Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure

Third Year B.Tech (Electrical Engineering)

with efffect from Year 2024-25 (RCP22 Scheme)

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
Ph: 02563 259 802, Web: www.rcpit.ac.in

Third Year B. Tech Electrical Engineering Semester-V (w.e.f 2024-2025) (Autonomous RCP22 Scheme)

SN	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				ESE	Total	Credit
				L	T	P	TA	Term Test 1 (TT 1)	Term Test 2 (TT 2)	Best of TT 1 / TT2			
							A			B	C	[A+B+C]	
1	PC	22PCEE5010T	Electrical Machine-II	3			25	10	10	10	65	100	3
2	PC	22PCEE5010L	Electrical Machine-II Laboratory			2	25				25	50	1
3	PC	22PCEE5020T	Power System Analysis	3			25	10	10	10	65	100	3
4	PC	22PCEE5020L	Power System Analysis Laboratory			2	25				25	50	1
5	PC	22PCEE5030T	Eletromagnetic Engineering	3	1		25	10	10	10	65	100	4
6	PC	22PCEE5040T	Electric Traction and Utilization	3			25	10	10	10	65	100	3
7	PE#	22PEEE505-T	Professional Elective Course	3			25	10	10	10	65	100	3
8	PE#	22PEEE505-L	Professional Elective Course Laboratory			2	25				25	50	1
9	PC	22PCEE5060L	E-CAD Laboratory			2	25				25	50	1
10	HM	22MCEE5070T	Environment Engineering	1								0	Audit Course
11	PJ	22PJEE5080L	Semester Project-III			2	25				25	50	1
12	HM	22HMEE5090L	Employability Skill Development Program-II			2	50					50	1
			Total	**16**	**1**	**12**	**300**	**50**	**50**	**50**	**450**	**800**	**22**

PC: Professional Course, PE: Professional Elective, HM: Humanity and Management, PJ: Project, # Any 1 Professional Elective

Semester-V Professional Elective Courses	
Coure Title	Course Code
22PEEE5051	Solar Power Plant Design & Installation
22PEEE5052	IoT & Its application in Electrical Engineering
22PEEE5053	Signals & Systems

Prepared By

Checked By

BOS Chairman

COE

Dy. Director

Director

Controller of Examinations
R.C.Patel Institute of Technology
Shirpur Dist.Dhule 425 405

Deputy Director
R. C. Patel Institute of Technology
Shirpur, Dist. Dhule (MS)

DIRECTOR
R C Patel Institute of Technology
Shirpur Dist Dhule (MS)

Third Year B. Tech Electrical Engineering Semester-VI (w.e.f 2024-2025)

(Autonomous RCP22 Scheme)

SN	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				ESE	Total	Credit
				L	T	P	TA	Term Test 1 (TT 1)	Term Test 2 (TT 2)	Best of TT 1 / TT2			
							A			B	C	[A+B+C]	
1	PC	22PCEE6010T	Control System	3			25	10	10	10	65	100	3
2	PC	22PCEE6010L	Control System Laboratory			2	25				25	50	1
3	PC	22PCEE6020T	Power Electronics	3			25	10	10	10	65	100	3
4	PC	22PCEE6020L	Power Electronics Laboratory			2	25				25	50	1
5	PC	22PCEE6030T	Electrical Machine Design	3			25	10	10	10	65	100	3
6	PC	22PCEE6030L	Electrical Machine Design Laboratory			2	25				25	50	1
7	PC	22PEEE6040T	Power System Operation & Control	3			25	10	10	10	65	100	3
8	PC	22PEEE6040L	Power System Operation & Control Laboratory			2	25				25	50	1
9	PE	22PCEE5060L	Professional Elective Course	3			25	10	10	10	65	100	3
10	PE	22MCEE5070T	Professional Elective Course Laboratory			2	25				25	50	1
11	PJ	22PJEE6060L	Project Stage-I			4	25				25	50	2
12	HM	22HMEE5090L	Professional & Business Communication Tutorial		2		25					25	2
			Total	**15**	**2**	**14**	**300**	**50**	**50**	**50**	**475**	**825**	**24**

PC: Professional Coourse, PE: Professional Elective, HM: Humanity and Management, PJ: Project, # Any 1 Professional Elective

Semester-VI Professional Elective Courses	
Coure Title	Course Code
22PEEE6051	Digital Signal Processing
22PEEE6052	Electrical Mobility
22PEEE6053	Programmable Logic Control

Prepared By

Checked By

BOS Chairman

COE

Dy. Director

Director

Controller of Examination
R.C.Patel Institute of Technology
Shirpur Dist.Dhule 425 405

DIRECTOR
R C Patel Institute of Technology
Shirpur Dist Dhule (MS)

Deputy Director
R. C. Patel Institute of Technology
Shirpur, Dist. Dhule (MS)

Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur
(An Autonomous Institute)

Syllabus Booklet
Departemtn of Electrical Engineering

Third Year B.Tech.

With Effect from Academic Year 2024-25

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
Ph: 02563 259 802, Web: www.rcpit.ac.in

Electrical Machines-II (22PCEE5010T)

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

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites:

1. Knowledge of Electrical Machine-I.

Course Objectives

1. To introduce the constructional and operational details of cylindrical and salient pole rotor type Synchronous machines working in generator and motor modes.
2. To present the procedure for analysis of synchronous generator and synchronous motor during the (a) steady state, (b) transient state (3-phase short-circuit) and (c) unbalanced operating conditions using Phasor diagrams and machine equations.
3. To introduce the methods of synchronization and analysis when alternators are connected to Infinite bus and in parallel with each other.
4. Determine the performance indices of AC series and single phase motors by experimentation.
5. Study the applications of different machines in industrial, commercial and social sectors.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To Apply basic knowledge of science and engineering to understand electrical machines.	L3	Apply
CO2	To Understand construction, concepts, and principles of operation, testing and application of Synchronous machines, induction motor and special function motors.	L2	Understand
CO3	To Understand the behavior of synchronous machine on infinite bus and analyze data for qualitative and quantitative parameters to determine characteristics of machines by performing practical.	L2	Understand
CO4	To analyze and perform professional duties in team of manufacturing, testing, operation and Maintenance with the sense of safety precautions.	L4	Analyze
CO5	To Apply knowledge for technological subjects such as utilization of electrical energy, Switchgear and machine design for economical and sustainable developments.	L3	Apply

Course Contents

Unit-I Synchronous Generator 8 Hrs.

Principle of generator, construction, excitation system, rotating MMF waves in A.C. Machines, E.M.F. equation, winding factors, alternator on- load. Synchronous reactance and synchronous impedance,armature reaction and its effect under different load power factors, Voltage regulation of non-salient pole alternator.

Unit-II Synchronous Generator Analysis 8 Hrs.

Two reaction theory for salient pole machines, slip test for finding xd, xq. Parallel operation of alternator. Effect of changing mechanical torque and excitation on alternator. Load sharing between two parallel connected alternators. Alternator on an infinite bus, induction generator

Unit-III Synchronous Motors 8 Hrs.

Principle of operation of Synchronous Motor, Power develop in Synchronous motor, Operation of 3-phase Synchronous motor with constant load and variable excitation, Operation with const. excitation and variable load, 'V' curves and 'inverted V' curves. Synchronous condenser, Phenomenon of hunting and its remedies. Applications of 3-phase synchronous motors.

Unit-IV Poly Phase Induction Machines 8 Hrs.

Construction and principle of operation of squirrel cage slip ring Induction motor Slip. Steady state analysis: Torque -speed characteristics, Torque -slip characteristics, maximum torque, and starting torque, Power stage in induction motor. Losses and efficiency, Methods of starting of slipping and cage rotor induction motor ,varies types of starters, Circle diagram and computation, Double squirrel cage motors, cogging, crawling of induction motor, Speed control of induction motor Comparison of 3 phase synchronous motor with 3-phase induction motor.

Unit-V Introduction to Special Machines 8 Hrs.

Single phase induction motor: - Construction of single phase induction motor, double field revolving theory. Equivalent circuit and torque-slip characteristics on the basis of double revolving field theory, Type of 1 phase IM. Special Machines: hysteresis motor, Repulsion motor. Linear Induction Motor, A.C. Servomotors A.C. series motor.

Text Books

1. Ashfaq Hussain, "Electrical Machines",Dhanpat Rai and Co. (P) Limited, 3rd edition, 2016.
2. I. J. Nagrath and D. P. Kothari, "Electrical Machinery", Tata McGraw-Hill Education, 5th edition, 2020.
3. M V Deshpande, "Electrical Machines", Prentice Hall of India,2011
4. V. K. Mehta and Rohit Mehta, "Principles of Electrical Machines" S Chand Publication, 1st Edition, 2014.

Reference Books

1. Bimbhra P.S., "Generalized Theory of Electrical Machines", Khanna Publisher, 7th Revised Edition, 2021.
2. M.G. Say, "Theory and Performance and Design of A.C. Machines", ELBS London, 2002.
3. J B Gupta,"Theory and performance of Electrical Machines", S K Kataria Publications, 1st Edition, 2015

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 10 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 Machines-II Labaratory (22PCEE5010L)

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 Machine-I

Course Objectives

1. To perform load test on three phase induction motor.
2. To observe the effect of rotor resistance and supply voltage on torque speed characteristic of induction motor.
3. To study and evaluation of Voltage Regulation for synchronous generator.
4. To conduct experiment to draw V and inverted V curves for synchronous motor.
5. To calculate Xd and Xq of a salient pole synchronous machine.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To apply the load test on three phase induction motor and understand variation in torque speed characteristics with different parameters.	L3	Apply
CO2	To analyze the Performance of synchronous machines.	L4	Analyze
CO3	To understand the voltage regulation in synchronous generator and different methods to find it.	L2	Understand
CO4	To analyze the V curve and inverted V-curve for synchronous motor under various load conditions.	L4	Analyze
CO5	To analyze find the magnetic axis of salient pole synchronous machines.	L4	Analyze

List of the Experiments

Perform 10 experiments from the following list of experiments. (8– Hardware, 1 – Simulation and 1 – Innovative)

1. Determination of voltage regulation and efficiency of three phase alternator by direct load test.
2. Open and short circuit test on three phase alternator: determination of its regulation by e.m.f. method and m.m.f. method.
3. Determination of direct axis and quadrature axis reactance by slip test on synchronous machine.
4. Synchronizing alternators: lamp methods and use of synchroscope.
5. Characteristic of synchronous motor at constant load and variable excitation.
6. Characteristic of synchronous motor at constant excitation and variable load.
7. Determination of performance of three phase induction motor by direct load test.
8. Load test on single phase induction motor.
9. Speed control of three phase Slip Ring Induction Motor.
10. To study different types of starters for three phase Squirrel cage induction motor
11. Simulation of three phase induction motor on MATLAB to obtain its performance

Text Books

1. Ashfaq Hussain, "Electrical Machines",Dhanpat Rai and Co. (P) Limited, 3rd edition, 2016.
2. I. J. Nagrath and D. P. Kothari, "Electrical Machinery", Tata McGraw-Hill Education, 5th edition, 2020.
3. M V Deshpande, "Electrical Machines", Prentice Hall of India,2011
4. V. K. Mehta and Rohit Mehta, "Principles of Electrical Machines" S Chand Publication, 1st Edition, 2014.

Reference Books

1. Bimbhra P.S., "Generalized Theory of Electrical Machines", Khanna Publisher, 7th Revised Edition, 2021.
2. M.G. Say, "Theory and Performance and Design of A.C. Machines", ELBS London, 2002.
3. J B Gupta,"Theory and performance of Electrical Machines", S K Kataria Publications, 1st Edition, 2015

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 Analysis (22PCEE5020T)

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

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 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. To understand the concepts of per-unit system and modeling of power system.
2. To understand and analyze the different types of faults in Power system.
3. To understand basic electricity market principles and power exchange.
4. To study concept of power system stability and its analysis.
5. To understand and study the modern power system concepts like SCADA, PMU, Security analysis.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To analyze three phase fault for small power systems.	L4	Analyze
CO2	To apply the concept of symmetrical components and evaluate the symmetrical components under fault conditions.	L3	Apply
CO3	To analyze unsymmetrical faults for small power networks.	L4	Analyze
CO4	To understand Electricity market concepts of deregulated power system and demand side management.	L2	Understand
CO5	To apply the knowledge for stable operation of power system and analyze the stability of power system.	L3	Apply

Course Contents

Unit-I Representation of Power System 8 Hrs.

Representation of power system components , per unit quantities – single phase and three phase selection of base quantities, advantages of PU systems, complex power, sequence networks of power system, regulating transformers, generators, transmission line, phase shift in star-delta transformer, sequence impedance of transmission line, transformer and generators.

Unit-II Symmetrical Fault Analysis and Components 8 Hrs.

Transient on a transmission line, Symmetrical fault analysis without and with pre-fault load currents, selection of circuit Breakers ratings, current limiting reactors, Symmetrical Component transformation, Operator a, Three phase power in unbalanced circuit in terms of symmetrical component, formation of sequence network of power system.

Unit-III Unsymmetrical Fault Analysis 8 Hrs.

Introduction, Single line to ground fault (LG) on an unloaded generator, line to line fault (LL) on an unloaded generator, double line to ground fault (LLG) on an unloaded generator, unsymmetrical fault on power systems, Single line to ground fault (LG) on a power system, line to line fault (LL) on a power system , double line to ground fault(LLG) on a power system, Shunt type and series type faults.

Unit-IV Load Flow Analysis 8 Hrs.

Introduction, Analysis of power flows, Network model formation, Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications. Application of numerical methods for solution of non-linear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations, Comparison of load flow studies, Computational Issues in Large-scale Power Systems.

Unit-V Power System Economics, Stability and Management 8 Hrs.

Basic Pricing Principles, Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing, Electricity Market Models (Vertically Integrated, Purchasing Agency, Whole-sale competition, Retail Competition), Demand Side-management, Transmission and Distributions charges, Ancillary Services, Regulatory framework.

Concepts of Stability, classification of Power System stability, Dynamics of a synchronous machine, Importance of Stability analysis in power system planning and operation, angle and voltage stability, Transient stability analysis, factor affecting transient stability, Methods to Improve transient stability, Single Machine Infinite bus (SMIB), Swing equation and its expression.

Text Books

1. D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education, 2003.
2. C. L. Wadhwa, "Electrical Power System” New Age International Publishers, 2017.
3. V. K. Mehta, Rohit Mehta, “Principles of Power System”, S.Chand Publications, 4th Edition , 2021.

Reference Books

1. J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education, 1994.
2. O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education, 1995.
3. A. R. Bergen and V. Vittal, “Power System Analysis” Pearson Education Inc., 1999.
4. Hadi Sadat, ”Power System Analysis” Tata McGraw Hill, 3rd Edition, 2016
5. L. P. Singh, ”Advanced Power System Analysis and Dynamics” New Age International, 2006.

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 10 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 Analysis Laboratory (22PCEE5020L)

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 networks by conducting various experiments.
2. To present a problem oriented knowledge of power system analysis methods.
3. To develop computer programs for analysis of power systems.
4. To analyze power system operation and stability control.
5. To identify and formulate solutions to relevant problems of power system using software tools.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	The students should be able Evaluate reactance of synchronous machine on no load and loaded condition.	L3	Apply
CO2	The students should be able Analyze the effects of symmetrical fault on power system.	L4	Analyze
CO3	The students should be able Analyze the effects of unsymmetrical faults on power system.	L4	Analyze
CO4	The students should be able Compute the Y-bus and Z-bus matrix for a given system.	L4	Analyze
CO5	The students should be able Determine the power flow for a given system	L3	Apply

List of the Experiments

Perform 10 experiments from the following list of experiments. (1– Hardware, 8 – Simulation and 1 – Innovative)

1. To study the effect of VAR compensation on voltage profile of transmission line using capacitor bank.
2. Load Flow Analysis using Newton Raphson (NR) Method Experiment.
3. Load Flow Analysis using Fast Decoupled (FD) Method.
4. Load Flow Analysis using Gauss Seidel (GS) Method.
5. Measurement of Direct axis and Quadrature axis reactance of synchronous machine.
6. Formation and calculation of Y BUS .
7. Formation and calculation of Z BUS .
8. Simulation and analysis for a symmetrical three phase fault.
9. Simulation and analysis of unsymmetrical fault LL.
10. Simulation and analysis of unsymmetrical fault LG.
11. Simulation and analysis of unsymmetrical fault LLG.
12. To study Transient and small signal stability analysis of Single Machine connected to infinite bus.

Reference Books

1. Hadi Sadat, “Power System Analysis” Tata McGraw Hill, 3rd edition, 2016.

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

Electromagnetic Engineering (22PCEE5030T)

Teaching Scheme
Lectures : 03 Hr/week
Tutorial : 01 Hr/week
Credit : 04

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Fundamental of Power electronics, Power system and Control system.

Course Objectives

1. Develop a thorough understanding of vector analysis principles and techniques, enabling students to analyze and solve diverse physical problems.
2. Equip students with the knowledge and skills necessary to comprehend and apply fundamental concepts in electrostatics and magneto statics, fostering their ability to analyze electromagnetic phenomena in real-world contexts.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply vector analysis techniques in various coordinate systems including gradient, divergence, and curl operations.	L3	Apply
CO2	Utilize Gauss's Divergence theorem and Stoke's theorem to solve vector analysis problems.	L3	Apply
CO3	Explain fundamental concepts of electrostatics such as Coulomb's law, Gauss's flux theorem, and Poisson's Equation.	L3	Understand
CO4	Analyze problems related to electrostatic fields in dielectrics including polarization, electric flux density, and capacitance.	L3	Apply
CO5	Describe principles of magnetic fields, electromagnetic induction, and Maxwell's equations. Apply concepts like Ampere's law and Faraday's law.	L4	Analyze

Course Contents

Unit-I Vector Analysis 08 Hrs.

General Treatment on Cartesian, cylindrical, spherical and general curvilinear co-ordinate systems with reference to vectors, operation of gradient, divergence, curl, Laplacian., Gauss's Divergence theorem, Stoke's theorem.

Unit-II Electrostatics 08 Hrs.

Review of electric field quantities and their definitions. Gauss's flux theorem, Poisson's Equation and Laplace Equation, uniqueness theorem, Green's theorem, Coulomb's law, dipole moment. Electrostatic Field in Dielectric: Polarization, electric flux density, boundary conditions, capacitor and capacitance, electrostatic shielding, energy stored in electric fields.

Unit-III Magnetic Fields & Electromagnetic Induction 08 Hrs

Magnetic flux and flux density, static currents in conducting media, Ampere's law, Biot-Savart law, boundary between magnetic media, forces between currents, magnetic potentials, magnetic torque and moment, Dipole, Energy stored in magnetic field. Faraday's law of induction (transformer and motion), Inductor and Inductances (self and mutual).

Unit-IV Maxwell's Equations Electromagnetic Waves 08 Hrs

Maxwell's equations - Equation of continuity - Displacement current - Maxwell's equation in point and integral forms ,Time-varying potentials, wave equations, plane waves in Losses Dielectrics, Free space Good conductors, Poynting vector and Theorem.

Unit-V Transmission Lines 08 Hrs.

Line equations, input impedance, SWR and power, smith chart, some applications of Transmission lines.

Text Books

1. N. Rao, "Elements of Engineering Electromagnetics", Prentice Hall, 6th edition, 2004.
2. Matthew N.O. Sadiku, "Element of electromagnetics Electromangnetics", Oxford University Press, 3rd edition, 2003.

Reference Books

1. William H. Hayt,"Engineering Electromagnetices", Mc-Graw Hill, Eleventh edition ,1998
2. R. P. Feynman, R. Leighton and M. Sands, Feynman Lectures on Physics Vol.-II (Millennium Edition), Pearson, 2012.
3. J. Edminister, Schaum's Outline: Theory and Problems in Electromagnetics (revised 2nd Edition), Tata McGraw-Hill, 2010.

4. D. J. Griffiths, Introduction to Electrodynamics (4th Edition), PHI Learning, New Delhi, 2015

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 10 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.

Electric Traction and Utilization (22PCEE5040T)

Teaching Scheme
Lectures : 03 Hr/week
Credit : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Basics of Electrical Engineering and Electrical Machine-I.

Course Objectives

1. To understand energy conversion process.
2. To impart knowledge of principles of electrical traction .
3. To explore various electrical subsystems of traction .
4. To possess knowledge of advanced and emerging topics in traction mechanism and applications.
5. To meet desired needs of locomotive industry within realistic constraints.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To understand types of Traction System.	L2	Understand
CO2	Interpret Various Power supply in Electric Traction.	L2	Understand
CO3	Analyze Various Traction Motors	L4	Analyze
CO4	Analyze methods of Traction motor Control.	L4	Analyze
CO5	Evaluate Train movement and Breaking in Traction system.	L5	Evaluate

Course Contents

Unit-I Electric Traction System 8 Hrs.

Requirements of Ideal Traction Systems. Types of eclectic drives, choice of motors, classification of loads. Electrical transmission system supplying traction motors, Advantages of electric traction over other systems of traction, Ideal choice of traction system. Track electrification: D.C. System, single phase low frequency A.C. system, single phase high frequency A.C. system, 3 phase A.C. system and composite system, Latest Developments with special reference to locomotives.

Unit-II Power Supply for Electric Traction 8 Hrs.

Current collection system, current collectors for Over Head Systems, Overhead construction for Tramways and trolley buses and railways, Traction substations, location of substations, feeding and distributing system, substation equipment's. Block Diagram of AC Electric locomotive, Signaling.

Unit-III Traction Motors 8 Hrs

Characteristics of traction motors, straight D.C. series motor, suitability of series motor for traction duty, constructional details of D.C. Traction Motors, suitability of shunt motor for traction duty, single phase series motors, Three phase Induction motor , Linear Induction motor.

Unit-IV Traction Control 8 Hrs

Traction control: Duty cycle, Methods of traction motor control, series-Parallel and other types of controllers, use of interlocks, run back prevented, multiple unit control, Master controllers, and use of Metadyne..

Unit-V Train Movement and Braking 8 Hrs.

Speed time curve for different services, schedule speed and factors affecting it, train resistance and its components. Tractive effort calculations, average acceleration and speed, energy output and consumption. Mechanical versus electric breaking, Plugging, Rheostatic braking, Regenerative braking method and energy saved in the process, Magnetic track brakes.

Text books

1. C. L. Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", New Age international Publishers, 2015.
2. Gonzalo Abad, "Power Electronics and Electric Drives for Traction Applications", Wiley, 2016.
3. E. Openshaw Taylor, "Utilization of Electric Energy", Orient Longman,2006.

Reference Books

1. J. B. Gupta, "Utilization of Electrical Power and Electic Traction", Kataria & Sons, 2013.
2. H. Partab, "Modern Electric Traction", Dhanpat Rai & Company, 2017.
3. Edward P. Burch, "Electric Traction for Railway Trains", McGraw Hill Book Company, 2007.

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 10 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.

Solar Power Plant Design and Installation (22PEEE5051T)

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

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites:

1. Knowledge of Basics of materials science and engineering.

Course Objectives

1. To Acquire knowledge on solar radiation principles with respect to solar energy estimation.
2. To familiarize the students with design methods of solar thermal and photovoltaic systems.
3. To Identify various energy technologies, codes, certifications and their relationship with solar photovoltaic system.
4. To learn the fundamentals, design and application of solar photovoltaic systems for power generation on small and large scale electrification.
5. To Analyze solar photovoltaic system energy and building resources.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To understand the solar radiation Principles with respect to solar energy estimation.	L2	Understand
CO2	To understand the design methods of solar thermal and photovoltaic systems.	L2	Understand
CO3	To understand various energy technologies, codes, certifications and their relationship with solar photovoltaic system.	L2	Understand
CO4	To analyze the design and application of solar photovoltaic systems for power generation on small and large scale electrification.	L4	Analyze
CO5	To analyze and Compare solar photovoltaic system materials and methods.	L4	Analyze

Course Contents

Unit-I Basics of Solar Cell 8 Hrs.

Photovoltaic effect - Principle of direct solar energy conversion into electricity in a solar cell. Fundamental of semiconductor, Charge Carries and their motion in Semiconductor, Semiconductor properties, energy levels, basic equations. P N Junction Diode.

Unit-II Design of Solar Cells 8 Hrs.

Upper limits of cell parameters, Losses in Solar cell, Solar cell design, Design for High Isc, Design for high Voc. Design for high FF, Analytical Techniques.

Unit-III Solar Cell Technologies 8 Hrs.

Production of Si, Si Water based solar cell technology-Processes used in solar cell technology, High efficiency si solar cells. Thin film solar cell technologies –generic advantages of thin film technologies, Materials for thin film technologies. Microcrystalline si thin film technology.

Unit-IV Photovoltaic System Design 8 Hrs.

Stand Alone PV System Configurations, Design Methodology of PV System, wire sizing in PV System, Hybrid PV System, Grid Connected PV System, and Lifecycle Costing.

Unit-V Solar Photovoltaic Applications 8 Hrs.

Solar Radiation-the sun and earth movement, Angle of Sunrays on solar collector, Sun Tracking, Solar Photovoltaic Modules:-Solar PV Modules from solar cell, Design and structure of PV Modules. PV Module Power Output.

Text Books

1. D. Yogi Goswami, “Principles of Solar Engineering”, CRC Pres, 3rd Edition, 2015.
2. Edward E. Anderson, “Fundamentals for Solar Energy Conversion”, Addison Wesley Publication, 1983.

Reference Books

1. S. P. Sukhatme, J. K. Nayak, "Solar Energy”, Tata McGraw Hill, 4th Edition, 2017.
2. G. N. Tiwari, “Solar Energy Fundamentals, Design, Modeling and Applications, Narosa Publication, 2005.
3. Chetan Singh Solanki,”Solar Photovoltaics Fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd, 3rd Edition, 2015.

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 10 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.

Solar Power Plant Design and Installation Laboratory (22PEEE5051L)

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 Engineering Material

Course Objectives

1. To familiarize the students with design methods of solar thermal and photovoltaic systems.
2. Identify various energy technologies, codes, certifications and their relationship with solar photovoltaic system.
3. To Study the Series parallel connections of solar panels and effect of shading.
4. To provide knowledge about development of Solar Power plant and various operational as well as performance parameters.
5. To recognize current and possible future role of Renewable energy sources.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To understand the solar radiation Principles with respect to solar energy estimation.	L2	Understand
CO2	To analyze design methods of solar thermal and photovoltaic systems.	L4	Analyze.
CO3	To understand Series parallel connections of solar panels.	L2	Understand
CO4	To understand various energy technologies, codes, certifications and their relationship with solar photovoltaic system.	L2	Understand
CO5	To apply the fundamentals, design and application of solar photovoltaic systems for power generation on small and large scale electrification.	L3	Apply

List of the Experiments

Perform 10 experiments from the following list of experiments. (8– Hardware, 1 – Simulation and 1 – Innovative)

1. Study on Solar Cell Characteristics.
2. Simulation study on Solar PV Energy System
3. Experiment On Vi-Characteristics And Efficiency Of 1kwp Solar Pv System
4. Effect of shading on solar pannel performance.
5. Performance study on different types of solar flat plate collector
6. Identifying and measuring the parameters of a solar PV module in the field
7. Study of effect of surrounding temperature and tilt angle on the performance solar PV panel.
8. Study of Solar Street Lighting and Lanterns.
9. Field visit to solar generation system.
10. Workout power flow calculations of stand-alone PV system with combined DC and AC load with battery.

Text Books

1. D. Yogi Goswami, “Principles of Solar Engineering”, CRC Pres, 3rd Edition, 2015.
2. Edward E. Anderson, “Fundamentals for Solar Energy Conversion”, Addison Wesley Publication, 1983.

Reference Books

1. S. P. Sukhatme, J. K. Nayak, "Solar Energy”, Tata McGraw Hill, 4th Edition, 2017.
2. G. N. Tiwari, “Solar Energy Fundamentals, Design, Modeling and Applications, Narosa Publication, 2005.
3. Chetan Singh Solanki,”Solar Photovoltaics Fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd, 3rd Edition, 2015.

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

IoT and Its Applications in Electrical Engineering (22PEEE5052T)

Teaching Scheme
Lectures : 03 Hr/week
Credit : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Basic Electrical and Electronics Engineering,Electrical Measurement.

Course Objectives

1. Provide an overview of concepts, trends and challenges of Internet of Things.
2. Impart the knowledge of sensors and embedded systems.
3. Describe IoT deployment levels and M2M technologies.
4. Facilitate use of hardware and software technologies related to Internet of Things.
5. Provide the knowledge of IoT communication models and protocols.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Gain knowledge of sensors and embedded systems.	L2	Understand
CO2	Understand the different IoT processors and controllers.	L3	Apply
CO3	Understand and apply the basic sensor network concepts to IoT.	L3	Apply
CO4	Understand the IoT communication models and protocols.	L2	Understand
CO5	Design and develop small IoT applications to create smart objects.	L6	Create

Course Contents

Unit-I Transducers, Sensors and Actuators 8 Hrs.

Introduction and classification of Transducers, Sensors and Actuators, Types of Sensors: Motion Detectors, Force Sensors, Temperature and Humidity Sensors, Light Sensor, Level Sensor, Ultrasonic Sensor, Current and voltage Sensor, Types of Actuators, Solenoid, DC Motor, AC Motor and Stepper motor.

Unit-II Introduction to Arduino and Raspberry Pi 8 Hrs.

Arduino : Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board and its types, Arduino platform

Raspberry Pi: Introduction to Raspberry Pi, Comparison of various Rpi Models, Understanding SoC architecture and SoCs used in Raspberry Pi, Pin Description of Raspberry Pi, On-board components of Rpi

Unit-III Introduction to WSN and IoT 8 Hrs.

Introduction to WSN and its Technologies, Architecture and characteristics of WSN, Scalability issues and challenges of a Wireless Sensor Network.

Introduction to Internet of Things, Characteristics and applications of IoT, IoT Reference Model, Security issues in the IoT, Disambiguation of IoT vs IoE vs M2M vs others.

Overview of Cloud and Fog Computing, Definition, Difference between Fog and Cloud.

Unit-IV IoT Communication Technologies and protocols 8 Hrs.

Introduction to communication Technologies like Wi-Fi, Bluetooth, RFID, Z-Wave, Zigbee.

IoT Levels and Deployment Templates, Various operating systems, TinyOS, Contiki OS, Protocol Classification, MQTT, XMPP, DDS, AMQP, COAP, REST, IPv6, 6LoWPAN, Comparison of protocols.

Unit-V IoT Applications 8 Hrs.

IoT applications in home, infrastructures, buildings, security, smart grid, Industries, Home appliances, other IoT electronic equipments, Industry 4.0 concepts.

Text books

1. Srinivasa K. G., Siddesh G. M., Hanumantha Raju R., "Internet of Things", CENGAGE Publication, 1st Edition, 2018.
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Willy Publications, 2013.
3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", Springer, 2011.
4. Parikshit N. Mahalle and Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers, 2015.

Reference Books

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-On Approach", Universities Press, 1st edition, 2014.
2. Raj Kamal, "Internet of Things : Architecture and Design Principles", McGraw Hill Education, 1st edition, 2017.
3. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", Willy Publications, 2nd Edition, 2012.
4. Fang Zhaho, Leonidas Guibas, "Wireless Sensor Network: An Information Processing Approach", Elsevier, 1st Edition, 2014.

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 10 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.

IoT and Its Applications in Electrical Engineering Laboratory (22PEEE5052L)

Teaching Scheme
Practical : 02 Hr/week
Credit : 01

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

Course Objectives

1. To study and install IDE for arduino.
2. To study the basic components IoT sensors.
3. Understand the sensors for IoT application.
4. Use of IoT processors and controllers for various applications.
5. To understand the application of IoT application in Electrical Engineering.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To study the various sensors used in IoT .	L2	Understand
CO2	To understand the use of IoT sensors for electrical applications	L2	Understand
CO3	Understand the various modules and cloud used for IoT applications	L2	Understand
CO4	Design and implementation of various IoT applications using Arduino	L6	Create
CO5	Apply IoT domain for automation of various applications	L3	Apply

List of the Experiments

Perform any 10 experiments from the following list of experiments

1. Study and Install IDE of Arduino and different types of Arduino.
2. Write program using Arduino IDE for Blink LED.
3. LCD interfacing with Arduino.
4. Write program to monitor temperature and humidity using Arduino.
5. Design of digital ac voltmeter and ammeter.
6. Interfacing of the Relay with Arduino.
7. Measurement of power and energy.
8. Traffic signal control.
9. Railway gate control by stepper motors.
10. Direction and Speed control of DC motor.
11. Over/under voltage protection of home appliances.
12. Reading sensor data and sending it to cloud platform for temperature and humidity sensor.

Lab Tools: Arduino IDE, Raspberry Pi OS

Reference Books

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-On Approach", Universities Press, 1st edition, 2014.
2. Raj Kamal, "Internet of Things : Architecture and Design Principles", McGraw Hill Education, 1st edition, 2017.
3. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", Willy Publications, 2nd Edition, 2012.
4. Fang Zhaho, Leonidas Guibas, "Wireless Sensor Network: An Information Processing Approach", Elsevier, 1st Edition, 2014.
5. https://www.arduino.cc/

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

Signals and Systems (22PEEE5053T)

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

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Frist Year. Physics, Engineering Mathematics-III

Course Objectives

1. This course intends to provide basic knowledge of theoretical structure, formal representation, computational methods, notation, and vocabulary of linear models.
2. It is aimed to impart skills to perform signal analysis with reference to spectrum analysis of deterministic signals.
3. Imparting basic knowledge of signals and systems analysis.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Classify signals and systems on the basis of their properties and analyse the implications in the context of practical signals and systems.	L1	Understand
CO2	Perform mathematical operations on signals to construct complex signals using basic elementary signals	L3	Apply
CO3	Describe the mathematical principles of continuous time, discrete-time systems and applications of signal processing techniques.	L2	Understand
CO4	Calculate the response of linear systems in time domain using various tools such as convolution, Laplace transform, Z transform.	L3	Apply
CO5	Compute Fourier series/ transforms for a set of well- defined signals from first principles and apply their appropriate properties for a broader class of signals.	L5	Evaluate

Course Contents

Unit-I Introduction to Signals and Systems 08 Hrs.

Continuous and discrete time representation of elementary signals, operations on signals (shift, invert, scale) Classification of signals: Continuous and discrete time, deterministic and non-deterministic, periodic and aperiodic, symmetric (even) and asymmetric (odd) Introduction to systems: Definition, Classification of systems: Static and dynamic, time variant and time invariant, linear and nonlinear, causal and non-causal, stable and unstable systems, Invertible and Non-Invertible Systems

Unit-II Time Domain Analysis of Continuous and Discrete Time Systems 08 Hrs.

Representation of systems using differential equation, Impulse response and convolution integral, properties of convolution, signal responses to CT-LTI system, system stability Impulse, step and, system stability Response of Discrete Time-LTI System: Representation of systems using difference equation, Impulse response characterization and convolution sum, Properties of convolution summation, Impulse response of DT-LTI system and its properties, step response, system stability.

Unit-III Fourier Domain Analysis of Continuous Time Signal 08 Hrs.

Trigonometric Fourier series, Compact Trigonometric Fourier series, Exponential form, Dirichlet Conditions, Frequency domain representation of periodic signals, Fourier Transform representation of aperiodic signals, Properties of CFT duality, time reversal, Convolution – time and frequency domain, etc.

Unit-IV Fourier Domain Analysis of Discrete Time Signal 08 Hrs.

Sampling theorem, sampling of continuous time signals, Nyquist Criterion, concept of aliasing, Discrete time Fourier Transform, Properties of DTFT: time reversal, Linear Convolution time and frequency domain, conjugate symmetry.

Unit-V Analysis of Discrete Time Signals and System 08 Hrs.

Need of Z-Transform, definition of unilateral and bilateral Z Transform, Z- Transform of finite and infinite duration sequences, properties, Inverse Z-Transform, relation between discrete time Fourier Transform and Z-Transform, Z Transform of standard signals, ROC for ZT, plotting poles and zeros of transfer function, Analysis of discrete time LTI systems using Z-Transform: Transfer Function, causality and stability of systems, relation between Laplace Transform and Z–Transform.

Text Books

1. A.V. Oppenheim, A.S. Willsky, S.H. Nawab, "Signals and Systems", Prentice Hall, 2nd Edition, 1998.

2. B. P. Lathi, "Principles of Linear systems and signals, Oxford University press, 2nd Edition, 2005.

Reference Books

1. M. J. Roberts, "Signals and systems", Tata Macgraw Hill, 3rd Edition, 2011.
2. Simon Haykin, Barry Van Veen, "Signals and systems", Wiley, 2nd Edition, 2007.

Suggested MOOCs

1. Signals and Systems byProf.KushalK.Shah(IISERBhopal)

   `https://archive.nptel.ac.in/courses/108/106/108106163`

2. Principles of Signals Systems by Prof. Aditya K.Jagannatham(IITKanpur)
   `https://archive.nptel.ac.in/courses/108/104/108104100/`

3. . Signals and Systems Laboratory: Virtual Laboratory
   `http://ssl-iitg.vlabs.ac.in/`

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 10 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.

Signals and Systems Laboratory (22PEEE5053L)

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

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

Prerequisites: Basic Electrical Engineering and mathematics

Course Objectives

1. Reinforce understanding of time-domain and frequency-domain analysis through hands-on experiments.
2. Collect, analyze, and interpret experimental data accurately.
3. Gain experience with software tools such as MATLAB, Simulink, or Python for signal analysis and system simulation.
4. Analyze and process both continuous and discrete signals.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze Signal and System Behavior	L4	Analyze
CO2	Design and Conduct Experiments	L3	Apply
CO3	Operate Laboratory Equipment and Software	L3	Apply
CO4	Evaluate Linear Time-Invariant Systems	L5	Evaluate
CO5	Implement and Analyze Digital Signal Processing Techniques	L4	Analyze

List of the Experiments

Perform any 10 experiments from the following list of experiments (9-software-based and 1- Innovative)

1. To generate and plot continuous and discrete-time signals (e.g., unit step, ramp, exponential, sine, cosine)
2. To classify systems based on properties such as static vs. dynamic, time-variant vs. time-invariant, linear vs. nonlinear, causal vs. non-causal, and stable vs. unstable
3. To determine the impulse response and perform convolution integral for continuous-time LTI systems
4. To analyze the step response and stability of discrete-time LTI systems.
5. To compute and plot the trigonometric and exponential Fourier series of periodic signals.
6. To compute and analyze the Fourier transform of aperiodic signals
7. To demonstrate the sampling theorem, Nyquist criterion, and aliasing effects.
8. To perform linear convolution of discrete-time signals in both time and frequency domains.
9. To determine the ROC for Z-transforms and plot poles and zeros of transfer functions.
10. To analyze discrete-time LTI systems using Z-transform, including transfer function, causality, and stability
11. Real-Time Audio Signal Processing and Effects using MATLAB or Python(Innovative)

Reference Books

1. M. J. Roberts, "Signals and systems", Tata Macgraw Hill, 3rd Edition, 2011.
2. Simon Haykin, Barry Van Veen, "Signals and systems", Wiley, 2nd Edition, 2007

Text Books

1. A.V. Oppenheim, A.S. Willsky, S.H. Nawab, "Signals and Systems", Prentice Hall, 2nd Edition, 1998.
2. B. P. Lathi, "Principles of Linear systems and signals, Oxford University press, 2nd Edition, 2005

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

E-CAD Labaratory (22PCEE5060L)

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

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

Course Objectives

1. To Understand the fundamentals of technical drawing.
2. To Learn to design basic electrical symbols and diagrams.
3. To acquire skills to effectively represent various electrical machines
4. Learn to draw and analyze complex systems such as three-point and four-point DC starters, transmission towers, and other related infrastructure.
5. Apply theoretical knowledge to practical applications.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To be proficient in using technical drawing tools and software to create accurate and detailed diagrams.	L3	Apply
CO2	To design and interpret electrical diagrams, including house wiring and machine layouts, enhancing their capability to work on residential, commercial, and industrial projects.	L4	Analyze
CO3	To gain the necessary skills to represent and understand the mechanical and electrical details of machinery through diagrams	L3	Apply
CO4	To develop the expertise to design and analyze high-level electrical systems	L4	Analyze
CO5	To apply their knowledge of electrical concepts and technical drawing in real-world scenarios	L5	Evaluation

List of the Experiments

Perform 10 experiments from the following list of experiments. (6– Program, 3 – Simulation, 1- study and 1 – Innovative)

1. To study Introduction to AutoCAD.
2. To draw the Basic shapes like lines, arcs, curves, shape filling.
3. To draw the Basic Electrical symbols.
4. To draw house wiring diagram and layout.
5. To draw the Electrical machine winding diagram.
6. To draw the Transmission tower.
7. To draw the Construction features of a DC motor.
8. To draw the basic Construction of Transformer.
9. To draw 3-point and 4-point DC starters.
10. To draw lamps used in illumination.
11. To draw the Single-line diagram of a power system.
12. To draw Simple power and control circuit diagrams.

Lab Tools

1. AUTOCAD

Text Books

1. Frederick E. Giesecke, "Technical Drawing with Engineering Graphics" Prentice Hall, USA, 15th Edition, 2018
2. S. K. Bhattacharya and Debashis De., "Electrical Engineering Drawing, New Age International Private Limited, 3rd Edition, 2016.

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

Environmental Engineering (22MCEE5070T)

Teaching Scheme
Lecture : 01 Hr/week

Examination Scheme
Audit Course

Course Objectives

1. Understand environmental issues such as depleting resources, pollution, ecological problems and the renewable energy scenario.
2. Familiarise environment related legislation.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand how human activities affect environment.	L1	Remember
CO2	Understand the various technology options that can make a difference	L1	Remember

Course Contents

Unit-I Social Issues and Environment 04 Hrs.

Ecological footprint and Carrying Capacity, Depleting nature of Environmental resources such as soil, water minerals and forests ,Carbon emissions and Global Warming.

Unit-II Directive Principles of State Policy 04 Hrs.

Technological growth for Sustainable Development: Social, Economic and Environmental aspects of Sustainable Development, Renewable Energy Harvesting ,Concept of Carbon credit, Green Building ,Power and functions of Central Pollution Control Board and State Pollution Control Board.

Unit-III Environmental impact due to technology 05 Hrs.

Environmental impact due to technology: Impact of Energy on Environment, Flow of Energy in Ecological system, Environment Degradation due to Energy, Control of pollution from Energy, Consumerelectronics, power saving devices, energy from waste, energy use and conservation.

Text books

1. R. Rajagopalan, "Environmental Studies From Crisis to Cure",Generic; 3rd edition, 2015.
2. Erach Bharucha, "Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education",Orient Blackswan Pvt Ltd, 3rd Edition, 2019 .
3. I.V Murali Krishna, Valli Manickam, Anil Shah, Naresh Davergave, "Environmental Management Science and Engineering for Industry", Butterworth-Heinemann, 2017.

Evaluation Scheme

1. Student should submit a report on the case study declared by teacher.
2. Audit point shall be awarded subject to submission of report of the case study declared by teacher.

Semester Project- III (22PJEE5080L)

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

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

Course Objectives:

Students are expected to design, simulate/implement a project based on the knowledge acquired from subject areas like Electrical Machines, Power System Analysis, Electromagnetic Engineering, Electric Traction and Utilization, Solar Power Plant Engineering, Internet of Things and Digital Signal Processing.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate various/alternate approaches to complete a project.	L2	Understand
CO2	Demonstrate the ability to work in teams and manage the conduct of the research study.	L2	Understand
CO3	Ensure a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Present their project work in the form of a technical report / paper and thereby improve the technical communication skill.	L3	Apply
CO5	Conduct a survey of several available literatures in the preferred field of study.	L4	Analyze

Semester Project:

The purpose of introducing semester project at Third Year level is to provide exposure to students with a variety of projects based on the knowledge acquired from the semester subjects. This activity is supposed to enrich their academic experience and bring enough maturity in student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation and discussion of technical ideas/topics. Therefore, proper attention shall be paid to the content of semester project report which is being submitted in partial fulfillment of the requirements of the Third Year and it is imperative that a standard format be prescribed for the report.

Each student shall work on project approved by departmental committee approved by the Head of Department, a group of 03 to 05 students (max allowed: 5 students in extraordinary cases, subject to the approval of the department committee and the Head of the department) shall be allotted for each Semester Project. Each group shall submit at least 3 topics for the Semester Project. The departmental committee shall finalize one topic for every group. Semester Project Title or Theme should be based on knowledge acquired during current semester. The project work shall involve sufficient work so that students get acquainted with different aspects of knowledge acquired from semester subjects.

Student is expected to:

- Select appropriate project title based on acquired knowledge from current semester subjects.
- Maintain Log Book of weekly work done(please see attached log book format).
- Report weekly to the project guide along with log book.

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).
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).

Prescribed project report guidelines:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation details
- Project Outcomes
- Conclusion

- References

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

Guide will monitor weekly progress and marks allocation will be as per Table A.

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

Departmental committee (including project guide) will evaluate project as per Table B.

Each group shall present/publish a paper based on the semester project in reputed/peer reviewed Conference/Journal/TechFest/Magazine/ before the end of the semester.

Table 1: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Table 2: Table A

Sr	Exam Seat No	Name of Student	Student Attendance	Log Book Maintain	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table 3: Table B

Sr	Exam Seat No	Name of Student	Project Selection	Design/ Simulation/ Logic	PCB/ hardware/ programming	Result Verification	Presentation	Total
			5	5	5	5	5	25

Employability Skill Development Program-II (22HMEE5090L)

Teaching Scheme
Practical : 02 Hr/week
Credit : 01

Examination Scheme
Teacher Assessment : 50 Marks
Total Marks : 50 Marks

Prerequisites: Basic Mathematics, Basic knowledge of C programming

Course Objectives

1. To enhance the problem solving skills with real life examples.
2. To enable the students to express their thoughts and knowledge on various platforms.
3. Able to describe the basic database management system.
4. Able to implement basic programming project using python.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze and solve the logical problem based on words, venn diagram etc.	L4	Analyze
CO2	Understand and solve the English comprehension, Sentence completion, Sentence Correction problems.	L2, L4	Understand, Apply
CO3	Understand and illustrate the concept of Exception Handling, Garbage collection.	L2, L3	Understand, Apply
CO4	Understand and describe the fundamental of DBMS, NoSql, MongoDB	L2	Understand

Course Contents

Unit-I — 10 Hrs.

Reasoning : Data sufficiency, Logical Deductions, Logical Sequence of Words, Logical Venn Diagrams, Statement and Arguments, Statement and Assumptions, Statement and Conclusions Syllogism.

English: Reading Comprehension, Para Jumbles, Cloze Test, Tenses/ Voice/ Speech, Prepositions/ SVA/ Articles, Vocab /Verbal Analogy, Sentence completion, Sentence Correction.

Unit-II — 10 Hrs.

Modules Introduction, Importance of Modularity programming, Import keyword, User defined modules creation, Function based modules, Classes based modules, Connecting modules, 'from' keyword.

Files Handling Reading file char by character, Reading file line by line, Modes of files, Writing into file, Append data to a file, Reading CSV file, Pickling and Un pickling

Garbage collection Introduction, Importance of manual GC, Self-referenced objects, 'gc' module, Collect() method, Threshold function

Unit-III — 8 Hrs.

Collections Framework Introduction to collection of data types, Importance of Data processing, DS algorithms introduction.

List Create a list, Adding elements, Deleting elements, Pre-defined functionality of List, Nested List, Immutability and Mutability of List.

Set The functionality of Set object, Frozen set, Dictionaries, Create a dictionary, Adding elements

Dict Pre-defined functions of Dict class, Programs using Collection types .

Unit IV — 8 Hrs.

Tkinter – GUI Types of Layouts , Create Labels and Display images, Create Buttons, Create Events, StringVar class, Calculator program using GUI.

Basic ML AI including Projects Iterators, Nested functions, Generators, Closures, Decorators, Basic ML and AI, PIP, Visualization etc.

Project Domain(Per domain 1 or 2 project)

- ML/AI Based Projects
- Data Analysis Based projects
- Test Summarization based projects
- Web scrapping and crawling

Unit V 10 Hrs.

DBMS Using Python Introduction to Mysql, Mysql – Python connectivity, DDL, DRL, DML, Transaction management examples (rollback and commit), GUI - Database connectivity.

NoSql Using Python Installation and Configuration, MongoDB Tools, Collection and Documents, CRUD and the MongoDB Shell, Introduction to CRUD, Introduction to the MongoDBAPI, Creating a Database, Collection and Documents.

Data Modelling and Schema Design MongoDB Database References Model Tree Structures, MongoDB Analysing Queries, Atomic Operations, Map Reduce, Text Search, Regular Expression, Capped Collections.

Administration MongoDB Deployment and Cluster setup, MongoDB GridFS, Trident Spout, Working with Replica Sets, MongoDB Sharding.

Reference books

1. Dr. R S Aggarwal, "Quantitative Aptitude for Competitive Examinations", S Chand Publication.
2. M. G. Venkateshmurthy, "Programming Techniques through C", Pearson Publication, 1st edition, 2002.
3. Behrouz Forouzan, "A Computer Science Structure Programming Approaches using C", Cengage Learning, 3rd edition, 2007.

Evaluation Scheme

Continuous Assessment (TA):

Teacher's Assessment (TA) will carry weightage of 50 marks. The components of TA are

The distribution of marks for term work shall be as follows:

- MCQ Test based on Aptitude: 20 Marks
- MCQ Test based on Programming skills: 30 Marks
- Total Marks 50 Marks

Any other component recommended by BOS and approved by Dean Academics.

Control System (22PCEE6010T)

Teaching Scheme
Lectures : 03 Hr/week
Credit : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Electrical Measurement, Signal and System

Course Objectives

1. Students will able to know different basic concepts and components of a control system..
2. Students will able to model physical systems mathematically.
3. Students will able to derive transfer functions of basic control system components.
4. Students will able to perform stability analysis using time domain and frequency domain response on a given system.
5. To learn the various approach for the state space analysis.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the basic concepts of control system and derive the mathematical model of different type of the systems.	L2	Understand
CO2	Solve transfer function for a given control system using block diagram reduction techniques and signal flow graph method.	L3	Apply
CO3	Determine time response of systems for a given input and perform analysis of first and second order systems using time domain specifications.	L4	Analyze
CO4	Analyze the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique.	L4	Analyze
CO5	Analyse the stability of a system in the frequency domain using Nyquist and bode plots.	L4	Analyse
CO6	Solve various transfer functions of digital control system using state variable models.	L3, L4	Apply, Analyze

Course Contents

Unit-I Mathematical Modeling of Control Systems 8 Hrs.

Introduction: Concept of open and closed loop control system, Transfer Function: a) Concept of system: physical system, Physical model, Linear and nonlinear systems, Time variant and invariant system. b) Equations of physical systems (Mass-Spring-Dashpot system, R-L-C series and parallel circuit) transfer function, transfer function of DC servo motor – AC servo motor – synchro, transmitter and receiver.

Unit-II Block diagrams and Signal Flow Graphs 8 Hrs.

a) Block diagram, Block Diagram reduction, and Numerical examples. b) Signal flow graph; Masons gain formula for deriving overall transfer function of systems. Feedback characteristics of control system: Concept of negative and positive feedback, Sensitivity of the system to parameter variation, using negative and positive feedback.

Unit-III Time Domain Analysis and Stability of System 8 Hrs.

Time domain analysis: Typical test signals, Time domain specifications, Steady state response, Types of system, Steady state error constants and steady state error, Numerical examples, transient response, Numericals, Concept of stability.

Stability : Definition of stability, Routh - Hurwitz criterion. Definition of Root Locus, Construction of root locus, and Stability from root locus plots, Root counters, Effect of addition of poles and zeros on root locus plots.

Unit-IV Frequency domain analysis 8 Hrs.

Introduction to frequency response, Advantages of frequency domain analysis, Bode plots, Nyquist criterion, Relative stability from Nyquist criterion, Numericals. .

Unit-V State Space Analysis of LTI Systems 8 Hrs.

Concepts of state, state variables and state model, state space representation of transfer function, diagonalization, solving the time invariant state equations, State Transition Matrix and it's Properties, concepts of controllability and observability.

Text books

1. K. A. Tsuhiko Ogata, "Modern Control System Engineering", Prentice Hall, 5th Edition, 2010.
2. I. J. Nagrath, M. Gopal, "Control System Engineering", New Age International Publishers, 6th Edition, 2017.
3. R. Anandanatrajan and P. Ramesh Babu, "Control Systems Engineering", Scitech Publication,3rd Edition, 2011

4. R. V. Jalgaonkar, Sisir Mazumder, "Feedback Control System", Everest Publishing House, Kolkata, 12th Edition, 2004.

Reference Books

1. B. C. Kuo, “Automatic Control System”, Wiley India, 8th Edition, 2003.
2. Richard C. Dorf and Robert H. Bishop, “Modern Control System", Pearson Education, 12th Edition, 2011.
3. D. Roy Choudhary, "Modern Control Engineering", PHI Learning Pvt. Ltd., 2005
4. B. Wayne Bequette, “Process Control: Modeling, Design and Simulation”, PHI, 2003.

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 10 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.

Tutorial

Minimum eight tutorials shall be conducted.

Control System Laboratory (22PCEE6010L)

Teaching Scheme
Practical : 02 Hr/week
Credit : 01

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

Prerequisites: Electrical Measurement, Signal and System, MATLAB fundamentals.

Course Objectives

1. Students will able to understand the performance of basic electrical control system components.
2. Students will able to explain the basic mathematical modeling of control system.
3. Students will able to understand and be able to use the MATLAB tool for control system.
4. Students will able to demonstrate the time domain and frequency domain analysis for linear time invariant systems.
5. Students will able to construct Simulink model for given system.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To study the basic electrical components of control system.	L2	Understand
CO2	To understand and apply the basic mathematical modelling concept of control system.	L2, L3	Understand, Apply
CO3	Demonstrate the response of first order and second order systems with various standard test signals.	L3	Apply
CO4	To Analyze the transfer function and examine the stability of the control system using various methods	L4	Analyze
CO5	Outline the effect of various types of inputs applied to a system for open loop and closed loop system	L3	Apply
CO6	Demonstrate and Analyse the system analysis using MATLAB and SIMULINK tools	L3, L4	Apply, Analyze

List of the Experiments

Perform any 10 experiments from the following list of experiments **(4 - Hardware, 5 - Simulation and 1 - Innovative))**

1. To determine Speed-Torque characteristics of an ac servomotor.
2. To determine an error using Potentiometer.
3. Experimental analysis of D.C. Motor Position control System.
4. Obtain output vs input characteristics for synchro-transmitter and receiver.
5. Experimental analysis of Stepper Motor.
6. To determine time domain response of a second order systems for step input and obtain performance parameters by using Matlab
7. To plot root locus diagram of an open loop transfer function and determine range of gain 'k' for stability by using Matlab.
8. To plot a Bode diagram of an open loop transfer function by using Matlab.
9. To draw a Nyquist plot of an open loop transfer function and examine the stability of the closed loop system by using Matlab.
10. Construct a Simulink diagram to calculate the response of the Mass-Spring system.
11. Study the effect of addition of zeros to the forward path transfer function of a closed loop system.
12. Simulink based control system mini project.**(Innovation)**

Lab Tools: MATLAB

Reference Books

1. B. C. Kuo, "Automatic Control System", Wiley India, 8th Edition, 2003.
2. Richard C Dorf and Robert H Bishop, "Modern control system", Pearson Education, 12th edition, 2011.
3. D. Roy Choudhary, "Modern Control Engineering", PHI Learning Pvt. Ltd., 2005
4. B. Wayne Bequette, "Process Control: Modeling, Design and Simulation", PHI, 2003.
5. www.mathworks.com

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 Electronics (22PCEE6020T)

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

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites:

1. Basic Electrical and Electronics Engineering, Circuit theory

Course Objectives

1. To facilitate students' comprehensive analysis and understanding of the foundational principles and operational characteristics inherent in power electronic devices, including thyristors, BJTs, MOSFETs, GTOs, IGBTs, and MCTs. This objective aims to equip students with the knowledge necessary to design and implement efficient power electronic circuits.
2. Through the design, simulation, and evaluation of phase-controlled rectifiers, chopper circuits, voltage source inverters, and AC voltage controllers, this objective aims to foster students' proficiency in addressing practical challenges encountered in power electronics applications.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the interdisciplinary nature and various applications of Power Electronics, and critically evaluate its significance in modern engineering systems.	L2	Apply
CO2	Analyze and interpret the operating principles, characteristics, and triggering methods of power electronic devices such as thyristors, BJTs, MOSFETs, GTOs, IGBTs, and MCTs.	L3	Analyze
CO3	Evaluate and synthesize phase-controlled rectifiers, including half-wave and full-wave configurations, and devise solutions for different loads and triggering schemes.	L4	Evaluate
CO4	Critically assess the operation of chopper circuits, including duty ratio control and frequency control strategies, and predict their steady-state performance.	L4	Analyze and Evaluate
CO5	Synthesize the operation of voltage source inverters and AC voltage controllers, including various topologies such as half bridge, full bridge, and pulse width modulated inverters. Develop strategies for harmonic reduction	L4	Analyze and Evaluate

Course Contents

Unit-I Introduction 08 Hrs.

Power Electronics Scope and Applications, Interdisciplinary Nature of Power Electronics, Types of power electronics circuits, Thyristor Characteristics, Two transistor analogy, Gate Characteristics, Methods of triggering and commutation, Ratings and protection of devices, Introduction to power electronic devices like Power BJT, MOSFET, GTO, IGBT, MCT etc.

Unit-II Phase Controlled Rectifiers 08 Hrs.

Principle of phase control, half wave controlled rectifiers, half wave controlled rectifiers with R, R-L, R-L-E load, single phase full wave controlled converters, 2-pulse mid-point converters, 2-pulse half and fully controlled bridge converters with R, R-L, R-L-E load, Three phase converter system with diodes, 3 phase half and fully controlled bridge converters, triggering scheme, Effect of source impedance on the performance or the converters, Dual converters.

Unit-III Choppers 08 Hrs.

Basic principle of chopper operation, Control strategies – Duty Ration Control and Frequency Control, Types of idealized chopper circuits, Steady state time domain analysis of Type A choppers, Step up chopper.

Unit-IV Inverters 08 Hrs.

Forced commutated inverters, Single phase voltage source inverters, Half bridge inverters, full bridge inverters, Steady state analysis, Voltage control in single phase inverters, 3-phase bridge inverters, Pulse width modulated inverters, Reduction of harmonics in Inverter.

Unit-V AC Voltage Controllers 8 Hrs.

Principle of AC Voltage Controllers – Integral Cycle Control and Phase Control, Types of AC voltage controllers, Analysis of 1-phase Integral Cycle Control AC controllers with R load, Analysis of 1-phase Phase Control AC controllers with R and R-L load.

Text Books

1. Bimbhra, P. S., "Power Electronics", Khanna Publishers, New Delhi, 2001.
2. Singh, M. D., Khanchandani, K. B., "Power Electronics", Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2001.

Reference Books

1. Rasid, M. H., "Power Electronics Circuits, Devices, and Applications", Prentice-Hall of India Pvt. Ltd., New Delhi, 2nd edition, 1999.
2. Mohan, Ned, Undeland, Tore M., Robbins, William P., "Power Electronics Converters, Applications, and Design", John Wiley & Sons, Inc., 2nd Edition, 1995. item Agrawal, J. P., "Power Electronic Systems: Theory and Design", Addison Wesley Longman (Singapore) Pte. Ltd., New Delhi, 2001.

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 10 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 Electronics Laboratory (22PCEE6020L)

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

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

Course Objectives

1. Understand semiconductor devices and circuits including SCRs and their characteristics
2. Explore power electronic converter circuits including semi and fully controlled converters
3. Learn inverter configurations and their applications
4. Develop simulation and analysis skills for power electronic circuits
5. Explore innovative applications of power electronic circuits

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Develop a comprehensive comprehension of semiconductor devices and their utilization within power electronic circuits.	L2	Understand
CO2	Analyze and formulate designs for semi and fully controlled converters suitable for various load conditions.	L3	Analyze
CO3	Demonstrate understanding of the operational principles governing series and parallel inverters and their practical usage.	L2	Understand
CO4	Exhibit proficiency in employing simulation software to model and scrutinize power electronic circuits effectively.	L3	Apply
CO5	Innovate and explore novel applications of power electronic circuits, such as AC voltage regulators and EV converters.	L6	Create

List of the Experiments

Perform 10 experiments from the following list of experiments. (4– Hardware, 5 – Simulation, 1- study and 1 – Innovative)

1. Study of V-I characteristic of SCR
2. Study of SCR gate triggering circuits
3. Study of turn off methods of SCR
4. Analysis of semi converter (with R, R-L load)
5. Analysis of fully controlled converter (with R, R-L load and freewheeling diode)
6. Study of step up chopper.
7. Study of step down chopper.
8. Study of series inverter.
9. Study of parallel inverter.
10. Simulation of single phase half wave controlled rectifier.
11. Simulation of single phase full wave controlled rectifier.
12. Simulation of single step up chopper.
13. Simulation of single step down chopper.
14. Simulation of single phase half bridge and full bridge inverter.
15. Simulation of three phase inverter (120° and 180° mode)
16. Simulation of AC voltage regulator
17. Simulation of EV converter (Innovative)
18. Simulation of SCR based DC circuit breaker (Innovative)
19. Simulation and multi level converter. (Innovative)

Lab Tools: MATLAB/Simulink, PSIM

Reference Books

1. Rasid, M. H., "Power Electronics Circuits, Devices, and Applications", Prentice-Hall of India Pvt. Ltd., New Delhi, 2nd edition, 1999.

2. Mohan, Ned, Undeland, Tore M., Robbins, William P., "Power Electronics Converters, Applications, and Design", John Wiley & Sons, Inc., 2nd Edition, 1995.

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 Machine Design (22PCEE6030T)

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

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites:

1. Knowledge of Electrical Machine-I, Electrical Machine-II.
2. Knowledge of fundamentals of electrical engineering.
3. Knowledge of various materials used in electrical machines.

Course Objectives

1. To present the properties of Electrical Engineering material.
2. Design of transformer based on specifications.
3. Determine performance based on the parameters of transformer.
4. Determine performance based on the parameters of Induction motor.
5. Apply computer aided design techniques to transformer and induction motor design.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To apply knowledge of mathematics, science, and engineering for design of electrical machines.	L3	Apply
CO2	To understand the electrical engineering material characteristic for designing an energy efficient electrical machine.	L2	Understand
CO3	To analyze the temperature rise in electrical machines and impact on rating and duty of machines.	L4	Analyze
CO4	To analyze and design an electrical machines and components to meet desired needs within realistic constraints such as economic, environmental, social, safety, manufacturability, and sustainability.	L4	Analyze
CO5	To apply Discharge duties in the field of design and manufacturing industries and able to do higher studies in optimal design and use latest software and engineering tools.	L3	Apply

Course Contents

Unit-I Fundamental Aspects of Electrical Machine Design 8 Hrs.

Design of machines: Design factors - Limitations in design - modern trends in Design of Electrical machines, Materials used in Transformers and Rotating Machines. Thermal Design aspects of Electrical machines. Design of Starters-Shunt Motors, Series Motor, Slip ring induction motor.

Unit-II Design of Transformer 8 Hrs.

Design of distribution and power Transformer,-types, Classifications, specifications, core construction, transformer winding, design of Transformer, output equation of single phase and three phase transformer , design of core, winding, overall dimension ,design of insulation, estimation of leakage reactance for H.V. and L.V. winding.

Unit-III Design Performances of Transformer 8 Hrs.

No Load Current of –single phase, Three phase, Magnetizing Volt-ampere, change of Parameters with change of frequency, Temperature rise of transformers , design of tank with tubes, transformer oil as a cooling medium, temperature rise in plain walled tanks, ,air blast cooling, forced oil circulation , thermal rating , heating time constant of transformers.

Unit-IV Design of Induction motors 8 Hrs.

Rating and dimensions of rotating Machines: symbols, factor affecting size of rotating machines, choice of specific magnetic loading , choice of specific electric loading , variation of output & losses with Linear dimensions , separation of D and L- d.c. Machines, Induction Motors, Synchronous Machines, standard Frames.

Design of three phase Induction Motors: design output equation, choice of average flux density in air gap, choice of ampere conductors per meter, efficiency and power factor, main dimensions.

Unit-V Design of Windings for AC and DC Machines 8 Hrs.

D.C. Machine Windings: - Types of D.C. Windings, choice and design of simplex and duplex lap and wave Windings, equalizer connections, dummy coils, concept of multiplex Windings, reason for choosing them. A.C. Machine Windings- single and double layer, single phase ac Windings with integral and fraction slots, three phase Windings.

Text Books

1. G. Upadhyay, “Design of Electrical Machines”, New Age International Publication, 2011.
2. Deshpande. M. V., “A Course in Electrical Machine Design", Prentice Hall of India, 2011.
3. S. K. Sen “Principles Of Electrical Machine Design With Computer Programs", Oxford & IBH Publishing Company Pvt. Limited, 2nd Edition, 2006.

Reference Books

1. A. K. Sawhney, “Electric Machine Design", Danpat Rai and Sons, 10th Edition, 2016.
2. A. E. Clayton, “Performance and Design of DC Machine", ELBS, ISAAC Pitman Sons, 3rd Edition, 2004.
3. S. V. Kulkarni, S. A. Khaparde , “Transformer Engineering: Design and Practice", Marcel Dekker Inc., 2004.

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 10 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 Machine Design Laboratory (22PCEE6030L)

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

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

Prerequisites: Basic knowledge of Electrical Machine-I and II.

Course Objectives

1. To understand the basic symbols used in electrical machine design..
2. To study about wiring diagram of residential buildings.
3. To design the starters for DC Motors.
4. To design AC machines winding.
5. To design a transformer based on various specification.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To understand the basics of electrical machine design.	L2	Understand
CO2	To design and calculate the main dimensions of single phase and three phase transformer.	L3	Apply
CO3	To analyze and design the main dimensions of three phase Induction motor.	L4	Analyze
CO4	To apply computer aided optimization techniques for design of electrical machines.	L3	Apply
CO5	To design and analyze electrical machines using finite element based software.	L3	Apply

List of the Experiments

Perform 8 experiments from the following list of experiments. (8– Hardware, 2 – Simulation and 1 – Innovative

1. To study General electrical symbol
2. To study Design of Dc shunt motor starter
3. Details and assembly of transformer design
4. To study Design of simplex lap winding
5. To study Design of wave winding
6. To study Design of ac lap winding
7. To study Design of ac wave winding
8. To study design of Mush winding
9. Report based on induction motor manufacturing/repairing unit
10. Assembly of three phase induction motor.

Text Books

1. G. Upadhyay, “Design of Electrical Machines”, New Age International Publication, 2011.
2. Deshpande. M. V., “A Course in Electrical Machine Design", Prentice Hall of India, 2011.
3. S. K. Sen “Principles Of Electrical Machine Design With Computer Programs", Oxford & IBH Publishing Company Pvt. Limited, 2nd Edition, 2006.

Reference Books

1. A. K. Sawhney, “Electric Machine Design", Danpat Rai and Sons, 10th Edition, 2016.
2. A. E. Clayton, “Performance and Design of DC Machine", ELBS, ISAAC Pitman Sons, 3rd Edition, 2004.
3. S. V. Kulkarni, S. A. Khaparde , “Transformer Engineering: Design and Practice", Marcel Dekker Inc., 2004.

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 (22PCEE6040T)

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

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

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

Course Objectives

1. To understand real power control and operation.
2. To know the importance of frequency control.
3. To analyze different methods to control reactive power.
4. To understand unit commitment problem and importance of economic load dispatch.
5. To understand real time control of power systems.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	To understand real power control and operation.	L2	Understand
CO2	To Know importance of frequency and real power control.	L2	Understand
CO3	To analyze the reactive power control methods and importance of reactive power.	L4	Analyze
CO4	To Compare unit commitment and economic dispatch and their importance.	L2	Understand
CO5	To understand real time control of power systems.	L2	Understand

Course Contents

Unit-I Load Frequency Control 08 Hrs.

Basics of speed governing mechanism and modeling – speed - load characteristics – load sharing between two synchronous machines in parallel. Control area concept. Load Frequency Control of a single area system. Static and dynamic analysis of uncontrolled and controlled cases. Integration of economic dispatch control with LFC. Two - area system – modeling - static analysis of uncontrolled case - tie line with frequency bias control of two-area system - state variable model.

Unit-II Reactive Power Voltage Control 08 Hrs.

Basics of reactive power control, Excitation systems – modelling. Static and dynamic analysis: stability compensation generation and absorption of reactive power. Methods of voltage control – tap changing transformer. System level control using generator voltage magnitude setting. Tap setting of OLTC transformer. MVAR injection of switched capacitors to maintain acceptable voltage profile and to minimize transmission loss.

Unit-III Economic Operation Of Power Systems 08 Hrs.

Statement of economic dispatch problem – cost of generation-Incremental cost curve - co-ordination equations without loss and with loss, solution by direct method and -iteration method. Economic Aspects of Power Generation: Load curve, load duration and integrated load duration curves – load demand, diversity, capacity, utilization and plant use factors - Numerical Problems.

Unit-IV Unit Commitment 08 Hrs.

Statement of Unit Commitment problem – constraints, spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints. Solution methods – Priority list methods - forward dynamic programming approach. Numerical problems on priority-list method using full- load average production cost and Forward DP method.

Unit-V Computer Control Of Power Systems 08 Hrs.

Need for computer control of power systems. Concept of energy control centre (or) load dispatch centre and the functions – SCADA and EMS functions.

Text Books

1. D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
2. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Ltd, New Delhi, 30th reprint,2007.

Text Books

1. D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
2. Singh Tarlok, "Installation, Commissioning and Maintenance of Electrical Equipment", S. K. Kataria and Sons, 2013.

Reference Books

1. Chakrabarti Haldar, "Power System Analysis: Operation and Control", Prentice Hall of India, 2004 Edition.
2. C.L.Wadhwa, 'Power System Analysis', New Age International- 6th Edition, 2010,
3. Robert Miller, James Malinowski, 'Power System Operation', Tata McGraw Hill Publishing Company Ltd, New Delhi, 3E, JUN-09.
4. P. Kundur, Neal J. Balu, 'Power System Stability Control', IEEE, 1998
5. Power System Analysis by Hadi Saadat – TMH Edition.

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 10 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 (22PCEE6040L)

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

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

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.

COs	Course Outcomes	Blooms Level	Blooms Description
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 10 experiments from the following list of experiments. (6– Program, 3 – Simulation, 1- study and 1 – 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)

Lab Tools

MATLAB

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

Digital Signal Processing (22PEEE6051T)

Teaching Scheme
Lectures : 03 Hr/week
Credit : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Signals and System, Engineering Mathematics.

Course Objectives

1. To develop a thorough understanding of DFT and FFT and their applications.
2. To teach the design techniques and performance analysis of digital filters.
3. To design the IIR and FIR filters.
4. To understand the use of digital signal processing in electrical engineering.
5. To introduce the students to digital signal processors and its applications.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply the efficient computing algorithms of DFT and FFT in finding the response of the system.	L2	Understand
CO2	Design different types of IIR and FIR filters.	L6	Create
CO3	Evaluate the effects of Poles and Zeros in design of digital filters	L5	Evaluate
CO4	Understand the architecture of DSP Processors.	L2	Understand
CO5	Explain the applications of Digital Signal Processing in Electrical Engineering.	L2	Understand

Course Contents

Unit-I Discrete Fourier Transform and Fast Fourier Transform 8 Hrs.

Definition and Properties of DFT, IDFT, Circular convolution of sequences using DFT and IDFT. Filtering of long data sequences: Overlap-Save and Overlap-Add Method for computation of DFT. Fast Fourier Transforms (FFT), Radix-2 decimation in time and decimation in frequency FFT algorithms, inverse FFT.

Unit-II IIR Digital Filters 8 Hrs.

Types of IIR Filters (Low Pass, High Pass, Band Pass, Band Stop), Analog filter approximations: Butterworth, Chebyshev I. Mapping of S-plane to Z-plane, impulse invariance method, bilinear transformation method, Design of IIR digital filters (Butterworth and Chebyshev-I) from Analog filters with numerical examples. Effect of Poles and Zeros on the Frequency Response of IIR filters. Position of Poles and Zeros of Low Pass, High Pass, Band Pass, Band Stop, All Pass filters.

Unit-III FIR Digital Filters 8 Hrs

Characteristics of FIR digital filters, Minimum Phase, Maximum Phase, Mixed Phase and Linear Phase (Type 1 to Type 4) FIR Filters. Design of FIR filters using Window techniques (Rectangular, Hamming, Hanning, Blackman, Kaiser), Design of FIR filters using Frequency Sampling technique, Comparison of IIR and FIR filters.

Unit-IV Poles, Zeros and Filters 8 Hrs

Effects of poles and zeros in the frequency response of IIR filters (LP, HP, BP, BR/Notch, All Pass filters). Placement of zeros and design of filters in Type1 to Type 4 Linear Phase FIR filters. Finite Word Length effects in Digital Filters Quantization, truncation and rounding, Error due to truncation and rounding.

Unit-V Processor and Application in Electrical Domain 8 Hrs.

Introduction to General Purpose and Special Purpose DSP processors, fixed point and floating-point DSP processor, Computer architecture for signal processing, Harvard Architecture, Pipelining, multiplier and accumulator (MAC). Applications of Digital Signal Processing in Electrical Engineering domain.

Text books

1. Emmanuel C. Ifeachor, Barrie W. Jervis, "Digital Signal Processing A Practical Approach", Pearson Education, 2nd Edition, 2002.

2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", McGraw Hill Education Private Limited, 4th Edition, 2013.

3. Tarun Kumar Rawat, "Digital Signal Processing", Oxford University Press, 2015.

4. Paulo Fernando Ribeiro, Carlos Augusto Duque, Paulo Márcio Ribeiro, Augusto Santiago Cerqueira, "Power Systems Signal Processing for Smart Grids", Wiley, 1st Edition, 2013

Reference Books

1. Proakis J., Manolakis D., "Digital Signal Processing", Pearson Education, 4th Edition, 2007.
2. Oppenheim A., Schafer R., Buck J., "Discrete Time Signal Processing", Pearson Education, 3rd Edition, 2014.
3. B. Venkata Ramani and M. Bhaskar, "Digital Signal Processors, Architecture, Programming and Applications", Tata McGraw Hill, 2nd Edition, 2004.
4. A. Anand Kumar, "Digital Signal Processing", PHI Learning Pvt. Ltd., 2nd Edition, 2015.
5. Ramesh P. Babu, "Digital Signal Processing", SCITECH Publication, 4th Edition, 2015.

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 10 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.

Digital Signal Processing Laboratory (22PEEE6051L)

Teaching Scheme
Practical : 02 Hr/week
Credit : 01

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

Prerequisites: Signals and System, Engineering Mathematics, MATLAB fundamentals.

Course Objectives

1. To plot various signals using MATLAB.
2. Interpret discrete-time signals using DFT.
3. To implement FIR and IIR filters in MATLAB.
4. Apply FFT algorithms for various signal processing operations.
5. To learn design of digital FIR and IIR filters with real-time applications in signal conditioning.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Familiarization with the MATLAB to perform digital filter design and filtering.	L2	Understand
CO2	Examine the frequency response and impulse response of discrete-time LTI systems	L4	Analyze
CO3	Interpret discrete-time signals using DFT.	L3	Apply
CO4	Apply FFT algorithms for various signal processing operations.	L3	Apply
CO5	Design digital FIR and IIR filters as per the requirements of pass-band and stopband.	L6	Create

List of the Experiments

Perform any 10 experiments from the following list of experiments

1. Plot of Discrete Time Signals.
2. Frequency response of LTI systems by DTFT .
3. To perform Discrete Fourier Transform .
4. To implement Circular Convolution of two discrete time sequences .
5. To perform Overlap Add method of DFT for long data sequence.
6. To implement the algorithm of DIT-Fast Fourier Transform.
7. To plot the FFT of Sinusoids with noise .
8. Magnitude and phase response of FIR filter .
9. Design an Analog Butterworth filter with given specifications .
10. Design a Digital IIR Butterworth filter with given specifications .
11. Design an FIR filter by window method.
12. Removal of Noise by a designed filter.

Reference Books

1. Vinay K. Ingle, John G. Proakis, "Digital Signal Processing using MATLAB", Cengage Learning, 3rd Edition, 2012. .
2. A. Anand Kumar, Digital Signal Processing, PHI Learning Pvt. Ltd., 2nd Edition, 2015.
3. Samir I. Abood, Digital Signal Processing A Primer With MATLAB, CRC Press, 1st Edition, 2020.
4. Alexander D. Poularikas, Understanding Digital Signal Processing with MATLAB and Solutions, CRC Press, 1st Edition, 2017.
5. Andre Quinquis, Digital Signal Processing Using MATLAB, Wiley, 1st Edition, 2010.
6. John W. Leis, Digital Signal Processing Using MATLAB for Students and Researchers, Wiley, 1st Edition, 2011.

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

Electric Mobility (22PEEE6052T)

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

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Basic concept of Batteries, Electrical Motors, Power Electronics

Course Objectives

1. To make students understand the need & importance of Electric & Hybrid Electric vehicles.
2. To differentiate and analyze the various energy storage devices.
3. To impart the knowledge about architecture and performance of Electric and Hybrid Vehicles.
4. To study the different Charging standards used for electric vehicles.
5. To classify the different drives and controls used in electric vehicles.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe the different types of energy storage systems and battery charging systems.	L2	Understand
CO2	Classify the different mode of operation for hybrid vehicle.	L3	Apply
CO3	Apply the different Charging standards used for electric vehicles.	L3	Apply
CO4	Differentiate between Vehicle to home and Vehicle to grid concepts.	L3	Apply
CO5	Analyze the concepts of Hybrid and Electric vehicles.	L4	Analyze

Course Contents

Unit-I Introduction to Hybrid and Electric Vehicles 08 Hrs.

Need and importance of Electric Vehicle and Hybrid Electric Vehicles, Environmental importance of Hybrid and Electric vehicles. Hybrid Electric vehicles: Concept and architecture of HEV drive train (Series, parallel and series-parallel). Micro Hybrid, Mild Hybrid, Full Hybrid, Plug-in Hybrid, Electric vehicles: Components, configuration, performance, tractive effort, Advantages and challenges in EV.

Unit-II Energy Storage Systems and Battery Management Systems 08 Hrs.

Energy Storage Systems: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery specifications, Battery based energy storage and its analysis, Classification of lithium-ion batteries, Aluminum Air and Aluminum ion battery. Fuel Cell based energy storage, Super Capacitor based energy storage.

Battery Management Systems: Introduction: Different Charging algorithms and Charging method, Cell Balancing methods. Battery Management System: Functions of BMS, Block diagram of BMS, SoC Estimation methods, Thermal Management of Battery

Unit-III Hybrid Power Train and Mode of Operation 08 Hrs.

Control Strategies and Design of the Major Components: Series and Parallel Hybrid Electric Drive Train. Energy Consumption in Braking, Braking Power and Energy on Front and Rear Wheels, Brake System of EVs and HEVs, Regenerative braking

Unit-IV Drives and Charging Infrastructure 08 Hrs.

Selection of drives for Electric vehicle: PMSM drive and BLDC drive, Sizing of motor, Charging Levels: 01,02 and 03, Charging Standards: CCS, CHAdeMO, SAE J1772, IEC 60309, Bharat DC 001, Bharat AC 001, Electric Vehicle Supply Equipment (EVSE).

Unit-V Vehicle to Home, Vehicle to Vehicle and Vehicle to Grid 08 Hrs.

Vehicle to Home: Introduction, applications, V2H with demand response, Case Study of V2H.

Vehicle to Grid: Introduction of V2G, V2G infrastructure in the smart grid, Role of aggregator for V2G, Case study of V2G.

Vehicle to Vehicle: Introduction of V2V, Concept structure

Text Books

1. James Larminie and John Lowry, "Electrical Vehicle", John Wiley Sons, 2nd Edition, 2012.
2. Ronald K. Jurgen, "Electric and Hybrid-Electric Vehicles",SAE International Publisher,2011 .
3. K T Chau, "Energy Systems for Electric and Hybrid Vehicles", The institution of Engineering and Technology Publication, 2016.4.
4. D.A.J Rand, RWoods RMDell, "Batteries for Electric Vehicles", Research studies press Ltd, New York, John Willey Sons

Reference Books

1. Mehrdad Ehsani, Yimin Gao and Ali Emadi, "Modern Electrical Hybrid Electric and Fuel Cell Vehicles: Fundamental, Theory and design", CRC Press, 2009.
2. Junwei Lu & Jahangir Hossain et al (eds), "Vehicle-to-Grid: Linking Electric Vehicles to the Smart Grid", IET Digital Library,2015.
3. Tom Denton, "Automobile Electrical and Electronic systems", SAE International publications, 5th Edition, 2017.
4. C.Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2nd 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 10 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 Mobility Laboratory (22PEEE6052L)

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

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

Course Objectives

1. This course aims to develop familiarity with power system.
2. To understand and estimation of transmission line parameters.
3. To obtain the equivalent circuits of the transmission lines for determining voltage regulation and efficiency.
4. To gain knowledge on design of insulators and their performance.
5. To develop an understanding of the environmental aspects of power transmission & distribution.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand Hybrid and Electric Vehicle Technologies.	L2	Understand
CO2	Implement Energy Storage Systems	L3	Apply
CO3	Develop Hybrid Powertrain Configurations	L4	Analyze
CO4	Design Electric Vehicle Drives and Charging Infrastructure	L4	Analyze
CO5	Explore Vehicle-to-X Technologies	L5	Evaluate

List of the Experiments

Perform 10 experiments from the following list of experiments.

1. Introduction to Electric Vehicle Technology.
2. Introduction to fundamentals and types of batteries.
3. Simulation of SPWM technique for electric vehicle converter using MATLAB/SIMULINK
4. Simulation of three-phase VSI for grid integration in EV using MATLAB/SIMULINK
5. Design of battery pack in MATLAB Simulink with C Rate Calculation
6. Design and Simulation of DC Motor for different load conditions in MATLAB/ SIMULINK
7. Design and Simulation of Induction Motor for different load conditions in MATLAB/ SIMULINK
8. BMS Modelling and Simulation
9. Battery Management System (BMS): Thermal Management Using MATLAB/SIMULINK
10. Design of PMSM drive in MATLAB
11. MATLAB/SIMULINK model of BLDC MOTOR for electrical vehicle
12. MATLAB simulation of DC-DC converter efficiency and voltage regulation.
13. Performance Analysis of Lithium-Ion battery for Electric Vehicle Applications (Innovative)
14. Simulink model to calculate vehicles speed from motor torque (Innovative)

Text Books

1. James Larminie and John Lowry, "Electrical Vehicle", John Wiley Sons, 2nd Edition, 2012.
2. Ronald K. Jurgen, "Electric and Hybrid-Electric Vehicles",SAE International Publisher,2011 .
3. K T Chau, "Energy Systems for Electric and Hybrid Vehicles", The institution of Engineering and Technology Publication, 2016.4.
4. D.A.J Rand, RWoods & RMDell, "Batteries for Electric Vehicles", Research studies press Ltd, New York, John Willey & Sons

Reference Books

1. Mehrdad Ehsani, Yimin Gao and Ali Emadi, "Modern Electrical Hybrid Electric and Fuel Cell Vehicles: Fundamental, Theory and design", CRC Press, 2009.
2. Junwei Lu Jahangir Hossain et al (eds), "Vehicle-to-Grid: Linking Electric Vehicles to the Smart Grid", IET Digital Library,2015.
3. Tom Denton, "Automobile Electrical and Electronic systems", SAE International publications, 5th Edition, 2017.
4. C.Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley Sons, 2nd 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

Programmable Logic Control (22PEEE6053T)

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

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisites: Analog and Digital Electronics

Course Objectives

1. Understanding of PLC programming, ladder logic.
2. Understand the operation of a PLC.
3. Understand advance programming techniques in PLC.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate knowledge of programmable logic controllers.	L2	Understand
CO2	Develop a program using ladder logic programming software.	L6	Create
CO3	Design PLC based system for process control.	L6	Create
CO4	Understand various timers, counters, fault and interrupt systems.	L2	Understand
CO5	Utilize ladder logic functions and advanced functions for PLC programming	L3	Apply

Course Contents

Unit-I Programmable Logic Controllers Components 08 Hrs.

Overview of PLC, Parts of a PLC, Principles of Operation, Modifying the Operation, PLC Size and Application, PLC Architecture, Input/Output Unit, I/O modules, Sourcing and Sinking, Central Processing Unit.

Unit-II Input and Output Devices 08 Hrs.

Mechanical Switches, Proximity Switches, Photoelectric Sensors and Switches, Encoders, Temperature Sensors, Position/Displacement Sensors, Strain Gauges, Pressure Sensors, Ultrasonic Proximity Sensors, Smart Sensors, Turbine -type flowmeters, Velocity and Position Sensors. Output Devices: Relay, Directional Control Valves, Motors, Stepper Motors, Examples of Applications, Conveyor Belt, Robot Control System, Packages on Conveyor Belt Systems.

Unit-III PLC Programming 08 Hrs.

Types of PLC programming methods, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Logic Functions using ladder diagram, Multiple Outputs, writing a Ladder Logic Program Directly from a Narrative Description, arithmetic and logic function implementation using ladder programming, Programming Examples.

Unit-IV Timers and Counters 08 Hrs.

Timers: On delay, off delay, and retentive timers, Cascading Timers, Programming Examples Counters: Up, down Cascading Counters, Combining Counter and Timer Functions, Programming Examples

Unit-V Program Control Instructions 08 Hrs.

Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Math Instructions, Addition, Subtraction, Multiplication, Division, Functional Block diagram, sequential function charts, Branching and Convergence, instruction list, Structured Text programming examples and case studies, overview of SCADA system.

Text Books

1. Frank D. Petruzella, Programmable Logic Controllers, Mc Graw Hill Education, 4th Edition, 2022.
2. W. Bolton, Programmable Logic Controllers, Elsevier, 6th Edition, 2015.

Reference Books

1. Terry R. Borden, Richard A. Cox, Technician's Guide to Programmable Controllers, Cengage Learning, 6th Edition, 2013.
2. Khaled Kamel, Eman Kamel, Programmable Logic Controllers Industrial Control, Mc Graw Hill Education,
3. Alan J Crispin, Programmable Logic Controllers and their Engineering Applications, McGraw-Hill, 2nd Edition, 1996.
4. Parr, "Programmable Controllers: An Engineers Guide", 3rd Edition, Elsevier, Indian Reprint, 2013

5. John R Hackworth and Fredrick D Hackworth Jr., Programmable Logic Controllers: Programming Methods and Applications‖, Pearson Education, 2015.

6. Webb J.W-Programmable controllers: Principle and Applications, PHI New Delhi

7. Stuart A. Boyer, SCADA supervisory control and data acquisition, ISA Publication

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 10 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.

Programmable Logic Control Laboratory (22PEEE6053L)

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

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

Prerequisites: Transducers, Control System, Digital Electronics

Course Objectives

1. To understand the automation process and its level
2. To apply PLC for the control of industrial processes

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the fundamentals of ladder logic programming	L2	Understand
CO2	Develop the ladder programming for arithmetic and logic operations	L6	Create
CO3	Develop the ladder programming for timers based operations	L6	Create
CO4	Develop the ladder programming for counter based operations	L6	Create

List of the Experiments

Perform any 10 experiments from the following list of experiments (Compulsory one innovative experiment)

1. Introduction to ladder programming.
2. Implementation Logic Gates
3. Implementation of Light ON/OFF control
4. Object detection and controlling conveyor motor using ladder programming
5. Implementation Of DOL Starter
6. Implementation Of On-Delay Timer
7. Implementation Of Off-Delay Timer
8. Implementation Of Up-Down Counter
9. Logic implementation for traffic Control Application
10. Logic implementation for Bottle Filling Application
11. Design a PLC program to control the liquid level in a tank.
12. Write the PLC programming for continues box filling operation that requires boxes moving on a conveyor to be automatically positioned and filled.

Design based Problems / Open Ended Problem:

1. Speed measurement using counter
2. DC motor control in both direction
3. Level controller of underground and overhand tank.
4. Servo motor control
5. Automatic Stamping machine
6. Automatic Drilling machine
7. Automatic painting machine
8. Four-way traffic light control
9. Control of robotic arm

List of Open Source Software/learning website:

1. `http://www.plcdev.com/book/export/html/9`
2. `http://www.plcmanual.com/`
3. `http://literature.rockwellautomation.com/`
4. `http://www.automation.siemens.com/`
5. `http://nptel.ac.in/video.php`
6. `https://ial-coep.vlabs.ac.in/`

Reference Books

1. Programmable Logic controllers and Industrial Automation: Madhuchhanda Mitra, SamarjitSen Gupta, Penram International Publishing India Pvt. Ltd
2. Gary Dunning, 'Introduction to Programmable Logic Controllers '' Thomson Learning, 2001.
3. W.Boldon, 'Programmable logic controllers', 5th Edition, Elsevier India Pvt. Ltd., New Delhi, 2011.
4. Parr, "Programmable Controllers: An Engineers Guide", 3rd Edition, Elsevier, Indian Reprint, 2013
5. John R Hackworth and Fredrick D Hackworth Jr., Programmable Logic Controllers: Programming Methods and Applications‖, Pearson Education, 2015.
6. Webb J.W-Programmable controllers: Principle and Applications, PHI New Delhi

7. Automatic painting machine
8. Four-way traffic light control
9. Control of robotic arm
10. Logic implementation for Bottle Filling Application
11. Design a PLC program to control the liquid level in a tank.
12. Write the PLC programming for continues box filling operation that requires boxes moving on a conveyor to be automatically positioned and filled.

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- I (22PJEE6060L)

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

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

Course Objectives:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply engineering knowledge to produce solution of a problem considering cultural, social, environmental, and economic factors using appropriate tool and method.	L4	Analyze
CO2	Demonstrate project based learning that allows students to transfer existing ideas into new applications.	L2	Understand
CO3	Develop an ability to work in teams and manage the conduct of the research study.	L3	Apply
CO4	Integrate different perspectives from relevant disciplines which help them to get internships, jobs and admission for higher studies.	L3	Apply
CO5	Present the research in the form of technical writing, understand what constitutes to plagiarism and how to use proper referencing styles.	L2	Understand

Syllabus:

Domain knowledge (any beyond) needed from the following areas for the effective implementation of the project: Electrical Machines, Power System Analysis, Electromagnetic Engineering,Utilization of Electrical Energy, Industrial Automation Control and Digital Signal Processing, Internet of Things, Machine Learning, Python Programming.

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 30 percent of project.
- In the second review of this semester, each group is expected to complete 50 percent of project.
- 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 con

  rmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide).
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).
- 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:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation details
- Project Outcomes

- Conclusion
- 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 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 below mentioned aspects.

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

Table 4: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Table 5: Continuous Assessment Sheet

Sr	Exam Seat No	Name of Student	Student Attendance	Log Book Maintain	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table 6: Evaluation Sheet

Sr	Exam Seat No	Name of Student	Project Selection	Design/ Simulation/ Logic	PCB/ hardware/ programming	Result Verification	Presentation	Total
			5	5	5	5	5	25

Professional and Business Communication Tutorial (22HMEE6070T)

Teaching Scheme
Tutorial : 02 Hr/week
Credit : 02

Examination Scheme
Teacher Assessment : 25 Marks
Total Marks : 25 Marks

Prerequisites: Basic course in Effective Communication Skills.

Course Objectives

1. To inculcate professional and ethical attitude at the workplace.
2. To enhance communication and interpersonal skills.
3. To develop effective presentation skills.
4. To hone written skills for technical documentation.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Plan, organize and write technical documents like reports, proposals and research papers in the prescribed format using appropriate language and style with an understanding of ethics in written communication.	L2	Understand
CO2	Apply techniques of writing resume, participating in a group discussion and facing interviews.	L3	Apply
CO3	Develop interpersonal skills in professional and personal situations.	L4	Analyse
CO4	Understand the documentation process of meetings and conduct meetings in a professional manner.	L2	Understand
CO5	Understand communication across cultures and work ethics.	L2	Understand
CO6	Design and deliver effective presentations using Power Point	L6	Create

Course Contents

Unit-I Technical Writing 8 Hrs.

Report Writing: Types of report, parts of formal report, collection of data and survey analysis, pre-writing of report, language and style in reports, formatting of reports, referencing in report.

Proposal Writing: Types of technical proposals, format of proposal, language and style, presentation of proposal.

Technical Paper Writing: Parts of a technical paper, language and formatting, referencing in IEEE format.

Plagiarism: Types of plagiarism, consequences of plagiarism

Unit-II Employment Skills 8 Hrs.

Group Discussion: Purpose of a GD, types of GD, criteria for evaluating a GD, Dos and Don'ts of a GD, Tips to be successful in GD.

Cover Letter and Resume Writing: Format and content of cover letter, types of resume, structure,content and formatting of resume.

Interview Skills: Types and modes of interview, Preparation for interview, Dos and Don'ts of interview, frequently asked questions during interview.

Unit-III Introduction to Interpersonal Skills 5 Hrs.

Emotional Intelligence: Definition, difference between IQ and EQ, how to develop EQ .

Leadership: Types of leadership, leadership styles, case studies.

Team Building: Difference between group and team, importance of team work, strategies to be a good team player.

Time Management: Importance of time management, cultural views of time, 80/20 rule, time wasters, setting priorities and goals, .

Conflict Management: Types of conflicts, strategies to manage conflict, case studies.

Unit-IV Meetings and Documentation 4 Hrs.

Planning and preparation for meetings, strategies for conducting effective meetings, notice, agenda and minutes of a meeting, business meeting etiquettes.

Unit-V Cross-culture Communication, Ethics & Presentation Skills 5 Hrs.

Communication across cultures, professional and work ethics, responsible use of social media, introduction to Intellectual Property Rights. Presentation strategies, overcoming stage fear, techniques to prepare effective Power Point presentation.

Reference Books

1. Fred Luthans, "Organizational Behavior", McGraw Hill, 7th edition, 2010.
2. Lesiker and Petit, "Report Writing for Business", McGraw Hill, 10th edition, 1997.
3. Huckin and Olsen, "Technical Writing and Professional Communication", McGraw Hill, 2nd edition, 1990.
4. Wallace and Masters, "Personal Development for Life and Work", Thomson Learning, 12th edition, 2012.
5. Heta Murphy, "Effective Business Communication", Mc Graw Hill, 7th edition, 1997.
6. Sharma R.C. and Krishna Mohan, "Business Correspondence and Report Writing", Tata McGrawHill Education, 2017.
7. Ghosh, B. N., "Managing Soft Skills for Personality Development", Tata McGraw Hill. Lehman.
8. Bell, Smith, "Management Communication", Wiley India Edition, 3rd edition.
9. Dr. Alex, K.,"Soft Skills", S Chand and Company, 2009.
10. Subramaniam, R., "Professional Ethics", Oxford University Press, 2nd edition, 2017.

List of Assignments

1. Business Proposal (PowerPoint presentation).
2. Resume writing.
3. Interpersonal Skills (documentation of activity).
4. Meetings and Documentation (Notice, Agenda, Minutes of Mock Meetings).
5. Business ethics.
6. Presentation Skills.

Evaluation Scheme

Teachers Assessment (TA):

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

- Assignments: 25 Marks
- Project Report and Presentation: 15 Marks
- Group Discussion: 10 Marks

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