Open Elective - I		
1	1OE501AD	Artificial Intelligence (Not for CSE , AIDS &AIML)
2	2OE501CE	Disaster Mitigation (Not for CE)
3	3OE501CS	OOPS using Java (Not for CSE , AIDS &AIML)
4	4OE501EE	Renewable Energy Systems (Not for EEE)
5	5OE501EC	Basics of Electronic Communication (Not for ECE)
6	6OE501ME	Startup Entrepreneurship (Not for ME)

HS: Humanities and Social Sciences BS: Basic Science ES: Engineering Science

MC: Mandatory Course PC : Professional Core

PE: Professional Elective OE: Open Elective

L:Lecture T:Tutorial P:Practical D:Drawing

CIE: Continuous Internal Evaluation

SEE: Semester End Evaluation (Univ. Exam) EE: Electrical Engg.

Note:

1. Each contact hour is a clock hour.
2. The duration of the practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course Code	Course Title	Core/Elective					
4PC508EE	ELECTRICAL MACHINES –II	Core					
		L	T	P/D	Credits	CIE	SEE
		3	1	0	4	40	60

COURSE OBJECTIVES :

The objective of this course is to make the student

1. To understand the construction and operating characteristics of Induction motor, synchronous machines and fractional KW machines.
2. To Analyze the Induction motor and Synchronous machine performance for different loading conditions, as well operating in parallel.
3. To know Different starting methods of Induction motor, Synchronous motor and Special motors.
4. To identify different speed control methods and various tests to assess the performance of AC Machines.

COURSE OUTCOMES:

After completion of the course, the student will be able to

1. Analyze the construction and operating characteristics of 3-phase Induction machines, synchronous machines and Special Machines
2. Analyze the Induction motor and Synchronous machine performance for different loading conditions, as well as operating in parallel.
3. Understand different speed control methods and various tests toassess the performance of AC Machines.
4. Identify and design the suitable AC machine for the desiredapplication based on their characteristics.
5. Analyze different starting methods of AC Machines.

UNIT - I :

Poly-Phase Induction Motors: Poly-phase Induction motors construction details of cage and wound rotor machines – production of a rotating magnetic field-principle of operation-rotor EMF and rotor frequency-rotor reactance, rotor current and pf at standstill and during operation. Rotor power input, rotor copper loss and mechanical power developed and their inter relation-torque equation –deduction from torque

equation-expressions for maximum torque and starting torque-torque slip characteristic-double cage and deep bar rotors-equipment circuit – phasor diagram-crawling and cogging.

UNIT - II:

Circle Diagram & Speed control of Induction Motors :

Circle Diagram: No load and blocked rotor tests –predetermination of performance-methods of starting and starting current and torque calculations.

Speed control: Change of frequency; change of poles and methods of consequent poles; cascade connection; Injection of EMF into rotor circuit (Qualitative treatment only)-Induction generator-principle of operation, applications.

UNIT - III:

Synchronous Generators: Constructional features of cylindrical rotor& Salient pole machines, armature windings - Integral Slot and Fractional Slot, distributed and concentrated, full pitch and short pitch windings. Pitch factor, distribution factor, winding factor and EMF equation, numerical problems. Harmonics in generated EMF, suppression of harmonics, Armature reaction, Leakage reactance, Synchronous reactance &synchronous Impedance-Experimental determination of synchronous reactance, Phasor diagram. Voltage regulation by synchronous impedance method, MMF method, ZPF method and ASA methods. Salient pole.

Alternators- Two reaction theory, Experimental determination of Xd & Xq, Phasor diagram, regulation of salient pole alternator, numerical problems.

UNIT - IV:

Parallel operation of Synchronous generators: Synchronization methods, synchronizing power, torque, parallel operation and Load sharing. Effect of change of excitation and mechanical power input, Analysis of short circuit current waveform-determination of sub-transient, transient and steady state reactance, numerical problems.

Synchronous Motors : Theory of operation, Phasor diagram, variation of current and power factor with excitation, synchronous condenser, mathematical analysis for power developed, hunting and its suppression. Methods of starting, numerical problems.

UNIT - V:

Single phase induction motors and Special motors :

Constructional features, double revolving field theory, equivalent circuit-

determination of parameters split phase starting methods, stepper motor, BLDC motor, Applications, numerical problems

TEXTBOOKS:

1. P. S. Bimbhra, Electrical Machinery, 7th Edition, Khanna Publishers,2011.
2. J.B. Gupta. Theory & Performance of Electrical Machines Publishedby S.K. Kataria& Sons, 2015 Edition.
3. I. J. Nagrath and D. P. Kothari, Electric Machines, 5th Edition, McGrawHill Education, 2017.

REFERENCES/SUGGESTEDREADING:

1. A. E. Fitzgerald and C. Kingsley, Electric Machinery, 6th Edition,McGraw Hill Education, 2005.
2. M. G. Say, Performance and design of AC machines, CBS Publishers,2002.
3. A. S. Langsdorf, Theory of Alternating Current Machinery, 2nd Edition,McGraw Hill Education, 1984.

Course Code	Course Title	Core/Elective					
4PC509EE	POWER ELECTRONICS	Core					
		L	T	P/D	Credits	CIE	SEE
		3	0	0	3	40	60

COURSE OBJECTIVES:

The objective of this course is to make the student

1. Familiarize with various power electronic converter topologies and their application.
2. Create an awareness of the general nature of power electronic equipment.
3. Understand the key features of the principal power electronicdevices.
4. Get an idea about which device to choose for particular application, base drive and protection of PE devices and equipment common to most varieties.

COURSE OUTCOMES :

After completion of the course, the student will be able to

1. Explain the operation & characteristics of power semiconductor devices.
2. Explain the triggering and commutation techniques of thyristor.
3. Analyze uncontrolled and controlled rectifiers.
4. Analyze chopping circuits & AC voltage controllers.
5. Analyze cycloconverter and inverter circuits.

UNIT – I:

Power Semi Conductor Devices and Commutation Circuits:

Thyristors – Silicon Controlled Rectifiers (SCR's) – Basic theory of operation of SCR – Static & Dynamic characteristics of SCR, other thyristor devices, two transistor analogy of SCR, Turn on methods of SCR, Gate firing methods-R, RC, UJT firing circuits –Commutation methods, Series and parallel connections of SCRs – Snubber circuit details – Specifications and Ratings of SCR, introduction to Integrated gate drives and wide band gap devices.

UNIT – II :

AC-DC Converters:

Phase control technique – Single phase Line commutated converters – Half wave controlled converters with Resistive, RL load and RLE load without and with

Freewheeling Diode – Numerical problems Single Phase Fully Controlled Converters: Fully controlled converters, Midpoint and Bridge connections with Resistive, RL loads and RLE load, semi-converters, Effect of source inductance –Numerical problems.

Three phase converters – Three pulse and six pulse converters and bridge connections with R, RL load voltage and current with R and RL load and RLE loads – Semi Converters, Effect of Source inductance–Dual converters Waveforms – Numerical Problems

UNIT – III:

DC-DC Converters: Choppers – Time ratio control and Current limit control strategies – Step down chopper, Step up Chopper, step up/down chopper– load voltage expression, Jones chopper, AC Chopper, Problems.

UNIT – IV :

AC-AC Converters: Single phase AC voltage with R and RL loads ,Triac with R and RL loads - wave forms , Numerical problems

Cyclo-converters – Single phase mid - point cyclo-converters with R and RL loads-waveforms, Bridge configuration of single phase cyclo-converter– Waveforms.

UNIT – V:

DC-AC Converters: Inverters – Single phase inverter – Basic series, parallel inverter –operation and Waveforms – Three phase inverters (180, 120 degrees conduction modes of operation)-Voltage control techniques for inverters, Pulse width modulation techniques – Numerical.

TEXTBOOKS:

1. Power Electronics: Circuits, Devices, and Applications' by M. H. Rashid, Pearson Education India, 2014.
2. Power Electronics: Converters, Applications and Design by N. Mohan and T.M. Undeland, John Wiley& Sons, 2007.

REFERENCES/SUGGESTEDREADING:

1. Fundamentals of Power Electronics by R.W. Erickson and D. Maksimovic, Springer Science & Business Media, 2007.
2. Power Electronics: Essentials and Applications by L. Umanand, WileyIndia, 2009.
3. Power Electronics by Dr. P.S Bimbhra, Khanna Publishers, 2013.

Course Code	Course Title	Core/Elective					
4PC510EE	POWER SYSTEMS-II	Core					
		L	T	P/D	Credits	CIE	SEE
		3	0	0	3	40	60

COURSE OBJECTIVES :

The objective of this course is to make the student

1. Learn and understand the performance analysis of transmission lines and cables.
2. Comprehend analysis of symmetrical and unsymmetrical faults in the power system.

COURSE OUTCOMES:

After completion of the course, the student will be able to

1. Calculate and compare the performance (Constants A, B, C & D, voltage regulation & efficiency) of different types of Transmission lines.
2. Explain the reasons for voltage variation, importance of maintaining constant voltage in power system and different voltage control methods.
3. Calculate the P.U quantities in power system and analyze symmetrical fault (LLL Fault) and calculate S.C capacity of a Bus.
4. Draw the diagram of Sequence networks of different components and compute the Unsymmetrical Fault (LG, LL, LLG& LLLG) current value & MVA values.
5. Acquire the knowledge of natural impedance of transmission line and significance in the operation of power system network.

UNIT - I

Transmission Line Theory : Performance of short, medium, long lines - Line calculations - Tuned lines, Power circle diagram and their applications. Corona - Causes - Disruptive and Visual critical voltages - Power loss - Minimization of corona effects.

UNIT-II

Symmetrical Faults: Use of per unit quantities in power systems, advantages of per unit system. Symmetrical Three-phase Faults, Transients in RL series circuits - Short circuit currents - Reactance's of synchronous machines - Symmetrical fault calculations, Short circuit capacity of bus.

UNIT - III

Unsymmetrical Faults: Symmetrical components of unsymmetrical phasors - Power in terms of symmetrical components - Sequence impedance and sequence networks, Sequence networks of unloaded generators - Sequence impedances of circuit elements - Single line to ground, line to line and double line to ground faults on unloaded generator - Unsymmetrical faults of power systems, Open circuit faults.

UNIT - IV

Voltage Control: Phase modifiers, Induction Regulators -Tap changing Transformers, Series and Shunt Capacitors, Reactive Power requirement calculations, Static VAR compensators - Thyristor Controlled reactor, Thyristor switched capacitor.

UNIT - V

Travelling Wave Theory : Causes of over voltages - Travelling wave theory - Wave equation - Open circuited line - The short circuited line - Junction of lines of different natural impedances - Reflection and Refraction Coefficients - Junction of cable and overhead lines - Junction of three lines of different natural impedances- Bewley Lattice diagram.

TEXTBOOKS :

1. CLWadhwa - Electrical Power Systems, New Age International, 4th Edition, 2018.
2. Grainger and Stevenson - Power System Analysis, Tata McGraw Hill, 4th Edition, 2003.
3. Nagarath and Kothari - Modern Power System Analysis, Tata McGraw Hill, 4th Edition, 2012.

REFERENCES/SUGGESTEDREADING :

1. Principles of power systems by VK.Metha, Rohit Mehta, S.Chand & Company Ltd, 8th Edition.
2. A course in Power Systems by J.B.Gupta, S.K.Kataria & sons 11th Edition 2016.

Course Code	Course Title	Core/Elective					
4PC511EE	ELECTRICAL	Core					
	MEASUREMENTS AND	L	T	P/D	Credits	CIE	SEE
	INSTRUMENTATION	3	0	0	3	40	60

COURSE OBJECTIVES:

The objectives of this course is to impart knowledge of

1. To learn and understand the fundamental concepts, principle of operation and applications of various electrical measuring instruments.
2. To understand various types of Bridges in measurement of resistance, inductance, capacitance andfrequency.
3. To understand the operation and applications of Ballistic Galvanometer, Flux meter and DC/AC Potentiometer.
4. To understand the application of CRO for measurement of Amplitude, Phase and frequencyof sinusoidal signals.

COURSE OUTCOMES :

After completing this course, the student will be able to:

1. Understand the fundamental concepts, principle of operation and applications of various electrical measuring instruments.
2. Understand various types of Bridges in measurement of resistance, inductance, capacitance andfrequency.
3. Understand the operation and applications of Ballistic Galvanometer, Fluxmeter.
4. Analyze thepotentiometer operation for voltage measurements
5. Analyze the CTs & PTs operation for voltage ,current measurements

UNIT – I

Instruments: Indicating, Recording and Integrating instruments, Ammeter, Voltmeter, Expression for torque of moving coil, moving iron, Dynamometer, induction and electrostatic instruments. Extension of range of instruments, Wattmeter Torque expression for dynamometer instruments, Reactive power measurement, Percentage error, Accuracy calculations.

UNIT - II

Meters: Energy meters, single phase and 3-phase, Driving torque and braking torque equations, Errors and testing compensation, Maximum demand indicator, Power factor meters, Frequency meters, Electrical resonance and Weston type of synchro scope. Concept of digital energy meter.

UNIT - III

Bridge Methods and transducers: Measurement of inductance, capacitance and resistance using Bridges, Maxwell's, Hay's. bridge, Anderson, Wein, Desauty's, Schering's bridges, Kelvin's double bridge, Megger, Loss of charge method, Wagners earthing device, Transducers - Analog and digital transducers, Strain gauges and Hall effect transducers, LVDT..

UNIT - IV

Magnetic Measurements and instrument transformers: Ballistic galvanometer, Calibration by Hibbert' s magnetic standard flux meter, Lloyd-Fischer square for measuring iron loss, Determination of B-H curve and Hysteresis loop using CRO, Instrument transformers – Current and potential transformers, ratio and phase angle errors of CT's and PT's.

UNIT - V

Potentiometers: Crompton's DC and AC polar and coordinate types, Applications, Measurements of impedance, Calibration and ammeter voltmeter and wattmeters. Use of oscilloscope in frequency, phase and amplitude measurements

TEXTBOOKS :

1. Shawney A.K., Electrical and Electronics Measurements and Instruments, Dhanpat rai & Sons, Delhi, 2000.
2. Umesh Sinha, Electrical, Electronics Measurement and Instrumentations, Satya Prakashan, New Delhi.

REFERENCES/SUGGESTED READING :

1. Golding E.W., Electrical Measurements and Measuring Instruments, Sir Issac& Pitman & Sons Ltd., London.
2. U.A.Bakshi, A.V.Bakshi, Electrical and Electronic Instrumentation, Technical publications.

Course Code	Course Title	Core/Elective					
4HS504HS	EFFECTIVE	Core					
	TECHNICAL	L	T	P/D	Credits	CIE	SEE
	COMMUNICATION	3		0	3	40	60

COURSE OBJECTIVES:

The objectives of this course is to impart knowledge of

1. To understand the process, features and barriers of Communication.
2. To learn the aspects of communication and Presentation.
3. To comprehend the types of official and business correspondence.
4. To analyze the techniques of Report Writing Aspects of data transfer andpresentation.

COURSE OUTCOMES :

After completion of the course, the student will be able to

1. Handle Technical Communication effectively by overcoming barriers of communication.
2. Use different types of Professional correspondence to communicate effectively.
3. Use different types of Business and Inter Office Correspondence.
4. Acquire adequate skills to draft reportsefficiently.
5. Enhance their skills of information transfer.

UNIT-I

Introduction to Communication: Definition, process and Channels of Communication.ABC of Technical communication Barriers to communication Differences between general and Technical writing.

UNIT-II

Aspects of Communication: Importance of listening and types of Listening, Types of Technical communication (Oral and Written), Features of technical communication (Precision, relevance, format, style & Use of visual aids),Persuasive Techniques.

UNIT-III

Technical Writing-I: Emails, IOM, Business Letters - enquiry and response;

compliant and Adjustment; placement of order; Cover letters/Job Application & Resume Writing, Business Proposals.

UNIT - IV

Technical Writing –II: Types of technical Reports (Informative, analytical, periodic, Special, formal and Informal) Formal Elements of a Report, Feasibility, Project, Progress and Evaluation reports.

UNIT - V

Information Transfer and Presentations: Non-verbal to verbal, Verbal to Non – Verbal, Important aspects of Oral and Visual Presentations.

TEXTBOOKS :

1. Raman, Meenakshi& Sharma, Sangeeta. (2015). Technical Communication: Principles and Practice (3rd Ed.). New Delhi. OUP.
2. Rizvi, Ashraf, M (2017). Effective Technical Communication (2nd Ed.) New Delhi, Tata McGraw Hill Education.
3. Sharma, R. C, & Mohan, Krishna. (2017). Business Correspondence and Report Writing: A Practical approach to business & technical communication (4th ed.) New Delhi, Tata McGraw Hill Education.

REFERENCES/SUGGESTEDREADING :

1. Tyagi, Kavita &Misra, Padma. (2011). Advanced Technical Communication. New Delhi, PHI Learning.
2. Jungk, Dale. (2004). Applied Writing for technicians. Newyork, McGraw Hill Higher Education.

Course Code	Course Title	Core/Elective					
4PE501EE	ELECTRICAL SAFETY AND STANDARDS (PROFESSIONAL ELECTIVE – I)	Elective					
		L	T	P/D	Credits	CIE	SEE
		3	0	0	3	40	60

COURSE OBJECTIVES :

1. To provide a comprehensive exposure to electrical hazards.
2. To understand various grounding techniques and safety procedures
3. To know about various electrical maintenance techniques.

COURSE OUTCOMES:

After completing this course, the student will be able to:

1. Explain the objectives and precautions of Electrical Safety, effects of Shocks and their Prevention.
2. Summarize the Safety aspects during Installation of Plant and Equipment.
3. Describe the electrical safety in residential, commercial and agricultural installations.
4. Describe the various Electrical Safety in Hazardous Areas, Equipment Earthing and System Neutral Earthing.
5. State the electrical systems safety management and IErule.

UNIT - I

Introduction To Electrical Safety, Shocks And Their Prevention: Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shop.

UNIT - II

Electrical Safety in Residential, Commercial and Agricultural Installations: Wiring and fitting – Domestic appliances –water tap giving shock –shock from wet wall –

fan firing shock –multi-storied building –Temporary installations – Agricultural pump installation –Do's and Don'ts for safety in the use of domestic electrical appliances.

UNIT - III

Electrical Safety during Installation, Testing and Commissioning, Operation and Maintenance: Preliminary preparations –safe sequence –risk of plant and equipment –safety documentation –field quality and safety -personal protective equipment – safety clearance notice –safety precautions –safeguards for operators –safety.

UNIT - IV

Electrical Safety in Hazardous Areas: Hazardous zones –class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipment's for hazardous locations – Classification of equipment enclosure for various hazardous gases and vapours – classification of equipment/ enclosure for hazardous locations.

UNIT - V

Fire Extinguishers: Fundamentals of fire-initiation of fires, types; extinguishing techniques, prevention of fire, types of fire extinguishers, fire detection and alarm system;CO2and Halogen gas schemes; foam schemes

TEXTBOOKS:

1. Rao, S. and Saluja, H.L., "Electrical Safety, Fire Safety Engineering and Safety Management", Khanna Publishers, 1988.
2. Cooper.W.F, "Electrical safety Engineering", Newnes-Butterworth Company, 1978.
3. John Codick, "Electrical safety hand book", McGraw Hill Inc., New Delhi, 2000.

REFERENCES/SUGGESTEDREADING:

1. Nagrath, I.J. and Kothari, D.P., "Power System Engineering", Tata McGraw Hill, 1998.
2. Wadhwa, C.L., "Electric Power Systems", New Age International, 2004.

Course Code	Course Title	Core/Elective					
4PE502EE	RENEWABLE ENERGY SOURCES (PROFESSIONAL ELECTIVE – I)	Elective					
		L	T	P/D	Credits	CIE	SEE
		3	0	0	3	40	60

COURSE OBJECTIVES :

The objectives of this course is to impart knowledge of

1. To understand the concepts and Importance of renewable energy sources such as solar, wind, biomass, tidal power.
2. To make the students understand the advantages and disadvantages of different renewable energy sources.

COURSE OUTCOMES :

At the end of the course students will be able to

1. Understand theadvantages, disadvantages and applications of different non-conventional sources.
2. Analyze principle of operation and applications of different Fuelcells.
3. Analyze the principles of Solar and Wind Energy sources and its applications
4. Understand the principles of OTEC and GTE.
5. Analyze the biomass conversion technologies , Biogas generation and Biogas plants.

UNIT - I

Review of Conventional and Non-Conventional energy sources - Need for non-conventional energy sources Types of Non- conventional energy sources - Fuel Cells - Principle of operation with special reference to H2 °2Cell - Classification and Block diagram of fuel cell systems - Ion exchange membrane cell - Molten carbonate cells - Solid oxide electrolyte cells - Regenerative system- Regenerative Fuel Cell - Advantages and disadvantages of Fuel Cells — Polarization - Conversion efficiency and Applications of Fuel Cells.

UNIT-II

Solar energy - Solar radiation and its measurements - Solar Energy collectors -Solar Energy storage systems - Solar Pond - Application of Solar Pond - Applications of solar energy, V-I and P-V curves and the concept of MPPT.

UNIT - III

Wind energy- Principles of wind energy conversion systems - Nature of wind - Power in the Wind-Basic components of WECS - Classification of WECS - Site selection considerations - Advantages and disadvantages of WECS - Wind energy collectors - Wind electric generating and control systems - Applications of Wind energy - Environmental aspects.

UNIT - IV

Energy from the Oceans - Ocean Thermal Electric Conversion (OTEC) methods - Principles of tidal power generation - Advantages and limitations of tidal power generation -Ocean waves - Wave energy conversion devices -Advantages and disadvantages of wave energy - Geo-thermal Energy - Types of Geo-thermal Energy Systems - Applications of Geo-thermal Energy.

UNIT - V

Energy from Biomass - Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation -Thermal gasification of biomass -Biomass gasifiers.

TEXTBOOKS:

1. Rai G.D, Non-Conventional Sources of Energy, Khandala Publishers, New Delhi, 2011.
2. David M Buchla and Thomas E Kissell ,Renewable Energy Systems, 1st Edition by, Pearson India.

REFERENCES/SUGGESTEDREADING:

1. M.M.El-Wakil, Power Plant Technology, McGraw Hill, 1984.
2. JohnTwidell, Tony Weir, Renewable Energy R73esources, 3rd Edition, Taylor and Francis.

Course Code	Course Title	Core/Elective					
4PE503EE	DIGITAL CONTROL SYSTEMS (PROFESSIONAL ELECTIVE-I)	Elective					
		L	T	P/D	Credits	CIE	SEE
		3	0	0	3	40	60

COURSE OBJECTIVES:

The objectives of this course is to impart knowledge of

1. To impart knowledge in the significance and features of design of discrete-time control system.
2. To review on the different transform techniques for digital control system design.
3. To impart knowledge on the techniques to analyze the system performance in the discrete-time domain. 4 To impart knowledge in discrete state space controller design.

COURSE OUTCOMES :

After completing this course, the student will be able to

1. Understand the various issues related to digital control systems such as effects of sampling andquantization, discrete time signals and models.
2. Represent a discrete-time control system using state spacetechnique.
3. Design discrete control systems via pole placement.
4. Design observers for discrete control systems.
5. Analyze the stability of a discrete-time controlsystem.

UNIT - I

Introduction to digital control Configuration of basic digital control system: discrete transfer function, discrete model sampled data systems using z- transform, transfer function model, signal analysis and dynamic response, zero-order hold equivalent, introduction to first-order-hold equivalent, transformation between splane, z-plane and w-plane, z-Domain description of sampled continuous-time systems. Controller design Controller Design using transform techniques: Root locus and frequency domain analysis compensator design.

UNIT - II

State space theory Control system analysis using state variable method: vector and matrices, state variable representation, conversion of state variable to transfer function and vice versa, conversion of transfer function to canonical state variable models, system realization, solution of state equations. Solution of discrete-time state equation. Computational methods.

UNIT - III

State space design using state-space methods: controllability and observability, control law design, pole placement, pole placement design using computer aided control system design (CACSD).

UNIT - IV

Observer design: Full order and reduced order discrete observer design - Kalman filter and extended Kalman filter design.

UNIT - V

Stability improvement by state feedback: Stability analysis and Jury's stability criterion, Lyapunov stability analysis to linear systems and discrete systems, Stability Improvement by state feedback.

TEXTBOOKS:

1. K. Ogata, Discrete Time Control Systems, Prentice Hall India, 2nd edition, 2005.
2. M. Gopal, Digital Control and State Variable Methods, Tata McGraw Hill, 4th edition., 2017.

REFERENCES/SUGGESTEDREADING:

1. R. Isermann, Digital Control Systems Vol 1&2, Springer-Verlag, 1991.
2. B. C. Kuo, Digital Control System, Oxford University Press, 2nd edition., 2007.

Course Code	Course Title	Core/Elective					
1OE501AD	ARTIFICIAL	Elective					
	INTELLIGENCE	L	T	P/D	Credits	CIE	SEE
	(OPEN ELECTIVE-I)	3		0	3	40	60

COURSE OBJECTIVES:

The objectives of this course is to impart knowledge of

1. To introduce the AI techniques to solve problems and search strategies to find optimal solution paths from start to goal state.
2. To introduces different knowledge representation methods in AI Programs.
3. To introduce different design techniques for Game Playing Programs.
4. To introduce the AI Agents their design, planning and learning techniques.
5. To introduce the natural language processing and expert systems

COURSE OUTCOMES :

After completion of the course, the student will be able to

1. Understand fundamental AI concepts and identify a range of symbolic and non symbolic AI techniques.
2. Demonstrate an understanding of various searching algorithms such as adversarial search and game-playing commonly used in artificial intelligence software.
3. Use different knowledge representation techniques used in AI Applications.
4. Demonstrate an understanding of agent based AI architectures, planning and logic based agents.
5. Exploring Expert systems.

UNIT-I

Introduction: Artificial Intelligence and its applications, Artificial Intelligence Techniques

Problem solving techniques: State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, AO* search, Constraint satisfaction problem, Agenda Driven Search, Mean-end analysis, Min- Max Search, Alpha-Beta Pruning, Iterative Deepening.

UNIT-II

Knowledge representation: Mapping between facts and representations, Approaches to knowledge representation, procedural vs. declarative knowledge, Forward vs. Backward reasoning, Matching, conflict resolution, Weak and Strong filler structures.

UNIT-III

Non Monotonic and Statistical Reasoning: on monotonic Logic, Default Logic, Circumscription, Bayes Theorem, Bayesian Network, Dempster Shafer Theory, Fuzzy sets, Fuzzy Logic, Defuzzification.

UNIT-IV

Planning and Learning Agents: Intelligent Agents, Nature and structure of Agents, Learning Agents, Introduction to different Forms of Learning, The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning.

UNIT-V

Introduction to Learning and Expert system: Expert systems, Expert system examples, Expert System Architectures, Rule base Expert systems, Non Monotonic Expert Systems, Decision tree base Expert Systems.

TEXTBOOKS:

1. AI: A Modern Approach Stuart J. Russel, Peter Norvig Pearson Education Latest Edition, 2012
2. Artificial Intelligence Elaine Rich, Knight McGraw Hill Third Edition2010
3. Artificial Intelligence, Saroj Kaushik Cengage Learning, First Edition2011

REFERENCES/SUGGESTEDREADING:

1. Artificial Intelligence, Partick Henry Winston Addison Wesley Latest Edition2012
2. Artificial Intelligence George Luger Pearson Education Latest Edition2010

Course Code	Course Title	Core/Elective					
2OE501CE	DISASTER MITIGATION (OPEN ELECTIVE-I)	Elective					
		L	T	P/D	Credits	CIE	SEE
		3		0	3	40	60

COURSE OBJECTIVES:

The objectives of this course is to impart knowledge of

1. Define disaster and explain the different types of disasters.
2. Describe the disaster management cycle and the role of NDMA in disaster management.
3. Analyze the legal aspects of disaster management.
4. Develop disaster mitigation plans.
5. Participate in disaster response and recovery activities.

COURSE OUTCOMES :

After completion of the course, the student will be able to

1. Demonstrate the concepts of disaster management
2. Identify different types of disasters
3. Explain the disaster management cycle
4. Illustrate the role of NDMA in disaster management
5. Explain the development of disaster mitigation plan

UNIT-I

Introduction to Disaster Management: Definition of disaster, Types of disasters, History of disaster management in India, National Disaster Management Authority (NDMA) and its role in disaster management, Disaster management cycle.Case studies of disasters in India and the world.

UNIT-II

Disaster Mitigation: Mitigation measures for different types of disasters, Use of technology in disaster mitigation, Disaster risk assessment, Disaster preparedness, Exercises and simulations on disaster mitigation.

UNIT-III

Disaster Response: Search and rescue operations, Medical relief, Food and shelter, Restoration of essential services, Rehabilitation and reconstruction.

UNIT-IV

Disaster Law and Policy: Disaster management acts of India, Disaster management policies of India, Legal aspects of disaster management.

UNIT-V

Disaster Communication and Public Awareness: Importance of communication in disaster management, Methods of disaster communication, Public awareness programs, Case studies of disaster communication and public awareness in India and the world.

TEXTBOOKS:

1 R.Subramanian, Disaster Management, Vikas Publishing House, 2018.

2 M. M. Sulphey, Disaster Management, PHI Learning, 2016.

REFERENCES/SUGGESTEDREADING:

1 S. C. Sharma, Disaster Management: Concepts, Approaches and Techniques, Khanna Book Publishing House, 2017.

2 G. K. Ghosh, Disaster Management: Theory and Practice, APH Publishing Corporation, 2018.

Course Code	Course Title	Core/Elective					
3OE501CS	OOPS USING JAVA (OPEN ELECTIVE-I)	Elective					
		L	T	P/D	Credits	CIE	SEE
		3		0	3	40	60

COURSE OBJECTIVES:

The objectives of this course is to impart knowledge of

1. The Java programming language: its syntax, idioms, patterns and styles
2. Object oriented concepts in Java and apply for solving the problems.
3. How exception handling and multithreading makes Java robust.
4. Explore java Standard API library such as io, util, applet,awt.
5. Building of applications using Applets and Swings.

COURSE OUTCOMES :

After completion of the course, the student will be able to

1. Understand the concept of OOP and analyze relationships among classes, objects.
2. Develop programs using concepts like inheritance, packages, interfaces, Java I/O streams and strings
3. Utilize exception handling and Multithreading concepts to develop Java programs
4. Interpret the Java Collection API, Java utility classes, concept of files and serialization
5. Design GUI applications using concepts like AWT controls and Swings and client server programs using networking concepts.

UNIT-I

Object Oriented Programming: Principles, Benefits of Object Oriented Programming. Introduction to Java: Java buzzwords, byte code. Java Programming Fundamentals: Applet and Application program using simple java program, data types, variables, arrays, operators, expressions, control statements, type conversion and casting, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, introducing access control, static, final, nested and inner classes, exploring string class, using command-linear arguments.

Inheritance: Inheritance concept, types of inheritance, Member access rules, use of super and final. Polymorphism - dynamic binding, method overriding, abstract classes and methods.

UNIT-II

Interfaces: Defining an interface, implementing interfaces, extending interface. **Packages:** Defining, Creating and Accessing a Package, importing packages Exception handling: Benefits of exception handling, classification, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, re throwing exceptions, built in exceptions, creating own exception sub classes Multith reading: Java Thread Model, The Main Thread, creating a Thread, creating multiple threads, using is Alive and join, thread priorities, synchronization, inter thread communication, deadlock.

UNIT-III

Collections: Overview of Java Collection frame work, commonly used Collection classes – Array List, Linked List, Hash Set, Tree Set, Collection Interfaces – Collection, List, Set. Accessing Collection via iterator, working with Map. Legacy classes and interfaces – Vector, Hash table, Stack, Dictionary, Enumeration interface.

Other Utility classes: String Tokenizer, Date, Calendar, Gregorian Calendar, Scanner Java Input/Output: exploring java.io, Java I/O classes and interfaces, File, Stream classes, byte stream, character stream, serialization.

UNIT-IV

GUI Programming with java: The AWT class hierarchy, MVC architecture. **Applet Revisited:** Basics, architecture and skeleton, simple applet program. Event Handling: Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. Handling mouse and keyboard events, Adapter classes. Database Programming using JDBC: Introduction to JDBC, JDBC Drivers & Architecture, CURD operation Using JDBC, Connecting to non-conventional Databases.

UNIT-V

Exploring Swing: JLabel, Image Icon, J Text Field, the Swing buttons, J Tab bed pane, J Scroll Pane, J List, J Combo Box. Servlet: Life cycle, using tomcat, simple servlet, servlet API, javax.servlet package, reading servlet parameters, javax.servlet. http package, handling HTTP requests and responses.

TEXTBOOKS:

1. Java: The Complete Reference, X Edition, Herbert Schildt, McgrawHill.
2. Java Fundamentals: A Comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.
3. Java for Programming, P.J.Dietel X Edition, PearsonEducation.

REFERENCES/SUGGESTEDREADING:

1. TheJavaProgramming Language, Ken Arnold, David Holmes, James Gosling, Prakash Goteti, III Edition, Pearson 2008
2. An Introduction to OOP, T. Budd, IIIEdition, Pearson Education.
3. Introduction to Java Programming, Y.Daniel Liang, X Edition, Pearson Education.

Course Code	Course Title	Core/Elective					
4OE501EE	RENEWABLE ENERGY SYSTEMS (OPEN ELECTIVE – I)	Elective					
		L	T	P/D	Credits	CIE	SEE
		3	0	0	3	40	60

COURSE OBJECTIVES :

The objectives of this course is to impart knowledge of

1. To understand the concepts and Importance of renewable energy sources such as solar, wind, biomass, tidal power.
2. To make the students understand the advantages and disadvantages of different renewable energy sources

COURSE OUTCOMES :

At the end of the course students will be able to

1. Understand theadvantages, disadvantages and applications of different non-conventional sources.
2. Analyze principle of operation and applications of different Fuelcells
3. Analyze the principles of Solar and Wind Energy sources and its applications
4. Understand the principles of OTEC and GTE
5. Analyze the biomass conversion technologies, Biogas generation and Biogas plants.

UNIT - I

Review of Conventional and Non-Conventional energy sources - Need for non-conventional energy sources Types of Non- conventional energy sources - Fuel Cells - Principle of operation with special reference to H2 °2Cell - Classification and Block diagram of fuel cell systems - Ion exchange membrane cell - Molten carbonate cells - Solid oxide electrolyte cells - Regenerative system- Regenerative Fuel Cell - Advantages and disadvantages of Fuel Cells — Polarization - Conversion efficiency and Applications of Fuel Cells.

UNIT - II

Solar energy - Solar radiation and its measurements - Solar Energy collectors -Solar Energy storage systems - Solar Pond - Application of Solar Pond - Applications of solar energy, V-I and P-V curves and the concept of MPPT.

UNIT-III

Wind energy- Principles of wind energy conversion systems - Nature of wind - Power in the Wind-Basic components of WECS - Classification of WECS - Site selection considerations - Advantages and disadvantages of WECS - Wind energy collectors - Wind electric generating and control systems - Applications of Wind energy - Environmental aspects.

UNIT-IV

Energy from the Oceans - Ocean Thermal Electric Conversion (OTEC) methods - Principles of tidal power generation - Advantages and limitations of tidal power generation -Ocean waves - Wave energy conversion devices -Advantages and disadvantages of wave energy - Geo-thermal Energy - Types of Geo-thermal Energy Systems - Applications of Geo-thermal Energy.

UNIT-V

Energy from Biomass - Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation -Thermal gasification of biomass -Biomass gasifiers.

TEXTBOOKS:

1. Rai G.D, Non-Conventional Sources of Energy, Khandala Publishers, New Delhi, 2011.
2. David M Buchla and Thomas E Kissell ,Renewable Energy Systems, 1st Edition by, Pearson India.

REFERENCES/SUGGESTEDREADING:

1. M.M.El-Wakil, Power Plant Technology, McGraw Hill, 1984.
2. John Twidell, Tony Weir, Renewable Energy R73esources, 3rd Edition, Taylor and Francis.

Course Code	Course Title	Core/Elective					
5OE501EC	BASICS OF	Elective					
	ELECTRONIC	L	T	P/D	Credits	CIE	SEE
	COMMUNICATION (OPEN ELECTIVE-I)	3	0	0	3	40	60

COURSE OBJECTIVES:

The objectives of this course is to impart knowledge of

1. To provide an introduction to fundamental concepts in the understanding ofcommunications systems.
2. To describe the network model and some of the network layers including physical layer, data link layer, network layer and transport layer.
3. To discuss the evolution of wireless systems and current wirelesstechnologies

COURSE OUTCOMES :

At the end of the course students will be able to

1. Understand the working of analog and digital communication systems.
2. Explain the OSI network model and the working of datatransmission.
3. Describe the evolution of communication technologies from traditional telephony systems to modern wireless communication systems.
4. Differentiate between analog and digital modulation techniques
5. Understand the optical fiber communication link, structure, propagation and transmission properties.

UNIT - I

Introduction to Communication systems: Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels.

Signal Transmission Concepts: Baseband transmission and Broadband transmission, Communication Parameters: Transmitted power, Channel bandwidth and Noise, Need for modulation Signal Radiation and Propagation: Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT - II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes – ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT - III

Data Communication and Networking: Network Models, OSI Model, Data Link Layer – Media Access control, Ethernet, Network Layer – Internet Protocol (IPv4/ IPv6), Transport Layer – TCP, UDP.

UNIT - IV

Telecommunication Systems: Telephones, Telephone system, **Optical Communications:** Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT - V

Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, OFDM. **Current Wireless Technologies:** Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

TEXTBOOKS:

1. Louis E. Frenzel, "Principles of Electronic Communication Systems", 3rd edition, McGraw Hill, 2008.
2. George Kennedy, Bernard Davis, "Electronic Communication systems", 4th edition, McGraw Hill, 1999.

REFERENCES/SUGGESTEDREADING:

1. M Behrouz A. Forouzan, "Data Communications and Networking", 5th edition, TMH, 2012.
2. Rappaport T.S., "Wireless communications", 2nd edition, Pearson Education, 2010.
3. Wayne Tomasi, "Advanced Electronic Communications Systems", 6th edition, Pearson Education.

Course Code	Course Title	Core/Elective					
6OE501ME	START- UP ENTREPRENEURSHIP (OPEN ELECTIVE-I)	Elective					
		L	T	P/D	Credits	CIE	SEE
		3	0	0	3	40	60

COURSE OBJECTIVES :

The objectives of this course is to impart knowledge of

1. To motivate students to take up entrepreneurship in future.
2. To learn nuances of starting an enterprise & project management.
3. To understand project formulation and choice Technology in Enterprise.
4. To understand Intellectual properties, patents, Start-ups.

COURSE OUTCOMES:

At the end of the course students will be able to

1. Understand Entrepreneurship and Economic growth, Small and Large Scale Industries, Types and forms of enterprises.
2. Identify the characteristics of entrepreneurs, Emergence of first generation entrepreneurs, Conception and evaluation of ideas and their sources.
3. Practice the principles of project formulation, Analysis of market demand, Financial and profitability analysis and Technical analysis.
4. Understand the concept of Intellectual Property Rights and Patents.
5. Comprehend the aspects of Start-Ups.

UNIT-I

Introduction to Communication systems: Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels.

Signal Transmission Concepts: Baseband transmission and Broadband transmission, Communication Parameters: Transmitted power, Channel bandwidth and Noise, Need for modulation Signal Radiation and Propagation: Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT-II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes – ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT-III

Data Communication and Networking: Network Models, OSI Model, Data Link Layer – Media Access control, Ethernet, Network Layer – Internet Protocol (IPv4/ IPv6), Transport Layer – TCP, UDP.

UNIT-IV

Telecommunication Systems: Telephones, Telephone system, **Optical Communications:** Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT-V

Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, OFDM. **Current Wireless Technologies:** Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

TEXTBOOKS:

3. Louis E. Frenzel, "Principles of Electronic Communication Systems", 3rd edition, McGraw Hill, 2008.
4. George Kennedy, Bernard Davis, "Electronic Communication systems", 4th edition, McGraw Hill, 1999.

REFERENCES/SUGGESTEDREADING:

4. M Behrouz A. Forouzan, "Data Communications and Networking", 5th edition, TMH, 2012.
5. Rappaport T.S., "Wireless communications", 2nd edition, Pearson Education, 2010.
6. Wayne Tomasi, "Advanced Electronic Communications Systems", 6th edition, Pearson Education.

Course Code	Course Title	Core/Elective					
4PC554EE	ELECTRICAL MACHINES - I LAB	Core					
		L	T	P/D	Credits	CIE	SEE
		0	0	2	1	40	60

COURSE OBJECTIVES:

The objectives of this course is to impart knowledge of

1. To gain thorough knowledge about operation and the performance of DC Machines.
2. To understand Different starting methods of DC Machines.
3. To draw the performance characteristics of DC Machines for different load conditions.
4. To understand the performance characteristics of transformers by conducting various experiments and tests.

COURSE OUTCOMES :

After completion of this course student should be able to:

1. Apply and conclude the principles of Electrical Machines through laboratory experimental work.
2. Construct the circuit to perform experiments, measure, analyze the observed data & come to a conclusion and Organize reports based on performed experiments with effective demonstration of diagrams and characteristics / graph.
3. Compare the performance characteristics of different electricalmachines.
4. Demonstrate the starting & speed control of various DCmotors.
5. Determine efficiency & voltage regulation of electrical machines by varioustests.

LIST OF EXPERIMENTS

1. Magnetization Characteristics of DC Shunt Generator. Determination of its critical field resistance and critical speed.
2. Brake test on DC shunt motor.
3. Brake test on DC Compound motor.

4. Load test on DC Shunt Generator.
5. Hopkinson's Test on DC Shunt Machines.
6. Swinburne's Test on DC Machine.
7. OC & SC test on single phase transformer
8. Separation of No Load losses in DC Shunt Motor.
9. Retardation test on DC shuntmotor.
10. Speed control of DC shunt motor.
11. Sumpner's test
12. Hopkinsons test
13. Load test on single phasetransformer

Note : At least 10 experiments should be conducted.

SUGGESTEDREADING:

1. Electrical Machinery, Theory: Performance & Applications, Dr. P. S. Bimbhra, Khanna Publishers, 2021. .
2. Nagarath&D.P.Kothari: ElectricalMachines,TMHPublishers,5th edition 2017.
3. Theory& Performance of Electrical Machines by J.B. Gupta, S.K. Kataria & Sons, 5th Edition, 2013.
4. Electric Machines, P. S Bimbhra- 2nd Edition, Khanna Publishers, 2017.

Course Code	Course Title	Core/Elective					
4PC555EE	ELECTRICAL	Core					
	MEASUREMENTS AND	L	T	P/D	Credits	CIE	SEE
	INSTRUMENTATION LAB	0	0	2	1	40	60

COURSE OBJECTIVES :

The objectives of this course is to impart knowledge of

1. To determine unknown inductance, resistance, capacitance by performing experiments on D.C Bridges & A.C Bridges.
2. To determine three phase active & reactive powers using single wattmeter method practically. Measurement of parameters of choke coil.
3. To calibrate LPF Watt Meter, energy meter, P.F Meter using electro dynamo meter type instrument as the standard instrument.
4. To determine the ratio and phase angle errors of current transformer and potential transformer.

COURSE OUTCOMES :

After completing this course, the student will be able to:

1. Calibrate various electrical measuring/recording instruments. Get the ability to choose instruments and can test any instrument can find the accuracy of any instrument by performing experiment can calibrate PMMC instrument using D.C potentiometer.
2. Accurately determine the values of inductance and capacitance using A.C bridges Accurately determine the values of very low resistances
3. Measure reactive power in 3-phase circuit using single wattmeter
4. Determine ratio error and phase angle error of CT & PT
5. Students should be able to test current transformers and dielectric strength of oil. Students should be able to calibrate LVDT

LISTOFEXPERIMENTS

1. Measurement of low resistance by Kelvin's DoubleBridge.
2. Calibration of single phase energy meter and study of digital energy meter.

3. Measurement of inductance by Maxwell's and Anderson's bridges.
4. Measurement of capacitance by Desauty's and Schering's bridges.
5. Measurement of Reactive power by single wattmeter method.
6. Measurement of Resistance and calibration of Ammeter using D.C. potentiometer.
7. Calibration of voltmeter and wattmeter using D.C. potentiometer.
8. Measurement of frequency of unknown sinusoidal signal with CRO.
9. Measurement of phase and amplitude using CRO.
10. Measurement of R, L, C & Q at 1KHz and 100 KHz frequency of supply by using LCR meter.
11. Displacement measurement using LVDT
12. Measurement of % ratio error and phase angle of given P.T.
13. Measurement of 3 phase power with single watt meter and 2 No's C.T.
14. Calibration of LPF meter by phantom loading.
15. Measurement of Active power by two wattmeter method.

Note : At least 10 experiments should be conducted.

SUGGESTED READING:

1. Shawney A.K., Electrical and Electronics Measurements and Instruments, Dhanpatrai& Sons, Delhi, 2000.
2. Umesh Sinha, Electrical, Electronics Measurement and Instrumentations, Satya Prakashan, New Delhi.