Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure

Final Year B.Tech (Electrical Engineering)

with efffect from Year 2023-24

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
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Semester-VII (w.e.f. 2023-24)													
SN	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme (CA)				ESE	Total	Credit
				L	T	P	TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best of TT1 / TT2			
							[A]			[B]	[C]	[A+B+C]	
1	PC	PCEE7010T	Switchgear and Protection	3			20	15	15	15	65	100	3
2	PC	PCEE7010L	Switchgear and Protection Laboratory			2	25				25	50	1
3	PC	PCEE7020T	Electrical Drives and Control	3			20	15	15	15	65	100	3
4	PC	PCEE7020L	Electrical Drives and Control Laboratory			2	25				25	50	1
5	PE	PCEE703-T	Professional Elective Course	3			20	15	15	15	65	100	3
6	PE	PEEE703-L	Professional Elective Course Laboratory			2	25				25	50	1
7	OE	OEEE704-T	Open Elective Course	3			20	15	15	15	65	100	3
8	PC	PCEE7050L	Electrical Engineering Simulation Laboratory			4	25				25	50	2
9	PJ	PJEE7060L	Project Stage-II			8	25				25	50	4
			Total	**12**		**18**	**205**			**60**	**385**	**650**	**21**

Semester-VII Professional Elective Courses		
SN	Course Code	Course Title
1	PEEE7031T	Power System Operation & Control
2	PEEE7032T	Electrical Power System Design
3	PEEE7033T	High Voltage Engineering
4	PEEE7034T	Computer Aided Power System Analysis
5	PEEE7035T	Illumination Engineering

Semester-VII Open Elective Courses					
SN	Course Code	Course Title	SN	Course Code	Course Title
1	OEEE7041T	Product Lifecycle Management	6	OEEE7046T	Disaster Management and Mitigation Measures
2	OEEE7042T	Management Information System	7	OEEE7047T	Science of Well-being
3	OEEE7043T	Operations Research	8	OEEE7048T	Research Methodology
4	OEEE7044T	Cyber Security and Laws	9	OEEE7049T	Public Systems and Policies
5	OEEE7045T	Personal Finance Management	10	OEEE70410T	Energy Audit and Management

Semester-VIII (w.e.f. 2022-23)														
SN	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme (CA)				ESE	Total	Credit
				L	T	P	TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best of TT1 / TT2			
							[A]			[B]	[C]	[A+B+C]	
1	PE	PEEE801-T	Professional Elective Course-I	3			20	15	15	15	65	100	3
2	PE	PEEE802-T	Professional Elective Course-II	3			20	15	15	15	65	100	3
3	INT	INTEE8030L	Internship			20	150				150	300	10
			Total	**6**		**20**	**190**			**30**	**280**	**500**	**16**

Semester-VIII Professional Elective-I Courses		
SN	Course Code	Course Title
1	PEEE8011T	HVDC Transmission*
2	PEEE8012T	EHVAC Transmission*
3	PEEE8013T	Restructured Power System*
4	PEEE8014T	Opmitization Techniques*
5	PEEE8015T	NPTEL / Swayam Course#

Semester-VIII Professional Elective-II Courses		
SN	Course Code	Course Title
1	PEEE8021T	Computer Vision and Image Processing - Fundamentals and Applications*
2	PEEE8022T	DC Microgrid and Control Systems*
3	PEEE8023T	Power System Dynamics*
4	PEEE8024T	Emerging Trends in Electrical Engineering*
5	PEEE8025T	NPTEL / Swayam Course#

1. * Professional Elective Courses offered for the students doing project at institute level.
2. # Professional Elective Courses offered for the students doing Internship. These courses are studied in self study mode using NPTEL / Swayam platform.
3. Students doing an internship either submit their NPTEL examination certificate to department OR appear to institute examinations like TT1, TT2, and ESE.
4. List of NPTEL courses will be declared by concerned BOS at the beginning of semester.

Prepared by | Checked by | BOS Chairman | Dean Academic/Dy. Director | C.O.E. | Director

Switchgear and Protection (PCEE7010T)

Teaching Scheme
Lectures : 03 Hrs./week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Generation Transmission and Distribution of Electric Power, Power System.

Course Outcome

1. To explores the knowledge of arc interruption.
2. To demonstrate different type of circuit breakers and relay.
3. To understanding the characteristic feature and proper selection of protective elements in different protective scheme.
4. To possess knowledge related to different protection for major and individual power system elements.
5. To meet desired needs the recent technology in protection.

Course Outcome

COs	Course Outcomes	Blooms Level	Blooms Description
At the end of this course students will be able,			
CO1	To impart **knowledge** of science for understanding arc generation and interruption in medium and high voltage circuit.	L2	Understand
CO2	To **illustrate** construction operation and specifications of different circuit breakers used in power system.	L2	Understand
CO3	To state and **apply** basic relay and their role in protection system.	L3	Apply
CO4	To **apply** relay based on modern techniques and their role in protection scheme.	L3	Apply
CO5	To **analyze** different protection scheme used in power system.	L4	Analyze

Course Contents

Unit-I **Arc Interruption Theories** **08 Hrs.**

Basic requirement of Switching and protection, Arc phenomenon, maintenance of arc Properties of arc, interruption theories Transient recovery Voltage, Transient analysis, RRRV. Switching Transients: Closing of a line, Reclosing of a line, Interruption of small capacitive Currents, Interruption of Inductive load currents, Current chopping.

Unit-II **Circuit Breakers** **08 Hrs.**

Construction, Working principle, Application and comparison of different types of circuit Breakers such as Air break, Air blast, Minimum oil circuit breaker, SF6 and Vacuum Circuit breakers, H.V.D.C. Circuit breakers, Circuit breaker ratings.

Unit-III **Protective Relay-I** **08 Hrs.**

Protection system and its attributes, organization of protection, zones of protection and maloperation. Desirable qualities of protective relaying, Definitions of terms used in relaying, Construction, working and characteristic features of electromagnetic relay: Over current, instantaneous over-current, definite time over-current, inverse time over-current relay directional over current relay and differential relay.

Unit-IV **Protective Relay-II** **08 Hrs.**

Principle of operation and characteristics of induction type, Impedance relay, Reactance relay, MHO relay, Buccolz, Negative Phase Sequence, Harmonic restraint relays. Static Over current relay: overview of Static relay, block diagram, operating principal, merits and demerits of static relay. Digital relay: Basic component of digital relay, Microprocessors based relay, block diagram, DMPR relays, DTPR relays, digital temperature protection relays.

Unit-V **Protection Schemes** **08 Hrs.**

Different type of protective scheme: Over current protection, Differential protection, earth fault protection, distance protection and carrier aided protection. Protective scheme for generator, transformer, bus-bar, transmission line and motor.

Text Books

1. B. Ravindranath, M. Chander,"Power System Protection and Switchgear", New Age International, Second Edition, 2018.
2. Sunil S. Rao, "Switchgear Protection and Power Systems", Khanna Publisher, 14th Edition, 1977.
3. Y. G. Paithankar, S. R. Bhide, "Fundmentals of Power System Protection", Prentis Hall of India, 2004 .

Reference Books

1. T. S. Madhavarao, "Power System Protection Static Relay", Tata MacGraw Hill, Second Edition, 2017 .
2. R. P. Maheshwari, Nilesh G. Chothani, "Protection and Switchgear", Oxford Press, 2011.
3. Badri Ram, D. Vishvakarma, "Power System Protection and Switchgear", Tata McGraw Hill, Second Edition, 2017.

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best performance among the two Term Tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Switchgear and Protection Laboratory (PCEE5010L)

Teaching Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total Marks : 50 Marks

Prerequisites: Power System.

Course Objectives

1. To inculcate in students basic ideas and principle of electrical engineering.
2. To impart the fundamental knowledge of various protective relays.
3. To understand the tripping characteristics of various protective relays and application.
4. To enhance knowledge of protected zone and able to design protective scheme.

Course Outcome

COs	Course Outcomes	Blooms Level	Blooms Description
At the end of this course students will be able,			
CO1	To **apply** the arc formation and arc extinction phenomenon.	L3	Apply
CO2	To **understand** Over current and earth fault protection scheme.	L2	Understand
CO3	To **understanding** differential protection scheme.	L2	Understand
CO4	To **apply** protective scheme for power system protection.	L3	Apply
CO5	To **apply** digital based protection.	L3	Apply

List of the Experiments

Perform any 10 experiments from the following list of experiments (two simulation and one Innovative)

1. To conduct and study of Arc extinction phenomenon,Application in air circuit breaker.
2. To conduct and plot the characteristic of rewirable fuses and MCB.
3. To conduct and plot operating characteristics of over current relay.
4. To conduct Protection of transformer using differential relay.
5. To conduct and study of Static relay.
6. To conduct and study of microprocessor base relay.
7. To Study of protection scheme for alternator.
8. Study of switchgear testing kit.
9. To Study Electromechanical Relay.
10. Simulation of protection of transmission line.
11. Simulation of differential protection of transformer.
12. Modeling and Simulation of Over Current Relay.
13. Modeling and Simulation Protection of alternator.
14. Modeling and Simulation of digital relay.

Text Books

1. B. Ravindranath, M. Chander,"Power System Protection and Switchgear", New Age International, Second Edition, 2018.
2. Y. G. Paithankar, S. R. Bhide, "Fundmentals of Power System Protection", Prentis Hall of India, 2004 .

Reference Books

1. T. S. Madhavarao, "Power System Protection Static Relay", Tata MacGraw Hill, Second Edition, 2017 .
2. Badri Ram, D. Vishvakarma, "Power System Protection and Switchgear", Tata McGraw Hill, Second Edition, 2017.

Evaluation Scheme

Laboratory

Continuous Assessment (TA):

Laboratory work will be based on subject specific lab assignment/case study. The distribution of marks for term work shall be as follows:

- Performance in Experiments: 05 Marks
- Journal Submission: 05 Marks
- Viva-voce: 05 Marks
- Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions

Electrical Drives and Control (PCEE7020T)

Teaching Scheme
Lectures : 03 Hrs./week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Electrical Machines, Power Electronics and Control System.

Course Objectives

1. To describe the structure of Electric Drive systems and their role in various applications.
2. To understand the basic principles of control aspects in drives using controlled converters.
3. To review the basic concepts of operation and modern control aspects of dc and ac motors.
4. To select suitable electric drive for various applications in industrial field.

Course Outcome

COs	Course Outcomes	Blooms Level	Blooms Description
At the end of this course students will be able,			
CO1	To **understand** the basic knowledge of an electrical drives.	L2	Understand
CO2	To **analyze** the different control techniques of an electrical drives.	L4	Analyze
CO3	To **analyze** the various parameters of converter fed electrical drives.	L4	Analyze
CO4	To **apply** the different speed control methods of AC Motor drives.	L3	Apply
CO5	To **analyze** the various parameters of electrical drives used in various industrial applications.	L4	Analyze

Course Contents

Unit-I **Introduction to Electrical Drives** **08 Hrs.**

Advantages of Electrical Drives, Parts of Electrical drive, Choice of Electric drives Dynamics of Electrical drives: fundamental torque equations, multi-quadrant operation, nature and classification of load torques, steady state stability, concept of load equalization in drives.

Unit-II **Control of Electrical Drives** **08 Hrs.**

Modes of operation: Steady state, Acceleration, Deceleration, Drive classification **Closed loop control of drives:** Current limit control, torque control, speed control, position control and control of multi-motor drives, speed sensing, current sensing. Classes of motor duty, criteria for selection of motor.

Unit-III **DC Motor Drives** **08 Hrs.**

Single phase drives: Single phase half wave, half controlled, Full controlled and Dual converter drives.
Three phase drives: Three phase half wave, half controlled, Full controlled and Dual converter drives.
Chopper drives: Principle of Rheostatic and regenerative braking control, combined control, two and four quadrant DC-DC converter fed drives. Introduction to closed loop control of DC drives.

Unit-IV **AC Motor Drives** **08 Hrs.**

Induction motor drives: Speed control methods on stator and rotor sides of induction motor drives. Closed loop control of Induction motors. Multi-quadrant operation of induction motor drives fed from Voltage Source Inverters. static slip power recovery control.
Synchronous Motor Drives: Static variable frequency control for Synchronous motors. Load commutated inverter fed Synchronous motor drive, Introduction to closed loop control of Load commutated inverter fed Synchronous motor drive

Unit-V **Drives for Specific Applications** **08 Hrs.**

Construction and operation, motor torque equation converter circuits, closed loop motor operation, solar and battery power drive. Textile Mill, Steel Rolling Mill, Cement Mill, and Sugar Mill: Various stages and drive requirements control of ac motors for controlling torque. **Introduction to Electric Drive Vehcile.**

Text Books

1. G. K. Dubey, "Fundamentals of Electrical Drives", Narosa Publishing House Pvt. Ltd, 2nd Edition, 2010.
2. B. R. Gupta, V. Singhal, "Fundamentals of Electric Drives and Control", S. K. Kataria and Sons, Reprint 2013 Edition, 2013.

Reference Books

1. Krishnan, "Electric Motor Drives: Modeling Analysis and Control", Pearson Education India, 1st Edition, 2015.
2. Vedam Subramanyam, "Electrical Drives", McGraw Hill Education, 2nd Edition, 2017.
3. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson India Education Services Pvt. Ltd, 1st Edition, 2022.

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best performance among the two Term Tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Electrical Drives and Control Laboratory (PCEE7020L)

Teaching Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total Marks : 50 Marks

Prerequisites: Electrical Machines, Power Electronics and Control System.

Course Objectives

1. To describe the structure of Electric Drive systems and their role in various applications.
2. To understand the basic principles of control aspects in drives using controlled converters.
3. To review the basic concepts of operation and modern control aspects of dc motors.
4. To review the basic concepts of operation and modern control aspects of ac motors.
5. To select suitable electric drive for various applications in industrial field.

Course Outcome

COs	Course Outcomes	Blooms Level	Blooms Description
At the end of this course students will be able,			
CO1	To **analyze** the electrical and mechanical parameters of AC-DC converter fed DC motor drives.	L4	Analyze
CO2	To **analyze** the electrical and mechanical parameters of DC-DC converter fed DC motor drives.	L4	Analyze
CO3	To **analyze** the electrical and mechanical parameters of DC-AC converter fed induction motor drives.	L4	Analyze
CO4	To **analyze** the electrical and mechanical parameters of DC-AC converter fed synchronous motor drives.	L4	Analyze
CO5	To **analyze** the electrical and mechanical parameters of SRM Motor Drives.	L4	Analyze

List of the Experiments

Perform any 10 experiments from the following list of experiments (two simulation and one Innovative)

1. To perform a speed control of D. C. Motor using Single phase fully and half controlled converter.
2. To study the operation of D. C. Drive in four quadrant mode.
3. To observe load voltage and load current waveform of shaded pole induction using A. C Voltage regulator.
4. To observe the speed control of three phase induction motor in vector control mode.
5. To study the working operation of dual converter with PMDC Motor.
6. To perform the MATLAB / SIMULINK model of closed loop speed control of dc motor using PID Controller.
7. To perform the MATLAB / SIMULINK model of Voltage Source Inverter fed Induction Motor Drive.
8. To perform the Step-up Chopper fed DC Drive using MATLAB / SIMULINK.
9. Design and Simulation of Three Phase Induction Motor at different load conditions
10. MATLAB / SIMULINK Model of Three Phase Permanent Magnet Synchronous Motor Drive
11. MATLAB / SIMULINK Model of Speed control of BLDC Motor using PID Controller **(Innovative)**
12. MATLAB / SIMULINK Model of Switched Reluctance Motor **(Innovative)**

Text Books

1. G. K. Dubey, "Fundamentals of Electrical Drives", Narosa Publishing House Pvt. Ltd, 2nd Edition, 2010.
2. B. R. Gupta, V. Singhal, "Fundamentals of Electric Drives and Control", S. K. Kataria and Sons, Reprint 2013 Edition, 2013.

Reference Books

1. Krishnan, "Electric Motor Drives: Modeling Analysis and Control", Pearson Education India, 1st Edition, 2015.
2. Vedam Subramanyam, "Electrical Drives", McGraw Hill Education, 2nd Edition, 2017.
3. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson India Education Services Pvt. Ltd, 1st Edition, 2022.

Evaluation Scheme

Laboratory

Continuous Assessment (TA):

Laboratory work will be based on subject specific lab assignment/case study. The distribution of marks for term work shall be as follows:

- Performance in Experiments: 05 Marks
- Journal Submission: 05 Marks
- Viva-voce: 05 Marks
- Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions

Power System Operation and Control (PEEE7031T)

Teaching Scheme
Lectures : 03 Hrs./week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Fundamental of Electrical Energy Generation System, Power System Transmission and Distribution.

Course Objectives

1. Significance of power system operation and control.
2. Real power-frequency interaction and design of power-frequency controller.
3. Reactive power-voltage interaction and the compensators for maintaining the voltage profile.
4. Generation scheduling and economic operation of power system.
5. To understand unit commitment problem and importance of power system stability.

Course Outcome

COs	Course Outcomes	Blooms Level	Blooms Description
At the end of this course students will be able,			
CO1	To **analyze** the day-to-day operation of electric power system.	L4	Analyze
CO2	To **analyze** the control actions that are implemented to meet the minute-to-minute variation of system real power demand.	L4	Analyze
CO3	To **analyze** the compensators for reactive power control.	L4	Analyze
CO4	To **prepare** day ahead and real time economic generation scheduling.	L6	Create
CO5	To **understand** power system stability	L2	Understand

Course Contents

Unit-I Introduction 08 Hrs.

Power scenario in Indian grid – National and Regional load dispatching centers – requirements of good power system - necessity of voltage and frequency regulation - real power vs frequency and reactive power vs voltage control loops - system load variation, load curves and basic concepts of load dispatching - load forecasting -Basics of speed governing mechanisms and modeling - speed load characteristics -regulation of two generators in parallel.

Unit-II Real Power - Frequency Control 08 Hrs.

Load Frequency Control (LFC) of single area system-static and dynamic analysis of uncontrolled and controlled cases - static and dynamic analysis - LFC of two area system - tie line modeling - block diagram representation of two area system - static and dynamic analysis - tie line with frequency bias control – state variable model - integration of economic dispatch control with LFC.

Unit-III Reactive Power – Voltage Control 08 Hrs.

Generation and absorption of reactive power - basics of reactive power control – Automatic Voltage Regulator (AVR) – brushless AC excitation system – block diagram representation of AVR loop -static and dynamic analysis – stability compensation – voltage drop in transmission line - methods of reactive power injection - tap changing transformer, SVC (TCR + TSC) and STATCOM for voltage control.

Unit-IV Economic Operation of Power System 08 Hrs.

Statement of economic dispatch problem - input and output characteristics of thermal plant -incremental cost curve - optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) - lambda-iteration method - base point and participation factors method. Statement of Unit Commitment (UC) problem - constraints on UC problem – solution of UC problem using priority list – special aspects of short term and long-term hydrothermal scheduling problems.

Unit-V Power System Stability 08 Hrs.

Introduction, power angle equation, steady state stability, transient stability and swing equation. Equal area criterion of stability – applications of equal area criterion, step by step solution of swing equation – factors effecting transient stability.

Text Books

1. Allen J. Wood and Bruce F. Wollen Berg, "Power Generation, Operation and Control", John Wiley & Sons, Inc., Third Edition, 2013.
2. Olle I. Elgerd, "Electric Energy Systems theory - An introduction", McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.

Reference Books

1. Kothari D. P. and Nagrath I. J., "Power System Engineering", Tata McGraw-Hill Education, Second Edition, 2008.
2. Hadi Saadat, "Power System Analysis", McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010
3. Kundur P., "Power System Stability and Control", McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
4. B. M. Weedy, B. J. Cory et al, "Electric Power Systems", Wiley 2012

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best performance among the two Term Tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Power System Operation and Control Laboratory (PEEE7031L)

Teaching Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total Marks : 50 Marks

Prerequisites: Fundamental of Electrical Energy Generation System, Power System Transmission and Distribution.

Course Objectives

1. To analyze the performance of power system by conducting various experiments.
2. To present a problem-oriented knowledge of power system controlling methods.
3. To develop computer programs for analysis of power systems.
4. To analyze power system operation and stability control.

Course Outcome

COs	Course Outcomes	Blooms Level	Blooms Description
At the end of this course students will be able,			
CO1	To **understand** the real and reactive power flow in power system network	L2	Understand
CO2	To **understand** the importance of load flow study.	L2	Understand
CO3	To **demonstrate** the concept of power system stability using equal area criteria, load frequency control.	L3	Apply
CO4	To **understand** the concept of economic load dispatch	L2	Understand
CO5	To **determine** the reactive power and voltage for a given system.	L4	Analyze

List of the Experiments

Perform any 10 experiments from the following list of experiments (two simulation and one Innovative)

1. Write a program for economic dispatch in power systems using MATLAB.
2. Simulation of Automatic voltage regulator using MATLAB.
3. Write a program for economic load dispatch using lambda-iteration method.
4. Write a program to compute the voltage and power factor for a given system using MATLAB.
5. Write a program to solve the given Equal Area Criteria problem using MATLAB.
6. Simulation of single area load frequency control using MATLAB.
7. To demonstrate the Excitation System using MATLAB.
8. Write a program to solve Swing Equation by Classical Method.
9. Write a program to plot power angle curve of synchronous machine using MATLAB.
10. To study reactive power compensation using any device.
11. To develop and execute dynamic programming method for unit commitment. **(Innovative)**

Reference Books

1. Hadi Sadat, "Power System Analysis" Tata McGraw Hill, 3rd edition, 2016
2. Kundur P., 'Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

Evaluation Scheme

Laboratory

Continuous Assessment (TA):

Laboratory work will be based on subject specific lab assignment/case study. The distribution of marks for term work shall be as follows:

- Performance in Experiments: 05 Marks
- Journal Submission: 05 Marks
- Viva-voce: 05 Marks
- Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions

High Voltage Engineering (PEEE7033T)

Teaching Scheme
Lectures : 03 Hrs./week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Knowledge basic sciences, mathematics and subjects of Electrical Engineering.

Course Objectives

1. To make students to know and compare the various processes of breakdown in solid, liquid and gaseous dielectric materials.
2. To make students understand and apply various methods of generation and measurement of DC, AC, impulse voltage and current.
3. To enable students to understand the charge formation and separation phenomena in clouds, the causes of over voltage and lightning phenomena.
4. To develop the ability among learners to execute testing on various high-voltage equipment as per standards.
5. To introduce students to the design, layout, safety precautions, earthling, and shielding of High Voltage laboratory.

Course Outcome

COs	Course Outcomes	Blooms Level	Blooms Description
At the end of this course students will be able,			
CO1	To **apply** basic knowledge of electrical engineering material for understanding breakdown phenomena in solid, liquid and gases.	L3	Apply
CO2	To **analyze** the occurrence of over voltage and to provide remedial solutions.	L4	Analyze
CO3	To **understand** and use of various methods of generation of high AC, DC, impulse voltage and current.	L2	Understand
CO4	To **apply** the methods of measurement of high AC, DC, impulse voltage and current, tests on high Voltage equipment and devices.	L3	Apply
CO5	To **apply** various testing procedures as per IS in laboratory with knowledge of earthling, safety and shielding of HV laboratory.	L3	Apply

Course Contents

Unit-I Breakdown In Gases, Liquids and Solids 08 Hrs.

Review and classification of insulating material, Breakdown in gases, Townsend's law. Breakdown in electronegative gases, streamer mechanism of spark, Paschen's law, corona discharge, electronegative gases. Breakdown in pure and commercial liquids, solid dielectric and composite dielectric, Breakdown in vacuum.

Unit-II Lightning and Switching Over Voltage Protection 08 Hrs.

Lightning phenomenon, Different types of lightning strokes and mechanisms of lightning strokes, Charge separation theories, Wilson theory, Simpson theory, Reynolds and Mason theory. Causes of over voltages and its effects on power systems, Over voltage due to switching surges and methods to minimize switching surges. Insulation co-ordination of HV and EHV power system.

Unit-III Generation of High Voltage and Currents 08 Hrs.

Generation of high ac voltages-Cascading of transformers, series and parallel resonance system, Tesla coil. Generation of impulse voltages and current-Impulse voltage definition, wave front and wave tail time, Multi-stage impulse generator, Modified Marx circuit, Tripping and control of impulse generators, Generation of high impulse current .

Unit-IV Measurement of High Voltage And Currents 08 Hrs.

Sphere gap voltmeter, electrostatic voltmeter, generating voltmeter, peak reading voltmeter, resistive and capacitive potential divider, and capacitance voltage transformer, cathode ray oscilloscope for impulse voltage and current measurement, partial discharge measurements. Measurement of high power frequency a.c using current transformer.

Unit-V Testing and EHV Line Insulation 08 Hrs.

Basic technology , testing of insulators bushing , cables , transformer, surge diverters and threshold current , capacitance of long objects, Electromagnetic interference, E.H.V line insulation design based upon transient over voltages.

Text Books

1. C. L. Wadhwa, "High Voltage Engineering", New Age International Publishers Ltd. 3rd Edition, 2012.
2. M. S. Naidu, V. Kamaraju, "High Voltage Engineering", Tata McGraw Hill Publication Co. Ltd. New Delhi, 6th Edition, 2013.

Reference Books

1. R. S. Jha, "High Voltage Engineering", Dhanpat Rai Publication, 1977.
2. Rakash Das Begamudre, "Extra High Voltage Transmission", New Age International Publication, Revised Edition, 2011.
3. E. Kuffel and W. S. Zaenglo, "High Voltage Engineering", ELSEVIER, 2nd Edition, 2008.
4. D. V. Razevig Translated from Russian by Dr. M. P. Chourasia, "High Voltage Engineering", Khanna Publishers, New Delhi,2005.
5. Subir Ray, "An Introduction to High Voltage Engineering" PHI Pvt. Ltd. New Delhi, 2nd Edition, 2013.

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best performance among the two Term Tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

High Voltage Engineering Labaratory (PEEE7033L)

Teaching Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total Marks : 50 Marks

Prerequisites: Electrical Material, Power Electronics.

Course Objectives

1. To make students to know and compare the various processes of breakdown in solid, liquid and gaseous dielectric materials.
2. To make students understand and apply various methods of generation and measurement of DC, AC, impulse voltage and current.
3. To enable students to understand the charge formation and separation phenomena in clouds, the causes of overvoltage and lightning phenomena.
4. To develop the ability among learners to execute testing on various high-voltage equipment as per standards.
5. To introduce students to the design, layout, safety precautions, earthing, and shielding of High Voltage laboratory.

Course Outcome

COs	Course Outcomes	Blooms Level	Blooms Description
At the end of this course students will be able,			
CO1	To **apply** basic knowledge of electrical engineering material for understanding breakdown phenomena in solid, liquid and gases.	L3	Apply
CO2	To **analyze** the occurrence of over voltage and to provide remedial solutions.	L4	Analyze
CO3	To **understand** the generation and measurement of high voltage for various testing.	L2	Understand
CO4	To **understand** the different high voltage testing of equipment's.	L2	Understand
CO5	To **apply** safety measures, earthling, shielding for layout of HV apparatus required in High voltage laboratory.	L3	Apply

List of the Experiments

Perform any 10 experiments from the following list of experiments (two simulation and one Innovative)

1. To perform breakdown test on transformer oil and obtain constants of breakdown voltage equation and breakdown strength.
2. To obtain breakdown strength of composite insulation system.
3. Measurement of unknown high a.c. voltage using sphere gap.
4. Measurement of insulation resistance of 11KV/110 V.P.T by Megger.
5. Analyzing the uniform and non-uniform field in breakdown strength of air insulation system.
6. To understand basic principle of corona and obtain audible and visible corona inception and extinction voltage under non uniform field.
7. Dry and Wet power frequency withstand test for insulator.
8. To Analyzing the Effect of EHV field on Human, Animals and Plants.
9. Study of impulse generator.
10. Simulation of lightening and switching impulse voltage generator.
11. To Analyzing effect of barrier on breakdown voltage of air/ transformer oil.
12. Parametric analysis of Impulse current generator using virtual Laboratory.

Text Books

1. C. L. Wadhwa, "High Voltage Engineering", New Age International Publishers Ltd. 3rd Edition, 2012.
2. M. S. Naidu, V. Kamaraju, "High Voltage Engineering", Tata McGraw Hill Publication Co. Ltd. New Delhi, 6th Edition, 2013.

Reference Books

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4. D. V. Razevig Translated from Russian by Dr. M. P. Chourasia, "High Voltage Engineering", Khanna Publishers, New Delhi,2005.
5. Subir Ray, "An Introduction to High Voltage Engineering" PHI Pvt. Ltd. New Delhi, 2nd Edition, 2013.

Evaluation Scheme

Laboratory

Continuous Assessment (TA):

Laboratory work will be based on subject specific lab assignment/case study. The distribution of marks for term work shall be as follows:

- Performance in Experiments: 05 Marks
- Journal Submission: 05 Marks
- Viva-voce: 05 Marks
- Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions

Illumination Engineering (PEEE7035T)

Teaching Scheme
Lectures : 03 Hrs./week
Credit : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Knowledge basic sciences, mathematics and subjects of Electrical Engineering.

Course Objectives

1. To get the detailed information about modern lamps and their accessories.
2. To get detailed insight of indoor and outdoor illumination system components, its controls and design aspects.
3. To know the requirements of energy efficient lighting.
4. To introduce the modern trends in the lighting.
5. To get the detailed information about modern lamps and their accessories.

Course Outcome

COs	Course Outcomes	Blooms Level	Blooms Description
At the end of this course students will be able,			
CO1	To **apply** basic engineering to understand concept of lighting system, selection of lighting factors effecting on lighting scheme.	L3	Apply
CO2	To **understand** the criteria for the selection of lamps, measurement of light and law of illuminations. And lighting systems for an indoor or outdoor space .	L2	Understand
CO3	To **design** and Evaluate different types of lighting scheme designs for indoor lighting and selection of luminary to meet the specified needs with appropriate consideration.	L6	Create
CO4	To **evaluate** calculations on photometric performance of light sources and luminaries for outdoor purposes.	L5	Analyze
CO5	To **understand** the modern trends in the lighting.	L2	Understand

Course Contents

Unit-I Introduction of Light 08 Hrs.

Introduction of Light: Radiation, colour and eye vision. Types of illumination, Day lighting, Supplementary artificial lighting and total lighting, Quality of good lighting, Factors affecting the lighting-shadow, glare, reflection, Colour rendering and stroboscopic effect, Methods of artificial lighting, Lighting systems-direct, indirect, semi direct, semi indirect, Lighting scheme, General and localized.

Unit-II Light Sources 08 Hrs.

Lamp materials: Filament, glass, ceramics, gases, phosphors and other metals and non-metals. Discharge Lamps: Theory of gas Discharge phenomena, lamp design considerations, characteristics of low and high mercury and Sodium vapour lamps, Low Vapour Pressure discharge lamps - Mercury Vapour lamp, Fluorescent Lamp, Compact Fluorescent Lamp (CFL) High Vapour Pressure discharge lamps - Mercury Vapour lamp, Sodium Vapour lamp, Metal halide Lamps, Solid Sodium Argon Neon lamps, SOX lamps, Electro luminescent lamps, Induction lamps.

Unit-III Design of Interior Lighting 08 Hrs.

Definitions of maintenance factor, Uniformity ratio, Direct ratio, Coefficients of utilization and factors affecting it, Illumination required for various work planes, Space to mounting height ratio, Types of fixtures and relative terms used for interior illumination, Calculation of wattage of each lamp and no of lamps needed, Layout of lamp luminaries, Calculation of space to mounting height ratio, Indian standard recommendation and standard practices for illumination levels in various areas, Special feature for entrance, staircase, Corridor lighting and industrial building.

Unit-IV Design of Outdoor Lighting 08 Hrs.

Street Lighting : Types of street and their level of illumination required, Terms related to street and street lighting, Types of fixtures used and their suitable application, Various arrangements in street lighting, Requirements of good street lighting, Selection of lamp and luminaries, Calculation of illumination level available on road .Flood Lighting Types of fixtures and their suitable applications, Selection of lamp and projector, Calculation of their wattage and number and their arrangement, Calculation of space to mounting height ratio.

Unit-V Modern trends in illumination 08 Hrs.

LED luminary designs Intelligent LED fixtures Natural light conducting Organic lighting system LASERS, characteristics, features and applications, non-lighting lamps Optical fiber, its construction as a light guide, features and applications.

Text Books

1. Gupta J. B., "Utilization of Electric Power and Electric Traction", S. K. Kataria and Sons, 2nd edition, 2012.
2. Uppal S. L, "Electrical Power", Khanna Book Publication, 13th Edition, 1988.
3. Partab H. P., "Art and Science of Utilization of Electrical Engineering", Dhanpat Rai Publications, Revised Edition, 2017.

Reference Books

1. Jack L. Lindsey, "Applied Illumination Engineering", Fairmont Pr, 2nd Edition, 1996.
2. John Matthews, "Introduction to the Design and Analysis of Building Electrical Systems", Springer Science and Business Media, 1993.
3. M. A. Cayless, "Lamps and Lighting", Routledge, 4th Edition, 2012.
4. O. E. Taylor, "Utilization of Electrical Energy", Longman, 1971.
5. H. S. Mamak, "Book on Lighting", Publisher International Lighting Academy.
6. Joseph B. Murdoch, "Illumination Engineering from Edison's Lamp to Lasers", Publisher -York, PA: Visions Communications, 1994.

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best performance among the two Term Tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Illumination Engineering Laboratory (PEEE7035L)

Teaching Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total Marks : 50 Marks

Prerequisites: Knowledge basic sciences, mathematics and subjects of Electrical Engineering.

Course Objectives

1. To get the detailed information about modern lamps and their accessories.
2. To get detailed insight of indoor and outdoor illumination system components, its controls and design aspects.
3. To know the requirements of energy efficient lighting.
4. To introduce the modern trends in the lighting.
5. To get the detailed information about modern lamps and their accessories.

Course Outcome

COs	Course Outcomes	Blooms Level	Blooms Description
At the end of this course students will be able,			
CO1	To **apply** an appropriate measurement and analysis technique of artificial lighting for different specific purposes.	L3	Apply
CO2	To **evaluate** various types of electric bulbs as well as can evaluate their performance in terms of their colour rendering and luminous efficacy.	L5	Evaluate
CO3	To **develop** a clear idea on various illumination techniques and hence can design lighting schemes for specific applications	L6	Create
CO4	To **apply** an appropriate light fitting method for any specific application.	L3	Apply
CO5	To **identify**, formulate, and figure out the need of research and development activities required for developing efficient artificial illumination.	L2	Understand

List of the Experiments

Perform any 10 experiments from the following list of experiments (two simulation and one Innovative)

1. To Study the status monitoring of light.
2. To study fault monitoring in Lighting Power Systems.
3. To study electrical load monitoring in Lighting Power Systems.
4. To calculate the life of Lighting Lamp.
5. To study the energy management in illumination.
6. To study the Energy efficient illuminating system components.
7. To measure Illumination by luxmeter.
8. To prepare a report of different luminaries available in the market and collect the technical data.
9. To study the different lighting accessories required for varies types of lamps.
10. Design an Illumination scheme for a garden of medium size.
11. Design an Illumination scheme for a conference room of medium size.
12. Design an Illumination scheme for a workshop for fine work of medium size.
13. Design an Illumination scheme for a medium size Hotel / Hospital /Shopping complex.

Text Books

1. Gupta J. B., "Utilization of Electric Power and Electric Traction", S. K. Kataria and Sons, 2nd edition, 2012.
2. Uppal S. L, "Electrical Power", Khanna Book Publication, 13th Edition, 1988.
3. Partab H. P., "Art and Science of Utilization of Electrical Engineering", Dhanpat Rai Publications, Revised Edition, 2017.

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2. John Matthews, "Introduction to the Design and Analysis of Building Electrical Systems", Springer Science and Business Media, 1993.
3. M. A. Cayless, "Lamps and Lighting", Routledge, 4th Edition, 2012.
4. O. E. Taylor, "Utilization of Electrical Energy", Longman, 1971.
5. H. S. Mamak, "Book on Lighting", Publisher International Lighting Academy.
6. Joseph B. Murdoch, "Illumination Engineering from Edison's Lamp to Lasers", Publisher -York, PA: Visions Communications, 1994.

Evaluation Scheme

Laboratory

Continuous Assessment (TA):

Laboratory work will be based on subject specific lab assignment/case study. The distribution of marks for term work shall be as follows:

- Performance in Experiments: 05 Marks
- Journal Submission: 05 Marks
- Viva-voce: 05 Marks
- Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions

Research Methodology (OEEE7059T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisite: Basic Knowledge of Probability and Statistics.

Course Objectives:

1. To understand Research and Research Process.
2. To acquaint learners with identifying problems for research and develop research strategies.
3. To familiarize learners with the techniques of data collection, analysis of data and interpretation.

Course Outcome

COs	Course Outcomes	Blooms Level	Blooms Description
At the end of this course students will be able,			
CO1	To **prepare** a preliminary research design for projects in their subject matter areas.	L2, L3	Understand, Apply
CO2	To accurately collect, **analyze** and report data.	L4	Analyze
CO3	To **present** complex data or situations clearly.	L2	Understand
CO4	To review and **analyze** research findings.	L4	Analyze
CO5	To **write** report about findings of research carried out.	L3	Apply

Course Contents

Unit-I — 07 Hrs.

Basic Research Concepts: Meaning of research, Objectives of research, Types of research, Significance of research Research process

Unit-II — 10 Hrs.

Research Methodology: Identification of research problem, Literature review, Formulation of hypothesis, Formulation of Research design.

Unit-III — 10 Hrs.

Research and Sample Design: Meaning of research and sample design, Need of research design, Features of good research design, Important concepts, Different research designs, Types of sampling designs.

Unit-IV — 10 Hrs.

Data Collection and Data Analysis: Types of data, Methods for collecting data: Experiments and surveys, Collection of primary and secondary data, Hypothesis testing and interpretation of Data

Unit-V — 05 Hrs.

Interpretation and Report Writing: Interpretation and drawing conclusions on the research, Preparation of the report, Ethical Issues

Reference Books:

1. Dawson, Catherine, "Practical Research Methods", New Delhi, UBS Publishers Distributors, 2002,.
2. Kothari, C.R.,"Research Methodology-Methods and Techniques", New Delhi, Wiley Eastern Limited, 1985.
3. Kumar, Ranjit, 2005, "Research Methodology-A Step-by-Step Guide for Beginners", 2nd Edition, Singapore, Pearson Education.

Evaluation Scheme:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Best performance among the two Term Tests will be considered for final grading.

End Semester Examination (C):

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Electrical Engineering Simulation Laboratory (PCEE7050L)

Teaching Scheme
Practical : 04 Hrs./week
Credit : 02

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total Marks : 50 Marks

Prerequisites: Fundamental of Electrical Energy Generation System, Power System Transmission and Distribution.

Course Objectives

1. The objective of this lab is to appreciate and use various software tools like MATLAB/ PSCAD/ ETAP/ POWER WORLD in electrical engineering for modeling and simulation of different courses like power systems, electrical machines, solar systems, electric vehicles, and power electronic circuits in lesser time.

Course Outcome

COs	Course Outcomes	Blooms Level	Blooms Description
At the end of this course students will be able,			
CO1	To **recognize** the importance of various modern tools for simulating electrical systems.	L1	Knowledge
CO2	To **analyze** the various electrical parameters of static and rotating machineries.	L4	Analyze
CO3	To **analyze** the design parameters of insulators, voltage sag, voltage swell, solar photovoltaic systems, and inverter system.	L4	Analyze
CO4	To **analyze** the power system stability , load flow analysis, relay coordination in power system.	L4	Analyze
CO5	To **design** and implement the models of cell balancing in battery management systems, battery controller, state of charge for battery in electric vehicle system.	L6	Create

List of the Experiments

Perform any 12 experiments from the following list of experiments. **(Compulsory two innovative experiment)**

1. Introduction to PSCAD.
2. Introduction to ETAP.
3. Introduction to Power world.
4. Speed control of induction motor using SVPWM. (Scalar Control)
5. Modeling and simulation of single-phase (two-winding) transformers.
6. Measurement of efficiency of 3 phase transformer.
7. Simulation of Transformer core saturation and inrush current.
8. Design and simulation of string efficiency model of suspension insulator.
9. Simulation of solar PV MPPT System.
10. Analysis of total harmonic distortion (THD) and FFT for an inverter.
11. Design and simulation of voltage sag and voltage swell model.
12. Simulation of power system stability using Power world/MATLAB.
13. Load flow analysis using ETAP/MATLAB/Power world.
14. Simulation study of relay coordination.
15. Simulation of battery management system using passive cell balancing for electric vehicle. **(Innovative)**
16. Design and simulation of battery controller for electric vehicle.**(Innovative)**
17. Estimation of state of charge of EV.**(Innovative)**
18. Development of GUI for electrical system. **(Innovative)**

Lab Tools:

1. MATLAB/Simulink
2. PSCAD
3. ETAP
4. Power world Software

Evaluation Scheme

Laboratory

Continuous Assessment (TA):

Laboratory work will be based on subject specific lab assignment/case study. The distribution of marks for term work shall be as follows:

- Performance in Experiments: 05 Marks
- Journal Submission: 05 Marks
- Viva-voce: 05 Marks
- Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions

Project Stage - II (PJEE7070L)

Practical Scheme
Practical : 08 Hrs./week
Credit : 04

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

- To implement the solution as per the problem statement.
- To develop the team building, writing, logical reasoning and management skills.
- To provide the connections between the designs and concepts across different disciplinary boundaries.
- To encourage students to become independent personnel, critical thinkers and lifelong learners.

Course Outcome

COs	Course Outcomes	Blooms Level	Blooms Description
At the end of this course students will be able,			
CO1	To **apply** engineering knowledge to produce solution of a problem considering cultural, social, environmental, and economic factors using appropriate tool and method.	L3	Apply
CO2	To **demonstrate** project based learning that allows students to transfer existing ideas into new applications.	L3	Apply
CO3	To **develop** an ability to work in teams and manage the conduct of the research study.	L6	Create
CO4	To **integrate** different perspectives from relevant disciplines which help them to get internships, jobs and admission for higher studies.	L6	Create
CO5	To **present** the research in the form of technical writing, understand what constitutes to plagiarism and how to use proper referencing styles.	L1	Remember

Syllabus:

- Project-I work done in VI semester shall be continued as Project-II in semester VII.
- Students should complete remaining implementation of ideas given in synopsis/Abstract of semester VII.
- Students / group must plan their execution of project, so that project work should be completed before end of semester.
- Project-II involves fabrication, design, experimentation, data analysis within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability. The stage also includes testing, possible results and report writing.
- Each project group is required to maintain log book for documenting various activities of Project-II and submit group project report at the end of Semester-VII in the form of Hard bound.
- Domain knowledge (any beyond) needed from the following areas for the effective implementation of the project:
  Microcontroller and Embedded Systems, Signal Processing, Microwave and Antennas, Networking and Internet of Things, Data science and Big data, Communication, Web and Application development, Robotics, AI and Machine learning. The above areas can be updated based on the technological innovations and development needed for specific project.

Guidelines:

The main purpose of this activity is to improve the students' technical skills, communication skills by integrating writing, presentation and teamwork opportunities.

- Each group will be reviewed twice in a semester and marks will be allotted based on the various points mentioned in the evaluation scheme.
- In the first review of this semester, each group is expected to complete 70% of project. (may consist theoretical design of project, block diagram and circuits / components required for realization of block, algorithm and its implementation details, simulation of circuits etc)
- In the second review of this semester, each group is expected to complete 100 % of project. (may consist practical hardware fabrication, interconnection of all PCBs/ boards, final testing of project, implementation of algorithm, testing, debugging, programming).
- The students may use this opportunity to learn different computational techniques towards development of a product.
- Interaction with alumni mentor will also be appreciated for the improvement of project.

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide).

Office Seal

- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).
- The candidate must bring the project part- 1 report and the fi

  nal report completed in all respect while appearing for End Semester Examination.
- Oral examination should be conducted by Internal and External examiners. Students have to give presentation and demonstration based on their project.

Prescribed project report guidelines:

Every group should prepare hard bound report (preferrable LaTeX) of about minimum 40 pages on the work carried out by a batch of students in respect of the project work done during semester-VII. Project Report should include appropriate content for:

- Title
- Abstract
- Introduction
- Problem identification and project objectives
- Literature Survey
- Related Theory
- Project design and Implementation details
- Case study/Analysis/Design Methodology
- Project Outcomes
- Result and Conclusion
- Future Scope
- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Each group will be reviewed twice in a semester by faculty guide and faculty coordinator based on the following criteria:

- Project progress
- Documentation/Technical paper writing
- Key findings
- Validation of results
- Product Development

Each review consists of 25 marks. Average of the marks scored in both the two reviews will be considered for final grading. The final certification and acceptance of TW ensures the satisfactory performance on the above aspects.

Table 1: Log Book Format

Week (Start Date : End Date)	Work Done	Sign of in-house mentor	Sign of Coordinator

Table 2: Continuous Assessment Sheet

Exam Seat No	Name of Student	Student Attendance (5 Marks)	Log Book (5 Marks)	Literature Review (5 Marks)	Depth of Under-standing (5 Marks)	Report (5 Marks)	Total (25 Marks)

Table 3: Evaluation Sheet

Exam Seat No	Name of Student	Project Selec-tion (5 Marks)	Design / Simulation / Logic (5 Marks)	PCB / hardware / program-ming (5 Marks)	Result Verifica-tion (5 Marks)	Presentation (5 Marks)	Total (25 Marks)