuration and classification of SCADA.
22EEE741.3	Analyze the effect of Automatic Voltage Regulator and Automatic Generation Control on Load Frequency Control of single area system.

22EEE741.4	Analyze the effect of Automatic Voltage Regulator and Automatic Generation Control on Load Frequency Control of interconnected systems
22EEE741.5	Articulate the different techniques to Control of Voltage, Reactive Power and Voltage collapse.
22EEE741.6	Analyze the various factors affecting the security power system for contingency ranking.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Power System Operation and Control	K. Uma Rao	Wiley India	1st Edition 2012
2	Modern Power System Analysis	I J Nagrath and D P Kothari	Tata McGraw-Hill Education India	4th Edition, 2011
3	Power generation, operation and control	Wood & B A J F Woollenberg	John Wiley and Sons	2nd Edition,1996
Reference Books				
1	Power System SCADA and Smart Grid	Mini S Thom and John D. McDonald	CRC Press	1st Edition 2015
2	Electric Power Systems	B M Weedy, B J Cory	Wiley India	4th Edition 2009

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/108101040 (Power System Operation and Control, IIT Bombay)
- https://nptel.ac.in/courses/108105133 (Power System Dynamics, Control and Monitoring, IIT Kharagpur)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22EEE741.1	-	-	2	-	-	-	-	-	-	-	-	-	1
22EEE741.2	-	-	-	-	3	-	-	-	-	-	-	-	1
22EEE741.3	-	2	-	-	-	-	-	-	-	-	-	-	1
22EEE741.4	-	2	-	-	2	-	-	-	-	-	-	-	-
22EEE741.5	-	-	2	-	-	-	-	-	-	-	-	-	-
22EEE741.6	-	-	2	-	-	-	-	-	-	-	-	-	1

1: Low 2: Medium 3: High

Energy Auditing & Demand Side Management			
Course Code	**22EEE742**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory (Professional Elective)	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE Hours	03
Total Hours	40 Hours	Credits	03

Course Learning Objectives: The objective of the course is to

- Understand the global and Indian energy scenario, including energy consumption patterns, conservation methods, and relevant codes and legislation.
- Analyze the performance of energy-efficient motors and power factor improvement techniques to optimize energy usage in electrical systems.
- Apply appropriate instruments and methods to conduct energy audits on lighting systems and interpret the collected data effectively.
- Explain the concepts and techniques of Demand Side Management (DSM) and their role in energy conservation and load management.
- Evaluate the economic feasibility and cost-effectiveness of DSM programs using various financial analysis tools and tests.

Module-1 Introduction to Energy Auditing **8 hours**

Energy Situation – World and India, Energy Consumption, Conservation, Codes, Standards and Legislation. Energy Audit- Definitions, Concept, Types of Audit, Energy Index, Cost Index, Pie Charts, Sankey Diagrams, Load Profiles, Energy Conservation Schemes. Measurements in Energy Audits, Presentation of Energy Audit Results**.**

Module-2 Energy Efficient Motors and Power Factor Improvement **8 hours**

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. Power Factor – Methods of Improvement, Power factor with Non-Linear Loads**.**

Module-3 Lighting and Energy Instruments for Audit **8 hours**

Good Lighting System Design and Practice, Numerical Problems, Lighting Control, Lighting Energy Audit - Energy Instruments- Watt Meter, Data Loggers, Thermocouples, Pyrometers, Lux Meters, Tong Testers.

Module-4 Introduction to Demand Side Management **8 hours**

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 DSM Programs **8 hours**

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 Numerical problems: Participant cost test, Total Resource Cost test and Ratepayer impact measure test

Course Outcomes: At the end of the course the student will be able to:	
22EEE742.1	Analyze energy use patterns and efficiency measures to develop auditing and DSM strategies for sustainable systems.
22EEE742.2	Apply audit techniques to identify and interpret energy issues in industrial and commercial systems.
22EEE742.3	Apply basic design concepts to suggest energy-saving improvements in lighting,

	motors, and load systems.
22EEE742.4	Use basic audit tools like data loggers and lux meters to measure and record energy parameters.
22EEE742.5	Apply DSM practices to support energy conservation and environmental sustainability.
22EEE742.6	Communicate audit findings and DSM proposals effectively in written or oral form.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Energy Auditing & Demand Side Management	K. Meenendranath Reddy	Blue Rose Publishers	1st Edition, 2022
2	A Text Book On Energy Auditing and Demand Side Management	Dr. G. Srinivasulu Reddy, Dr. V. Madhusudhana Reddy, Dr. Akhib Khan Bahamani, Mr. K.V. Kishore, Dr. G. Venkateswarlu	Authors Click Publishing	1st Edition, 2024
Reference Books				
1	Energy Audit and Management	L. Ashok Kumar , Gokul Ganesan	CRC Press	1st Edition, 2022

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/124105552 (Building Energy Systems and Auditing, IIT Kharagpur)
- https://nptel.ac.in/courses/109106161 (Energy Economics and Policy, IIT Mandi)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22EEE742.1	3	-	-	-	-	-	-	-	-	-	-	-	-
22EEE742.2	-	2	-	-	-	-	-	-	-	-	-	-	-
22EEE742.3	-	-	1	-	-	-	-	-	-	-	-	-	-
22EEE742.4	-	-	-	-	1	-	-	-	-	-	-	-	-
22EEE742.5	-	-	-	-	-	1	-	-	-	-	-	-	-
22EEE742.6	-	-	-	-	-	-	-	-	1	-	-	-	-

1: Low 2: Medium 3: High

Advanced Power Electronics			
Course Code	**22EEE743**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory (Professional Elective)	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE Hours	03
Total Hours	40 hours	Credits	03

Course Learning Objectives: The objective of the course is to

- Explore the principles and operation of switching mode regulators, boost converters, resonant pulse inverters, and multilevel inverters.
- Apply design and analysis techniques for DC-DC converters, resonant pulse inverters, and multilevel inverter circuits.
- Explain the operating principles and frequency characteristics of resonant inverters, including methods for achieving zero-voltage and zero-current switching.
- Examin**e** various power supply types and circuit topologies, and analyze their operation and performance.
- Investigate the practical applications of power electronic devices across different systems and industries.

Module-1 DC–DC Converters	**8 hours**
Switching-mode regulators, comparison of regulators, multi-output boost converter, diode rectifier-fed boost converter, averaging models of converters, state–space concepts, design considerations for input filter and converters, drive IC for converters.	
Module-2 Resonant Pulse Inverters	**8 hours**
Introduction. Series resonant inverters, frequency response of series inverters, parallel resonant inverters, voltage controlled resonant inverters, class e resonant inverter, class e resonant rectifier, zero – current switching (ZCS) resonant converters, zero voltage switching resonant converters (ZVS), comparison between ZCS and ZVS resonant converters, two quadrant ZVS resonant converters, resonant DC – link inverters.	
Module-3 Multilevel Inverters	**8 hours**
Introduction, multilevel concept, types of multilevel inverters, diode – clamped multilevel inverter, flying - capacitors multilevel inverter. Cascaded multilevel inverter, applications, features of multilevel inverters, comparison of multilevel converters.	
Module-4 Power Supplies	**8 hours**
Introduction, DC power supplies, AC power supplies, multistage conversions, control circuits, magnetic design considerations.	
Module-5 Electrical Utility Applications	**8 hours**
Introduction, high voltage DC transmission, static VAR compensators, interconnection of renewable energy sources and energy storage systems to the utility grid, active filters.	

Course Outcomes: At the end of the course the student will be able to:	
22EEE743.1	Describe and apply design techniques for various types of switching regulators and DC-DC converters.
22EEE743.2	Evaluate the performance characteristics and parameters of resonant converters.
22EEE743.3	Describe the fundamental principles of Zero-Voltage Switching (ZVS) and Zero-Current Switching (ZCS) in resonant converters.
22EEE743.4	Describe control strategies used in multilevel inverters and their impact on performance.
22EEE743.5	Analyz**e** the types, topologies, and operational principles of different power supply circuits.
22EEE743.6	Discuss the applications of power electronic devices in electrical utility and industrial systems.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Power Electronics: Circuits Devices and Applications	Mohammad H Rashid	Pearson	4th Edition, 2014
Reference Books				
1	Power Electronics Essentials and Applications	L Umanand	Wiley	1st Edition, 2009

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/108/107/108107128/ (Advanced Power Electronics and Control, IIT Roorkee)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
22EEE743.1	1	2	3	-	-	-	-	-	-	-	-	-	-
22EEE743.2	-	2	1	1	-	-	-	-	-	-	-	-	-
22EEE743.3	-	3	2	1	-	-	-	-	-	-	-	-	-
22EEE743.4	-	-	2	1	1	-	-	-	-	-	-	-	-
22EEE743.5	-	-	-	1	2	3	-	-	-	-	-	2	-
22EEE743.6	-	-	-	-	2	3	-	-	-	-	2	-	2

1: Low 2: Medium 3: High

Industrial Drives & Applications			
Course Code	**22EEE744**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory (Professional Elective)	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE Hours	03
Total Hours	40 Hours	Credits	03

Course Learning Objectives: The objective of the course is to

- Describe electric drives, identify their main components, and evaluate the advantages and criteria for selecting an appropriate electric drive.
- Discuss the dynamics and various modes of operation of electric drives.
- Illustrate the process for selecting motor power ratings and demonstrate control methods for DC motors using rectifiers.
- Analyze the performance and control techniques of induction motors, synchronous motors, and stepper motor drives.
- Examine common industrial applications of electrical drives and their impact on system performance.

Module-1 Dynamics and Control of Electrical Drives **8 hours**

Electrical Drives: Electrical drives, Advantages of Electrical drives, Parts of Electrical Drives, Choice of Electrical Drives.

Dynamics of Electrical Drives: Fundamental Torque Equations, Speed Torque Conventions and Multi-quadrant Operation. Equivalent Values of Drive Parameters, Calculation of Time and Energy Loss in transient Operations, Steady State Stability, Load Equalization.

Control of Electrical Drives: Modes of Operation, Speed Control and Drive Classifications, Closed loop Control of Drives.

Module-2 Selection of Motor Power rating and Control of DC Motor Drives **8 hours**

Selection of Motor Power Ratings: Thermal Model of Motor for Heating and Cooling, Classes of Motor Duty, Determination of Motor Rating.

Direct Current Motor Drives: Controlled Rectifier Fed dc Drives, Three Phase Fully Controlled Rectifier Control of DC Separately Excited Motor, Three Phase Half Controlled Rectifier Control of DC Separately Excited Motor, Multi-quadrant Operation of DC Separately Excited Motor Fed from Fully Controlled Rectifier, Rectifier Control of DC Series Motor, Chopper Control of Separately Excited DC Motor, Chopper Control of Series Motor.

Module-3 Performance of Induction Motor Drives **8 hours**

Induction Motor Drives: Analysis and Performance of Three Phase Induction Motors, Operation with Unbalanced Source Voltage and Single Phasing, Operation with Unbalanced Rotor Impedances, Starting, Braking, Transient Analysis.

Module-4 Speed Control of Induction Motor Drives and Performance of Synchronous Motor Drives **8 hours**

Speed Control Techniques- Brief Introduction to Scalar and Vector Control. Stator Voltage Control, Variable Voltage Frequency Control from Voltage Sources. Voltage Source Inverter (VSI) Control, Closed Loop Speed Control of Induction Motor Drives, Current Source Inverter (CSI) control.

Synchronous Motor Drives: Operation from Fixed Frequency Supply- Starting of Synchronous Motor.

Module-5 Control of Synchronous Motor, PMAC, BLDC, Stepper Motor and Industrial Drives **8 hours**

Synchronous Motor Drives: Self Controlled Synchronous Motor Drive Employing Load Commutated Thyristor Inverter, Starting of Large Synchronous Machines, Permanent Magnet AC (PMAC) Motor Drives, Sinusoidal PMAC Motor Drives, Brushless DC Motor Drives.

Stepper Motor Drives: Variable Reluctance, Permanent Magnet, Drive Circuits for Stepper Motor.

Industrial Applications of Drives: Textile Mills, Steel Rolling Mills, Cranes and Hoists, Machine Tools.

Course Outcomes: At the end of the course the student will be able to:	
22EEE744.1	Describe the advantages of electric drives and justify their selection based on application requirements.
22EEE744.2	Explain the dynamic behavior and various modes of operation of electric drives.
22EEE744.3	Determine appropriate motor power ratings for industrial applications and analyze the performance and control of DC motors using controlled rectifiers and choppers.
22EEE744.4	Evaluate the performance and implement speed control strategies for induction motor drives under different operating conditions.
22EEE744.5	Analyze the operation and control methods of synchronous motors, permanent magnet AC motors (PMAC), brushless DC (BLDC) motors, and stepper motor drives.
22EEE744.6	Select and recommend suitable electric drives for specific industrial applications based on performance requirements and operational constraints.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Fundamentals of Electrical Drives	Gopal K Dubey	Narosa Publishers	2nd Edition, 2001
2	Electrical Drives: Concepts and applications	Vedam Subramanyam	McGraw Hill	2nd Edition, 2011
Reference Books				
1	Electric Drives	N K De, P K Sen	PHI Learning	1st Edition, 2009

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/108108077 (Industrial Drives – Power Electronics, IISc Bangalore)
- https://onlinecourses.nptel.ac.in/noc21_me67/preview (Industrial Automation and Control, IIT Kharagpur)

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22EEE744.1	2	2	3	-	-	-	-	-	-	-	-	-	-
22EEE744.2	-	2	2	1	-	-	-	-	-	-	-	-	-
22EEE744.3	-	-	2	2	-	-	-	-	-	-	2	-	-
22EEE744.4	-	-	-	2	2	1	-	-	-	-	-	-	-
22EEE744.5	-	-	-	1	2	-	-	-	-	-	2	2	-
22EEE744.6	-	-	-	2	2	-	-	-	-	-	3	-	2

1: Low 2: Medium 3: High

Major Project Phase II			
Course Code	**22EEE75**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P)	(0:0:6)	SEE Hours	03
Total Hours	72 hours	Credits	06

Course Learning Objectives: The objective of the course is to

- Utilize fundamental principles of engineering and interdisciplinary knowledge to identify, analyse, and solve complex problems in the project domain.
- Develop and execute a comprehensive project plan that includes designing, prototyping, testing, and evaluating a system, component, or process to meet specific needs and constraints.
- Conduct in-depth research, critically review literature, and integrate innovative solutions or techniques within the project framework.
- Demonstrate effective teamwork, communication, and collaboration skills in a multidisciplinary environment to achieve project objectives.
- Incorporate ethical considerations, societal impact, and sustainable practices in the project development, while adhering to professional engineering standards.
- Prepare and present a well-structured project report, supported by technical documentation and visual aids, and confidently defend the work during project viva-voce or presentations.

1. Project Execution

- **Regular Meetings**: Students should meet regularly with their project-guide to discuss progress, challenges, and next steps.
- **Documentation**: Maintain detailed documentation throughout the project in a project work-dairy, including design decisions, experiments, and testing results.
- **Milestones**: Set clear milestones and deadlines to ensure steady progress. These could include design completion, initial prototype, testing, etc.

2. Mid-term Review

- **Progress Presentation**: DPEC shall conduct a mid-term review where students present their progress to a panel of faculty members.
- **Feedback**: Provide constructive feedback and guidance to help students refine their projects.

3. Final Submission

- **Report**: The project report should include an abstract, introduction, literature review, methodology, implementation, results, discussion, conclusion, and references.
- **Code and Data**: If applicable, students should submit their code, datasets, and any other relevant materials.

4. Project Presentations

- **Oral Presentation**: Students should present their projects to a panel, explaining their work, findings, and contributions.
- **Demonstration**: If possible, include a live demonstration of the project or show relevant simulations and results.
- **Q&A**: Be prepared to answer questions from the panel and justify the project's methodology and conclusions.

5. Evaluation Criteria

- **Originality and Innovation**: Assess the novelty and creativity of the project.
- **Technical Competence**: Evaluate the depth of technical knowledge and problem-solving ability demonstrated.
- **Project Execution**: Consider the effectiveness of project planning, adherence to timelines, and quality of implementation.

- **Presentation and Communication**: Judge the clarity and coherence of the final report, presentation, and the ability to answer questions.

6. Plagiarism Check

- **Academic Integrity**: Ensure that the work submitted is original and properly cites all references and sources.
- **Plagiarism Check**: Run all reports through plagiarism detection software and ensure that similarity index is less than the threshold value (25%).

7. Mentorship and Feedback

- **Feedback:** Students are required to consult with their project guide regularly throughout the project work to seek guidance and feedback.
- **Weekly Meetings:** At least one mentorship meeting every week shall be held and recorded in the project work-dairy.

8. Post Submission

- **Publication**: DPEC shall encourage students to publish their work in conferences or journals, especially if it contributes significantly to their field.
- **Project Archive**: Store all projects in the department's digital archive for future reference.

Continuous Internal Evaluation (CIE)		
Description	**Proposed Dates**	**CIE Weightage (Max 100 marks)**
1. Project Progress Evaluation -I	Beginning of the 7th Semester	20 marks
2. Project Progress Evaluation -II	Middle of the 7th Semester	30 marks
3. Project Report Evaluation (Phase II)	End of the 7th Semester	50 marks
Semester End Examinations (SEE)		
4. SEE will be conducted for 100 marks (after the last working day of the 7th semester) in the presence of the external examiner with the weightage as **Project Report: 50 marks, Project Presentation: 25 marks and Question & Answer Session: 25 marks**. Marks awarded for Project Report is same for all batch-mates.		

Course Outcomes: At the end of the course the student will be able to:	
22EEE75.1	Demonstrate the ability to identify, define, and solve complex engineering problems using appropriate methodologies and modern tools.
22EEE75.2	Successfully design, develop, and test an engineering solution that meets specified requirements, addressing technical, economic, environmental, and social constraints.
22EEE75.3	Apply research skills to review existing literature, gather and analyze data, and incorporate innovative or state-of-the-art technologies in the project
22EEE75.4	Collaborate effectively within a team, taking on leadership or supportive roles as needed, while ensuring clear communication and efficient project management.
22EEE75.5	Demonstrate awareness of professional ethics, societal impact, and sustainability in the design and implementation of engineering solutions.
22EEE75.6	Exhibit strong written and oral communication skills by preparing technical reports, project documentation, and delivering persuasive project presentations.

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
22EEE75.1	2	3	-	-	1	-	-	-	-	-	-	-	-
22EEE75.2	-	-	3	-	-	2	1	-	-	-	-	-	-
22EEE75.3	1	2	-	3	-	-	-	-	-	-	-	-	-
22EEE75.4	-	-	-	-	-	1	-	-	3	2	2	-	-
22EEE75.5	-	-	1	-	-	-	2	3	-	-	-	-	-
22EEE75.6	-	-	-	-	-	-	-	-	-	3	2	-	-

1: Low 2: Medium 3: High

VIII Semester

Professional Elective – IV (Online Course)			
Course Code	**22EEE81**	CIE Marks	50 *
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50 *
		Total Marks	100
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Hours	03
Total Hours	36 hours	Credits	03

Course Learning Objectives:

1. Understand and apply foundational concepts and principles of the chosen elective domain to real-world engineering problems.
2. Develop the ability to learn independently and navigate MOOC platforms effectively to acquire domain-specific knowledge and skills.
3. Demonstrate analytical and problem-solving abilities by engaging in course assessments, simulations, case studies, or project-based activities.
4. Interpret and evaluate course content critically from multiple sources including video lectures, reading materials, and peer discussions.
5. Integrate interdisciplinary knowledge gained from the MOOC into core engineering subjects for innovative applications or design thinking.
6. Communicate technical ideas and solutions effectively, both in written and oral form, based on the knowledge acquired through the online course.

*Note: In case of MOOCs certificates submitted by the students, the marks/grade shall be awarded based on the percentage of marks/grade reflected in the certificates

1. **Selection of MOOCs**

1.1 Accredited Platforms: Students shall select MOOCs from accredited platforms such as Coursera, edX, SWAYAM/NPTEL, Udacity, or any online learning platform recognized by the respective Engineering Department / Board of Studies (BoS). Engineering Departments with the approval of BoS shall publish a list of MOOCs courses in the beginning of every semester/academic session.

1.2 Prerequisites: Students shall ensure that he/she has completed any foundational courses or prerequisites required for the chosen MOOCs.

1.3 Relevant Courses: Students shall choose courses that are relevant to the Student's Engineering discipline and career goals. Students shall NOT opt for the course which is part of their curriculum (I to VIII semester B.E program) and Honors Degree/Minor Degree courses. In case of any overlapping in the contents of the MOOC Course with that in the curriculum or other courses, the maximum permitted overlapping in the course contents (syllabus) is 20-25%.

1.4 Credit Value: Students shall ensure that the selected MOOCs collectively account for 3 credits. Typically, a 3-credit MOOC will require around 35-40 hours of study, a 2-credit MOOC will require around 20-25 hours of study and a 1-credit MOOC will require 10-12 hours of study.

1.5 Duration of Course: A 4-weeks MOOCs is eligible for 1-credit. Students are advised to enroll for one 12-weeks MOOCs course to earn 3 credits. However, Students can also take one 8-weeks MOOCs + one 4-weeks MOOCs instead of one course. In each case, the number of hours of study mentioned shall be satisfied. The total performance in the MOOCs will be average of performances considering both MOOCs courses.

2. **Approval Process**

2.1 Pre-Approval: Students must seek pre-approval from the Department MOOCs Coordinator before enrolling in MOOCs.

2.2 Submission of Proposal: Students can submit a detailed proposal to Department MOOCs Coordinator including the name of the MOOCs, the platforms, course duration, credit value, and relevance to their field of study.

If a Student has already completed any MOOCs course/s from the beginning of the III semester B.E, that satisfies the criteria mentioned in the clause 1. Selection of MOOCs, such course/s can be considered by the Department for credit transfer, provided the student has NOT already claimed

the benefit of completing the MOOCs under any assessment in any of the subject. **2.3 Evaluation:** The Department will evaluate the proposal for relevance, academic rigor, and credit equivalence and will communicate the decision to the Students
3. **Registration and Enrollment**
3.1 Official Enrollment: Students shall register for the approved MOOCs on the respective platforms. **3.2 Documentation:** Students shall keep documentation of registration and course details for future reference and provide the same when asked by the Department.
4. **Course Completion**
4.1 Active Participation: Students shall engage actively in all course activities including lectures, assignments, quizzes, and discussion forums. **4.2 Completion Certificate:** Students shall obtain a verified certificate of completion for MOOC Course. Free versions without certificates are NOT eligible for credit.
5. **Assessment and Evaluation**
5.1 Performance Tracking: Students shall maintain records of performance in all assessments throughout the course. **5.2 Final Assessment:** The Department may conduct a final assessment (proctored exam) to ensure that the knowledge gained aligns with the academic standards. This summative assessment (proctored exam) by the Engineering Department is mandatory in the absence of such assessment in the MOOC course/s by the online platform.
6. **Credit Transfer**
6.1 Submission of Certificates: Students shall submit the completion certificate/s and performance records to the Department MOOCs Coordinator. **6.2 Credit Evaluation:** The Department will evaluate the certificates and performance records to approve the credit transfer. **6.3 Grade Conversion:** College will take care to convert the grades from the MOOCs into the grading system as per established Academic Rules and Regulations.
7. **Integration into Academic Record**
7.1 Transcript Update: Upon approval, the credits and grades will be integrated into the student's academic transcript. **7.2 Grade Point Average (GPA) Calculation:** The MOOC grades are included in the calculation of the student's GPA.
8. **Support and Resources**
8.1 Academic Advising: The Department MOOCs Coordinator shall provide guidance and support to the students throughout the process. **8. 2 Technical Support:** The Department MOOCs Coordinator shall ensure that students have access to the necessary technical resources to complete MOOCs courses.
9. **Feedback and Improvement**
9.1 Student Feedback: Department MOOCs Coordinator shall collect feedback from students on their MOOC experiences to improve future implementations. **9.2 Continuous Improvement:** MOOCs guidelines and processes will be updated based on student feedback, Department feedback and evolving educational standards.

Course Outcomes: At the end of the course the student will be able to:	
22EEE81.1	Demonstrate comprehensive understanding of the key concepts, tools, and techniques in the chosen elective domain.
22EEE81.2	Apply the acquired knowledge to solve domain-specific engineering problems using appropriate methods and tools.
22EEE81.3	Analyze and interpret information from MOOC resources to support decision-making and problem-solving.

22EEE81.4	Exhibit self-directed learning skills and effective time management to complete the MOOC as per defined timelines.
22EEE81.5	Collaborate and communicate effectively in online learning environments through discussions, peer reviews, and group tasks (if applicable).
22EEE81.6	Integrate the knowledge gained from the MOOC into interdisciplinary engineering contexts and reflect on its professional relevance.

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22EEE81.1	**3**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
22EEE81.2	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
22EEE81.3	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
22EEE81.4	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**
22EEE81.5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**1**	**-**
22EEE81.6	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

1: Low 2: Medium 3: High

Open Elective – II (Online Course)			
Course Code	**22EEE82**	CIE Marks	50 *
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50 *
		Total Marks	100
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Hours	03
Total Hours	36 hours	Credits	03

Course Learning Objectives:

1. Understand and apply foundational concepts and principles of the chosen elective domain to real-world engineering problems.
2. Develop the ability to learn independently and navigate MOOC platforms effectively to acquire domain-specific knowledge and skills.
3. Demonstrate analytical and problem-solving abilities by engaging in course assessments, simulations, case studies, or project-based activities.
4. Interpret and evaluate course content critically from multiple sources including video lectures, reading materials, and peer discussions.
5. Integrate interdisciplinary knowledge gained from the MOOC into core engineering subjects for innovative applications or design thinking.
6. Communicate technical ideas and solutions effectively, both in written and oral form, based on the knowledge acquired through the online course.

*Note: In case of MOOCs certificates submitted by the students, the marks/grade shall be awarded based on the percentage of marks/grade reflected in the certificates

1. **Selection of MOOCs**

1.1 Accredited Platforms: Students shall select MOOCs from accredited platforms such as Coursera, edX, SWAYAM/NPTEL, Udacity, or any online learning platform recognized by the respective Engineering Department / Board of Studies (BoS). Engineering Departments with the approval of BoS shall publish a list of MOOCs courses in the beginning of every semester/academic session.

1.2 Prerequisites: Students shall ensure that he/she has completed any foundational courses or prerequisites required for the chosen MOOCs.

1.3 Relevant Courses: Students shall choose courses that are relevant to the Student's Engineering discipline and career goals. Students shall NOT opt for the course which is part of their curriculum (I to VIII semester B.E program) and Honors Degree/Minor Degree courses. In case of any overlapping in the contents of the MOOC Course with that in the curriculum or other courses, the maximum permitted overlapping in the course contents (syllabus) is 20-25%.

1.4 Credit Value: Students shall ensure that the selected MOOCs collectively account for 3 credits. Typically, a 3-credit MOOC will require around 35-40 hours of study , a 2-credit MOOC will require around 20-25 hours of study and a 1-credit MOOC will require 10-12 hours of study.

1.5 Duration of Course: A 4-weeks MOOCs is eligible for 1-credit. Students are advised to enroll for one 12-weeks MOOCs course to earn 3 credits. However, Students can also take one 8-weeks MOOCs + one 4-weeks MOOCs instead of one course. In each case, the number of hours of study mentioned shall be satisfied. The total performance in the MOOCs will be average of performances considering both MOOCs courses.

2. **Approval Process**

2.1 Pre-Approval: Students must seek pre-approval from the Department MOOCs Coordinator before enrolling in MOOCs.

2.2 Submission of Proposal: Students can submit a detailed proposal to Department MOOCs Coordinator including the name of the MOOCs, the platforms, course duration, credit value, and relevance to their field of study.

If a Student has already completed any MOOCs course/s from the beginning of the III semester B.E, that satisfies the criteria mentioned in the clause 1. Selection of MOOCs, such course/s can be considered by the Department for credit transfer, provided the student has NOT already claimed

the benefit of completing the MOOCs under any assessment in any of the subject. **2.3 Evaluation:** The Department will evaluate the proposal for relevance, academic rigor, and credit equivalence and will communicate the decision to the Students
3. **Registration and Enrollment**
3.1 Official Enrollment: Students shall register for the approved MOOCs on the respective platforms. **3.2 Documentation:** Students shall keep documentation of registration and course details for future reference and provide the same when asked by the Department.
4. **Course Completion**
4.1 Active Participation: Students shall engage actively in all course activities including lectures, assignments, quizzes, and discussion forums. **4.2 Completion Certificate:** Students shall obtain a verified certificate of completion for MOOC Course. Free versions without certificates are NOT eligible for credit.
5. **Assessment and Evaluation**
5.1 Performance Tracking: Students shall maintain records of performance in all assessments throughout the course. **5.2 Final Assessment:** The Department may conduct a final assessment (proctored exam) to ensure that the knowledge gained aligns with the academic standards. This summative assessment (proctored exam) by the Engineering Department is mandatory in the absence of such assessment in the MOOC course/s by the online platform.
6. **Credit Transfer**
6.1 Submission of Certificates: Students shall submit the completion certificate/s and performance records to the Department MOOCs Coordinator. **6.2 Credit Evaluation:** The Department will evaluate the certificates and performance records to approve the credit transfer. **6.3 Grade Conversion:** College will take care to convert the grades from the MOOCs into the grading system as per established Academic Rules and Regulations.
7. **Integration into Academic Record**
7.1 Transcript Update: Upon approval, the credits and grades will be integrated into the student's academic transcript. **7.2 Grade Point Average (GPA) Calculation:** The MOOC grades are included in the calculation of the student's GPA.
8. **Support and Resources**
8.1 Academic Advising: The Department MOOCs Coordinator shall provide guidance and support to the students throughout the process. **8. 2 Technical Support:** The Department MOOCs Coordinator shall ensure that students have access to the necessary technical resources to complete MOOCs courses.
9. **Feedback and Improvement**
9.1 Student Feedback: Department MOOCs Coordinator shall collect feedback from students on their MOOC experiences to improve future implementations. **9.2 Continuous Improvement:** MOOCs guidelines and processes will be updated based on student feedback, Department feedback and evolving educational standards

Course Outcomes: At the end of the course the student will be able to:	
22EEE82.1	Demonstrate comprehensive understanding of the key concepts, tools, and techniques in the chosen elective domain.
22EEE82.2	Apply the acquired knowledge to solve domain-specific engineering problems using appropriate methods and tools.
22EEE82.3	Analyze and interpret information from MOOC resources to support decision-making and problem-solving.

22EEE82.4	Exhibit self-directed learning skills and effective time management to complete the MOOC as per defined timelines.
22EEE82.5	Collaborate and communicate effectively in online learning environments through discussions, peer reviews, and group tasks (if applicable).
22EEE82.6	Integrate the knowledge gained from the MOOC into interdisciplinary engineering contexts and reflect on its professional relevance.

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
22EEE82.1	**3**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
22EEE82.2	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
22EEE82.3	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
22EEE82.4	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**
22EEE82.5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**1**	**-**
22EEE82.6	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

1: Low 2: Medium 3: High

Research/Industry Internship			
Course Code	**22EEE83**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Number of Weeks	14-16 Weeks	SEE	3 Hours
		Credits	10

Research Internship

Course Learning Objectives:

1. To equip students with the knowledge of fundamental research principles, methodologies, and techniques applicable to their engineering discipline.
2. To enable students to formulate research questions, design experiments or studies, and use appropriate data collection and analysis tools.
3. To foster the ability to think critically and innovatively while solving complex engineering problems during the research process.
4. To guide students in developing the skills necessary for writing clear and well-structured research reports, papers, and presentations.
5. To instill an understanding of ethical practices in research, including integrity, responsible data handling, and respect for intellectual property.
6. To prepare students to work effectively in research teams, communicate their ideas clearly, and present their findings to both technical and non-technical audiences.

Pre-Internship Preparation

1. **Orientation Session:** Attend an orientation session with the academic mentor (allotted from the Department) and the Research Supervisor to understand the research goals, expectations, and assessment criteria.
2. **Documentation:** Complete necessary documentation, including the approval from the Department, processing of the internship request application, research agreements and confidentiality agreements, if applicable.
3. **Research Proposal:** Develop a research proposal in consultation with the Research Supervisor and academic mentor outlining the objectives, methodology, and expected outcomes.

During the Internship

1. **Work Plan:** Follow a structured research plan provided by the supervising researcher or mentor.
2. **Literature Review:** Conduct a comprehensive literature review to understand the current state of research in the chosen area.
3. **Regular Meetings:** Participate in regular meetings with academic and research mentors to discuss progress, challenges, and next steps.
4. **Lab Work/Field Work:** Engage in experimental work, simulations, or field studies as required by the research project.
5. **Data Collection and Analysis:** Collect, analyze, and interpret data using appropriate tools and techniques.
6. **Documentation:** Maintain detailed records of research activities, experiments, and findings.

Deliverables

1. **Weekly Reports:** Submit weekly progress reports to academic and research mentors.
2. **Monthly Reports:** Submit monthly progress reports to academic and research mentors.
3. **Mid-Term Review:** Participate in a mid-term review meeting to assess progress and realign research goals if necessary.
4. **Report and Research Paper:** Prepare a draft report and a research paper detailing the research problem, methodology, results and discussions, and conclusions.
5. **Presentation:** Deliver a presentation summarizing the research work to faculty, peers, and other stakeholders upon completion of the internship.

Assessment Criteria
1. **Research Quality:** Evaluate the quality and rigor of the research conducted. 2. **Report Quality:** Assess the clarity, organization, and thoroughness of the report and the research paper. 3. **Presentation:** Evaluate the effectiveness and clarity of the final presentation. 4. **Innovation and Creativity:** Consider the originality and innovative aspects of the research. 5. **Self-Reflection:** Review the student's ability to critically reflect on their research experience and identify areas for future growth.
Post-Internship
1. **Feedback Session:** Attend a feedback session with academic mentors to discuss the research experience and areas of improvement. 2. **Publication:** Explore opportunities to publish the research findings in academic journals or conferences. 3. **Networking:** Maintain professional relationships established during the internship for future research collaborations.
Additional Tips
• **Curiosity:** Cultivate a curious mindset and a willingness to explore new ideas. • **Collaboration:** Work collaboratively with other researchers and team members. • **Adaptability:** Be open to modifying research approaches based on findings and feedback. • **Communication:** Develop strong written and oral communication skills to effectively present research findings. • **Time Management:** Prioritize tasks and manage time efficiently to meet research deadlines.

Evaluation Scheme	
Continuous Internal Evaluation (CIE): I (Only OFFLINE)	Will be conducted during the 7th semester BE. Students shall submit the Research Internship Proposal and make a presentation and answer questions raised by the Departmental Internship Evaluation Committee (DIEC). Marks split-up: Research Internship Proposal – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.
Continuous Internal Evaluation (CIE): II (ONLINE/OFFLINE)	Will be conducted during the middle of the 8th semester BE. Students shall submit the Reports (daily/weekly/monthly reports), make a presentation on progress done so far and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.
Continuous Internal Evaluation (CIE): III (Only OFFLINE)	Will be conducted at the end of the 8th semester BE. Students shall submit the Reports (daily/weekly/monthly reports) and the final internship report, make a presentation on work completed and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.
CIE Marks (Max 100)	Average of the CIE:I , CIE-II and CIE:III marks
Semester-End-Examinations (SEE) (Only OFFLINE)	Will be conducted within a week of the last working day of the 8th semester BE. Student shall submit the internship report approved by all the concerned, make a presentation and answer the questions raised by the internal and external examiners. Marks split-up: Reports – 50 marks + Oral Presentation-25 marks + Question and Answer-25 marks.

Course Outcomes: At the end of the course the student will be able to:	
22EEE83.1	Apply appropriate research methodologies and tools to design and conduct experiments, analyze data, and draw conclusions.
22EEE83.2	Demonstrate the ability to identify and solve complex engineering problems through innovative and systematic research approaches.
22EEE83.3	Acquire proficiency in using advanced technologies, tools, and techniques relevant to their field of research.
22EEE83.4	Develop skills in writing comprehensive research reports, documentation, and effectively presenting research findings.
22EEE83.5	Understand and apply ethical standards in research, including plagiarism avoidance, proper citations, and data integrity.
22EEE83.6	Gain experience in working collaboratively within a research team and contributing effectively to the shared goals of the project.

References

1. **AICTE Internship Policy : Guidelines and Procedures 2019.**
   Available at https://aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf
2. **UGC Guidelines for Internship/Research Internship for Under Graduate Students 2023.**
   Available at https://www.ugc.gov.in/pdfnews/0063650_Draft-Guidelines-for-Internship-and-Research-Internship-for-Under-Graduate-Students.pdf
3. **VTU Mandatory Internship Guidelines 2021.**
   Available at https://vtu.ac.in/pdf/regulations2021/anex4.pdf

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
22EEE83.1	1	-	2	3	-	-	-	-	-	-	-	-	-
22EEE83.2	3	2	-	-	-	-	-	-	-	-	-	-	-
22EEE83.3	-	-	-	-	3	2	-	-	-	-	-	1	-
22EEE83.4	-	-	-	-	-	-	-	-	-	3	-	1	-
22EEE83.5	-	-	-	-	-	2	-	3	-	-	-	1	-
22EEE83.6	-	-	-	-	-	-	-	-	3	2	1	-	-

1: Low 2: Medium 3: High

Research/Industry Internship			
Course Code	**22EEE83**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Practical	SEE Marks	50
		Total Marks	100
Number of Weeks	14-16 Weeks	SEE	3 Hours
		Credits	10

Industry Internship

Course Learning Objectives:

1. To develop practical engineering skills through hands-on experience in a real-world industrial environment.
2. To enhance the ability to identify, analyze, and solve complex engineering problems encountered during the internship.
3. To gain an understanding of the functioning of the industry, including exposure to its standards, practices, and emerging technologies.
4. To improve communication, collaboration, and teamwork skills by working with professionals in a multidisciplinary team setting.
5. To foster adaptability by learning to work in dynamic and fast-paced industrial environments while embracing lifelong learning.
6. To instill a sense of professional ethics, responsibility, and accountability in engineering practice by adhering to industry-specific codes of conduct.

Pre-Internship Preparation

1. **Orientation Session:** Attend an orientation session with the academic mentor (allotted from the Department) to understand the internship goals, expectations, and assessment criteria.
2. **Documentation:** Complete necessary documentation, including the approval from the Department, processing of the internship request application, internship agreements if applicable etc.
3. **Goal Setting:** Define specific, measurable, achievable, relevant, and time-bound (SMART) goals in consultation with academic and industry mentors.

During the Internship

1. **Work Plan:** Follow a structured work plan provided by the host organization.
2. **Mentorship:** Regularly meet with assigned industry and academic mentors to review progress and seek guidance.
3. **Work Diary/Daily Report/Learning Diary:** Maintain a diary/logbook documenting daily activities, learnings, challenges, and reflections.
4. **Professional Conduct:** Adhere to the professional and ethical standards of the host organization, including dress code, punctuality, and communication protocols.
5. **Skill Application:** Actively participate in projects and tasks assigned, applying theoretical knowledge to practical situations.

Deliverables

1. **Weekly Reports:** Submit the weekly progress reports to academic and industry mentors.
2. **Monthly Reports:** Submit the monthly progress reports to academic and industry mentors.
3. **Mid-Term Review/Evaluation:** Participate in a mid-term review meeting/evaluation to assess progress and realign goals if necessary.
4. **Final Report:** Prepare a comprehensive final report in the specified format detailing the projects undertaken, skills acquired, challenges faced, and overall learning experience.
5. **Presentation:** Deliver a presentation summarizing the internship experience to faculty evaluators and peers upon completion of the internship.

Assessment Criteria

1. **Performance Evaluation:** Receive feedback from the industry mentor based on work performance, technical skills, and professional behaviour.

2. **Report Quality:** Evaluate the quality, clarity, and comprehensiveness of the final report.
3. **Presentation:** Assess the effectiveness and clarity of the final presentation.
4. **Self-Reflection:** Review the student's ability to critically reflect on their learning experience and identify areas for future growth.

Post-Internship

1. **Feedback Session:** Attend a feedback session with academic mentors to discuss the internship experience and areas of improvement.
2. **Certification:** Obtain an internship completion certificate from the host organization.
3. **Networking:** Maintain professional relationships established during the internship for future opportunities.

Additional Tips

- **Professionalism:** Demonstrate a professional attitude and work ethic at all times.
- **Adaptability:** Be open to learning and adapting to new environments and technologies.
- **Communication:** Develop strong communication skills to effectively collaborate with colleagues and mentors.
- **Time Management:** Prioritize tasks and manage time efficiently to meet deadlines.

Evaluation Scheme	
Continuous Internal Evaluation (CIE): I (ONLINE/OFFLINE)	Will be conducted during the middle of the 8th semester BE. Students shall submit the Reports (daily/weekly/monthly reports), make a presentation on work done so far and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation 25 marks + Question and Answer 25 marks.
Continuous Internal Evaluation (CIE): II (Only OFFLINE)	Will be conducted at the end of the 8th semester BE. Students shall submit the Reports (daily/weekly/monthly reports) and the final report, make a presentation on work completed and answer questions raised by the Departmental Internship Evaluation Committee. Marks split-up: Reports – 50 marks + Oral Presentation 25 marks + Question and Answer 25 marks.
CIE Marks (Max 100)	Average of the CIE:I and CIE:II marks
Semester-End-Examinations (SEE) (Only OFFLINE)	Will be conducted within a week of the last working day of the 8th semester BE. Student shall submit the internship report approved by all the concerned, make a presentation and answer the questions raised by the internal and external examiners. Marks split-up: Reports – 50 marks + Oral Presentation 25 marks + Question and Answer 25 marks.

Course Outcomes: At the end of the course the student will be able to:	
22EEE83.1	Apply engineering concepts and theoretical knowledge to solve real-world industry problems.
22EEE83.2	Enhance their problem-solving abilities by identifying, analyzing, and providing innovative solutions to engineering challenges in the industry.
22EEE83.3	Develop key professional skills such as teamwork, communication, and time management in a corporate or industrial environment.
22EEE83.4	Gain exposure to industry-standard tools, technologies, methodologies, and regulatory standards relevant to their field of study.
22EEE83.5	Demonstrate understanding and adherence to professional ethics, safety regulations, and responsibilities in an industrial setting.

22EEE83.6	Build a network of industry professionals and gain insights into career opportunities, preparing them for future employment in the engineering sector.

References

1. AICTE Internship Policy : Guidelines and Procedures 2019.
Available at https://aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf

2. UGC Guidelines for Internship/Research Internship for Under Graduate Students 2023.
Available at https://www.ugc.gov.in/pdfnews/0063650_Draft-Guidelines-for-Internship-and-Research-Internship-for-Under-Graduate-Students.pdf

3. VTU Mandatory Internship Guidelines 2021.
Available at https://vtu.ac.in/pdf/regulations2021/anex4.pdf

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
22EEE83.1	1	-	2	3	-	-	-	-	-	-	-	-	-
22EEE83.2	3	2	-	-	-	-	-	-	-	-	-	-	-
22EEE83.3	-	-	-	-	3	2	-	-	-	-	-	1	-
22EEE83.4	-	-	-	-	-	-	-	-	-	3	-	1	-
22EEE83.5	-	-	-	-	-	2	-	3	-	-	-	1	-
22EEE83.6	-	-	-	-	-	-	-	-	3	2	1	-	-

1: Low 2: Medium 3: High

Core Values of the Institution

SERVICE

A Josephite will keep service as the prime goal in everything that is undertaken. Meeting the needs of the stakeholders will be the prime focus of all our endeavors.

EXCELLENCE

A Josephite will not only endeavor to serve, but serve with excellence. Preparing rigorously to excel in whatever we do will be our hallmark.

ACCOUNTABILITY

Every member of the SJEC Family will be guided to deliver on assurances given within the constraints set. A Josephite will always keep budgets and deadlines in mind when delivering a service.

CONTINUOUS ADAPTATION

Every member of the SJEC Family will strive to provide reliable and continuous service by adapting to the changing environment.

COLLABORATION

A Josephite will always seek to collaborate with others and be a team-player in the service of the stakeholders.

Objectives

- Provide Quality Technical Education facilities to every student admitted to the College and facilitate the development of all round personality of the students.
- Provide most competent staff and excellent support facilities like laboratory, library and internet required for good education on a continuous basis.
- Encourage organizing and participation of staff and students in in-house and outside Training programmes, seminars, conferences and workshops on continuous basis.
- Provide incentives and encouragement to motivate staff and students to actively involve in research-innovative projects in collaboration with industry and R &D centres on continuous basis
- Invite more and more number of persons from industry from India and abroad for collaboration and promote Industry-Institute Partnership.
- Encourage consultancy and testing and respond to the needs of the immediate neighbourhood.

St Joseph Engineering College

AN AUTONOMOUS INSTITUTION

Affiliated to VTU, Belagavi | Recognised by AICTE, New Delhi
Accredited by NAAC with A+ Grade
B.E. (ECE, EEE, ME, CIV), MBA & MCA Accredited by NBA, New Delhi

Vamanjoor, Mangaluru - 575 028, Karnataka, India
Ph: 91-824-2868100 / 2263753 / 54 / 55
E-mail: sjec@sjec.ac.in| Website: www.sjec.ac.in