RAMAIAH
Institute of Technology

CURRICULUM

for the Academic year 2019 – 2020

ELECTRICAL AND ELECTRONICS ENGINEERING

VII & VIII SEMESTER B.E

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

About the Institute:

Ramaiah Institute of Technology (RIT) (formerly known as M. S. Ramaiah Institute of Technology) is a self-financing institution established in Bangalore in the year 1962 by the industrialist and philanthropist, Late Dr. M S Ramaiah. The institute is accredited with "A" grade by NAAC in 2014 and all engineering departments offering bachelor degree programs have been accredited by NBA. RIT is one of the few institutes with prescribed faculty student ratio and achieves excellent academic results. The institute was a participant of the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. All the departments have competent faculty, with 100% of them being postgraduates or doctorates. Some of the distinguished features of RIT are: State of the art laboratories, individual computing facility to all faculty members. All research departments are active with sponsored projects and more than 304 scholars are pursuing PhD. The Centre for Advanced Training and Continuing Education (CATCE), and Entrepreneurship Development Cell (EDC) have been set up on campus. RIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with over 1,35,427 books with subscription to more than 300 International and National Journals. The Digital Library subscribes to several online e-journals like IEEE, JET etc. RIT is a member of DELNET, and AICTE INDEST Consortium. RIT has a modern auditorium, several hi-tech conference halls and all are air-conditioned with video conferencing facilities. It has excellent hostel facilities for boys and girls. RIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association. RIT obtained Academic Autonomy for all its UG and PG programs in the year 2007. As per the National Institutional Ranking Framework, MHRD, Government of India, Ramaiah Institute of Technology has achieved 64th rank in 2019 among the top 100 engineering colleges across India.

About the Department:

The department was started in the year 1962 along with the establishment of the college. In 2003, the Department was recognized as a Research Centre by Visvesvaraya Technological University, Belagavi and offers Ph.D and MSc.(Engg.) by research programs. The Department also started a PG program in Computer Applications in Industrial Drives, in 2004. Our UG programme is accredited **by NBA for five years with effect from July 2015.**

The department has 18 well-qualified faculty members. The entire faculty holds postgraduate degree in either Power Systems / Power Electronics. Five of the faculty members are doctorates. Dr. Premila Manohar is Ph.D in HVDC transmission (from HVE, IISc, 1991), Dr. Pradipkumar Dixit is specialized in High Voltage Engineering (Ph.D from Visvesvaraya Technological University, Belagavi, 2009), Dr. Chandrashekhar Badachi is specialized in High Voltage Engineering (Ph.D from Jain University, Bengaluru, 2016) and Dr. Kodeeswara Kumaran is specialized in Power Electronics for Renewable Energy Applications (Ph.D from NITK, Surathkal, 2018). In addition, Dr. G. R. Nagabhushana, with a long record of service (Retired Professor from HVE, IISc) is with the department as Professor Emeritus.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio economic needs.

MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization.
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations.
- Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs.

QUALITY POLICY

We at MS Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

To excel in engineering education and research, inculcating professional ethics in students and emerge as leaders globally in the field of electrical & electronics engineering.

MISSION OF THE DEPARTMENT

The mission of the department is to produce graduates who will

1. Be able to apply their knowledge to identify and solve problems arising in any industry.
2. Be able to contribute to research and developmental activities in frontier areas.
3. Master innovative skills to be entrepreneurs and/or consultants.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO 1: Produce graduates who will have the ability to apply the knowledge of basic Sciences engineering sciences and electrical engineering to excel in professional career.

PEO 2: Produce graduates who will continue to enhance their knowledge.

PEO 3: Produce graduates who are confident to take up diverse career paths.

PEO 4: Produce graduates who will provide leadership and demonstrate the importance of professional integrity.

PROGRAM OUTCOMES (POs):

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: Identify, formulate, analyze, design and implement—electrical and electronics circuits, control systems, drives, power systems and power electronic systems.

PSO2: Use modern tools to solve problems in diverse and multidisciplinary environment.

PSO3: Understand the impact of engineering solutions in societal and environmental context, commit to professional ethics, lifelong learning and communicate effectively.

PSO4: Apply project management techniques to electrical/electronic(s) systems, exhibiting team work.

Curriculum Course Credits Distribution
Batch 2016-20

Semester	Humanities & Social Sciences (HSS)	Basic Sciences/ Lab (BS)	Engineering Sciences/ Lab (ES)	Professional Courses- Core (Hard core, soft core, Lab) (PC-C)	Professional Courses - Electives (PC-E)	Other Electives (OE)	Project Work (PW)	Internship/ other activities (IS/ECA)	Total semester load
First	2	09	14						**25**
Second	2	09	14						**25**
Third		4		21					**25**
Fourth		4		21					**25**
Fifth	2			19	4				**25**
Sixth				15	4		6		**25**
Seventh				14	12				**26**
Eighth						4	14	6	**24**
Total	**06**	**26**	**28**	**90**	**20**	**4**	**20**	**6**	**200**

SCHEME OF TEACHING
VII SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits L	T	P	S	Total	Contact Hours
1.	EE71	Switchgear and Protection	PC-C	3	0	0	1	4	3
2.	EE72	Power Systems-II	PC-C	3	1	0	0	4	5
3.	EE73	High Voltage Engineering	PC-C	3	0	0	1	4	3
4.	EEExx	Department Elective – C	Elective	4	0	0	0	4	4
5.	EEExx	Department Elective – D	Elective	4	0	0	0	4	4
6.	EEExx	Department Elective – E	Elective	4	0	0	0	4	4
7.	EEL74	Protection & High Voltage Lab.	Lab	0	0	1	0	1	2
8.	EEL75	Power Systems Lab.	Lab	0	0	1	0	1	2
			Total	**21**	**1**	**2**	**2**	**26**	

Elective Code	**Elective Title**
EEE01	Solar Photovoltaics
EEE11	Electric Drives
EEE17	Operations Research
EEE20	Generation, Economics & Reliability Aspects Of Power Systems
EEE24	Digital Image Processing
EEE27	Machine Learning

SCHEME OF TEACHING
VIII SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1.	XXOExx	Institutional Elective	OE	**4**	**0**	**0**	**0**	**4**	4
2.	EEIN2/ EEExx	Internship / Departmental Elective (Industry collaborated course)	Internship	**0**	**0**	**4**	**0**	**4**	-
3.	EEP3	Project Work	Project	**0**	**0**	**14**	**0**	**14**	-
Total				**4**		**20**		**24**	

Elective Code	Elective Title
EEE28	Smart Grid
EEE29	Electric Vehicle Technology

VII SEMESTER

SWITCHGEAR AND PROTECTION

Subject Code: EE71 **Credit: 3: 0: 0:1**
Prerequisites: Nil **Contact Hours: 42**
Course Coordinator/s: Sri. Ramakrishna Murthy

Course Content:

Unit I

Switches and Fuses: Isolating switch, Fuse law, cut-off characteristics and time current characteristics, Fuse material, HRC fuse, Liquid fuse, Application of fuse, Selection of fuses.

Principles of Circuit Breakers: Principles of AC circuit breaking, Principles of DC circuit breaking, Arc initiation, maintenance and interruption, Arc interruption theories - slepian's theory and energy balance theory, Re-striking voltage, Recovery voltage, Rate of rise of re-striking voltage, Current chopping.

Unit II

Circuit Breakers: Classification of circuit breakers (CB), Air blast circuit breakers, Air break CB, Oil circuit breakers - single break, double break, minimum oil, SF_6 breaker -properties of SF_6 gas puffer and non-puffer type of SF_6 breakers, Vacuum CB, Operating mechanism of CB, Rating of CB.

Philosophy of protective relaying system: Need for protective system, Types and effects of faults, Zones of Protection, Primary and Back up Protection, Essential qualities of protective relaying, Classification of protective relays, Classification of protective schemes, CT & PT for Protection.

Unit III

Relays: Principle of relay operation, Static relays (block diagrams) – overcurrent, directional, distance relays, Advantages and limitations of static relays, Comparators-duality between amplitude and phase comparators, Rectifier bridge and phase splitting type amplitude comparators, coincidence type phase comparator.

Relay characteristics: Non-directional and Directional overcurrent relays, IDMT and directional characteristics. Differential relay –Types of differential relay, Distance Protection - impedance relay, reactance, Mho relay.

Unit IV

Protection Schemes: Generator protection scheme - stator & rotor protection. Transformer protection - external and internal faults protection, Buchholz Relay, Bus-zone protection - differential current protection, frame leakage protection of busbar, ring main protection, Motor protection - ground fault and phase fault protection, Pilot relaying schemes - circulating current scheme, balanced voltage scheme, Carrier aided distance protection.

Unit V

Numerical Protection: Numerical over current and distance protection (generalized interface).
Wide area measurement application: Introduction, PMU, WAMS architecture, Adaptive relaying - transformer protection, transmission line protection, reclosing, WAMS based protection concepts - supervision of backup zones, intelligent load shedding, load shedding and restoration.

Text Books

1. Badriram and ViswaKharma, '*Power System Protection and Switchgear',* 2nd edition, TMH, 2011.
2. Sunil S. Rao, '*Switchgear and Protection',* 10th edition, Khanna Publishers, 1992.
3. James S. Thorp; Arun G. Phadke, '*Computer Relaying for Power Systems'*, John Wiley & Sons, 2nd edition, 2009.

Reference Books

1. Soni, Gupta and Bhatnagar, '*A Course in Electrical Power'*, 4th edition, Dhanapat Rai Publications, 2010.
2. Y.G. Painthankar and S R Bhide, '*Fundamentals of Power system Protection'*, PHI, 2007.

Course Outcomes (COs):

A student completing this course should be able to:

1. Select a fuse and/or a circuit breaker for a given application. (PO-1) (PSO-1)
2. Distinguish between various types of circuit breakers. (PO-1) (PSO-1)
3. Compare the characteristic of different relays and identify a suitable relay for different zones of protection. (PO-1, 6) (PSO-1)
4. To identify different faults in generator, power transformers, transmission lines, busbars and motors and their protection. (PO-1, 6) (PSO-1)
5. To apply the basic concept of numerical relay and WAMS for protection. (PO-1) (PSO-1)

POWER SYSTEMS – II

Subject Code: EE72 **Credits: 3: 1: 0: 0**
Prerequisites: Nil **Contact Hours: 70**
Course Coordinator/s: Dr. Chandrashekhar Badachi

Course Content:

Unit I

Modeling of transmission lines, off nominal transformer, loads and generator. Formation of Y_{BUS} by method of inspection. Basic concepts of network topology. Formation of Y_{BUS} by method of singular transformation..
Z_{BUS} formation by inverting Y_{BUS} and Z_{BUS} building Algorithm (Without mutual coupling). Computation of 3phase fault current using Z_{BUS} (derivation excluded).

Unit II

Load Flow Studies: Introduction, review of numerical solutions of algebraic equations by iterative methods, power flow equations, and classification of buses, operating constraints and data for load flow study. Load flow solution using Gauss–Seidal method, (numerical problem for not more than 2 iteration), acceleration of convergence. Load flow solution using Newton–Raphson method in polar co-ordinates (numerical problem for 1 iteration only). Fast Decoupled load flow method.

Unit III

Economic Operation of Power System: Introduction, economic generation scheduling neglecting losses and, iterative techniques. Derivation of transmission loss formula. Economic dispatch including transmission losses. Approximate penalty factor. Iterative technique for solution of economic dispatch with losses. Introduction to unit commitment (problem formulation)

Unit IV

Transient Stability Studies: Classical and transient representation of Machine. Numerical solution of swing equation by Point-by-Point method, Modified Euler's method, Runge–Kutta method, Milne's predictor – corrector method. Solution techniques with flowcharts/algorithms.

Unit V

Load Frequency Control: Schematic diagram of automatic load frequency control and automatic voltage control. Generator model, turbine model, and governor model. Block diagram representation of single area ALFC.

Compensation in Power Systems: Introduction, load compensation, line compensation, series compensation and shunt compensators. Principle and operation of converters. Introduction to FACTS Controllers.

Text books

1. Nagrath, I. J., and Kothari, D. P, 'Modern Power System Analysis', TMH, 2003.
2. K.UmaRao, 'Computer Techniques and Models in Power Systems', I.K. International, 2007.
3. Pai, M.A, 'Computer Techniques in Power System Analysis', TMH, 2nd Edition.
4. John Grainger, Jr.,William Stevenson, 'Power System Analysis', McGraw Hill, 1994.
5. Stag, G. W., and El Abiad, A. H. 'Computer Methods in Power System Analysis', McGraw Hill International Student Edition, 1968.

Reference books

1. Singh, L. P, 'Advanced Power System Analysis and Dynamics', New Age International (P) Ltd, New Delhi, 2001.
2. HaadiSadat,'Power System Analysis', TMH, 2nd Edition, 12th Reprint.

Course Outcomes (COs):

After the completion the course, the students will be able to:

1. Formulate the Y_{BUS} and Z Bus. (PO-1) (PSO-1)
2. Obtain load flow solution by Gauss Siedel method, Newton Raphson Method and FDLF Method. (PO-1) (PSO-1)
3. Obtain economic load dispatch of a thermal power plant. (PO-1) (PSO-1)
4. Apply numerical techniques to solve the swing equation and determine the transient stability. (PO-1) (PSO-1)
5. Develop the block diagram of ALFC, evaluate load sharing. (PO-1) (PSO-1)

HIGH VOLTAGE ENGINEERING

Subject Code: EE73 **Credit: 3: 0: 0: 1**
Prerequisites: Nil **Contact Hours: 42**
Course Coordinator/s: Dr.Pradipkumar Dixit & Dr. Chandrashekhar Badachi

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Course Content:

Unit I

Conduction and breakdown in Gases:
Gases as insulating media, Ionization Processes, ionization by collision, Photo-ionization, secondary ionization processes, Electron emission due to positive ion impact, electron emission due to photons, electron emission due to metastable and neutral atoms. Townsend's current growth equation, current growth in the presence of secondary processes. Townsend's criterion for breakdown. Breakdown in electronegative gases, electron attachment process. Time lags for breakdown. Streamer theory of breakdown in Gases, Paschen's law, breakdown in non-uniform fields and corona discharges.

Unit II

Conduction and breakdown in liquid dielectrics:
Liquid as insulation, conduction and breakdown in commercial liquids, suspended particle theory, Bubble theory, stressed oil volume theory.
Breakdown in Solid dielectrics:
Introduction, Intrinsic breakdown, Electromechanical breakdown, Thermal breakdown, breakdown due to treeing and tracking, breakdown due to internal discharges.
Generation of HVDC Voltages:
Half and full wave rectifier circuits, voltage doubler circuit, Cockcroft-Walton voltage multiplier circuit, expression for ripple and voltage drop, Electrostatic generators, Van-de-Graaff generator.

Unit III

Generation of HVAC voltages:
Cascade transformers, Resonant transformers, Generation of high frequency AC high voltages.
Generation of Impulse Voltages:
Standard impulse wave shapes, single stage impulse generator circuits and their analysis, Marx circuit, components of a multistage impulse generator. Generation of switching surges.
Generation of Impulse currents:
Definition of impulse current waveforms, circuit for producing impulse current waves, generation of high impulse currents, generation of rectangular current pulses, Trigatron gap.

Unit IV

Measurement of High Voltages:

High ohmic series resistance with microammeter, Generating voltmeters, Electrostatic voltmeter, Chubb-Fortescue method, Sphere gaps, Potential dividers for impulse voltage measurements, Resistance potential divider for very low impulse voltages and fast rising pulses, Resistance and Capacitance potential dividers with oscilloscope(impedance matching).

Unit V

Non-destructive Testing of Electrical Apparatus:

Measurement of Dielectric constant and loss factor: Low frequency measurement method-More's bridge, power frequency measurement methods – high voltage Schering bridge, Schering bridge arrangement for grounded capacitors

Partial discharge measurements: Introduction, terminology used, Straight discharge detection method, balanced detection method

High Voltage Testing of Electrical Apparatus:

Testing of Insulators, Bushings and Transformers

Text Book

1. M. S. Naidu and V. Kamaraju, '*High Voltage Engineering'*, 3ed, Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2005.

Reference Books

1. E. Kuffel, W. S. Zaengl and J. Kuffel, *"High Voltage Engineering – Fundamentals'*, Second edition 2000, published by Butterworth-Heinemann.
2. C. L. Wadhwa, 'High *Voltage Engineering'*, New Age International (P) Limited, Publishers, 2003.
3. R. S. Jha, '*High Voltage Engineering'*, Dhanpat Rai& Sons, New Delhi, 1984.

Course Outcomes (COs):

At the end of the course, the student is able to:

1. Classify the insulation and analyze the electrical breakdown phenomena in any insulating medium. (PO-1) (PSO 1)
2. Identify the methods for generating High AC & DC Voltages. (PO-1) (PSO 1)
3. Design of circuits for generation of impulse voltages and currents.(PO-1,3) (PSO 1)
4. Explain different techniques for measurement of High Voltages (PO-1) (PSO 1)
5. Identify different types of high voltage testing. (PO-1) (PSO 1)

PROTECTION & HIGH VOLTAGE LAB

Subject Code: EEL74 **Credit: 0: 0: 1: 0**
Prerequisites: Nil **Contact Hours: 28**
Course Coordinator/s: Dr. Pradipkumar Dixit & Sri. C. Ravindra Kumar

LIST OF EXPERIMENTS

1. Over current relay: IDMT non-directional characteristics
2. IDMT characteristics of over voltage or under voltage relay (solid state or electromechanical type)
3. Current-time characteristics of fuse
4. Operating characteristics of microprocessor based(numeric) over-current relay
5. Operating characteristics of microprocessor based(numeric) over/under voltage relay.
6. Motor protection scheme fault studies
7. Field mapping using electrolytic tank for any one-model cable/capacitor/transmission line/sphere gap models.
8. Flashover characteristics of sphere gaps under AC and DC corrected to STP
9. Determine the breakdown strength of transformer oil
10. Flashover characteristics of non-uniform field gaps under HVAC
11. Measurement of HVAC using sphere gaps
12. Determine the breakdown voltage of solid insulations

Course Outcomes (COs):

A student completing this course should be able to:

1. Demonstrate the characteristics of fuse. (PO-1,4,9) (PSO-1)
2. Demonstrate the characteristics of voltage and current relays (PO-1,4,9) (PSO-1)
3. Realize the field distribution of a coaxial cable / parallel plate capacitor. (PO-1,4,9) (PSO-1)
4. Determine the breakdown voltage of air in uniform and non-uniform fields. (PO-1,4,9) (PSO-1)
5. Determine the breakdown voltage/strength of solid and liquid insulations. (PO-1,4,9) (PSO-1)

POWER SYSTEMS LAB

Subject Code: EEL75 **Credit: 0: 0: 1: 0**
Prerequisites: Nil **Contact Hours: 28**
Course Coordinator/s: Dr.Chandrashekhar Badachi

LIST OF EXPERIMENTS

1. To plot Swing curve, find the system stability and Critical clearing time for a SMIB (Using Simulink)
2. Determination of power angle characteristics for salient and non-salient pole synchronous machines
3. Determination of ABCD Parameters, Regulation and transmission efficiency of transmission line (Developing GUI)
4. Optimal generator scheduling for thermal power plant
5. Y-bus formation for power systems without mutual coupling by singular transformation method and inspection method.
6. Fault Analysis (Using standard Software Package)
7. Load flow analysis using Gauss Siedal Method/ Newton–Raphson method

(Two Lab sessions required for each program)

Course Outcomes (COs):

After completion of the course, the students will be able to:

1. Determine the power angle characteristics of synchronous machines. Solve the swing equation and determine the transient stability. (PO-1,5) (PSO-1,2)
2. Determine the transmission line performance. (PO-1,5) (PSO-1,2)
3. Obtain economic load dispatch of a thermal power plant. (PO-1,5) (PSO-1,2)
4. Analyze power system faults. (PO-1,5) (PSO-1,2)
5. Analyze the Power flow of a given system. (PO-1,5) (PSO-1,2)

PROJECT WORK

Subject Code: EEP3 **Credit: 0: 0:14:0**
Prerequisites: Nil **Contact Hours: 78**
Course Coordinator/s: Smt. S. Dawnee

Course Content:

Students will analyze, design and implement ideas pertaining to different aspects of electrical and electronics engineering. They will work in a group of 3/4 to solve a problem of current concern requiring an engineering solution. They are required to follow a systematic approach towards developing the solution by considering technical and non-technical factors. The working model of the solution along with the design documentation will be considered for final evaluation. Emphasis will also be on the skills to communicate effectively and present ideas clearly and coherently in both the written and oral forms.

Course Outcomes (COs):

At the end of the course Students will be able to:

1. Define the problem to be solved in a clear and unambiguous terms. (POs – 1, 2, 3, 4, PSO – 1)
2. Identify and establish the need to solve the problem by gathering relevant literature. (POs – 1, 2, 3, 4, PSO – 1)
3. Describe the proposed design method in terms of technical block diagram or flowchart. (POs – 2, 3, 10, PSOs – 2, 3).
4. Implement and demonstrate the proposed design method using software/hardware tools. (POs – 2, 3, 4, 5, PSOs – 2, 3).
5. Document and present the solution to the peer group. (POs – 9, 10, PSOs – 2, 3)

SOLAR PHOTOVOLTAICS

Subject Code: EEE01 **Credit: 3:0:1:0**
Prerequisites: Nil **Contact Hours: 70**
Course Coordinator/s: Smt. Archana Diwakar

Course content:

Unit I

Introduction: Introduction to photovoltaic (PV) systems. Historical development of PV systems. Overview of PV usage in the world.
Nature of Solar Radiation: Irradiance, Solar Radiation Geometry, Solar Radiation measurements, estimating solar radiation, sun tracking.

Unit II

The Physics of the Solar Cell: Photovoltaic effect, working of a solar cell, modeling of solar cells, effects of temperature, irradiation, losses in a solar cell, theoretical cell efficiency, PV module power output
Losses and Efficiency Limits: thermodynamic limit, The Shockley-Queisser Limit, Other Losses, Design Rules for Solar Cells

Unit III

PV Technology: Crystalline Silicon Solar Cells, Thin-film solar cells, III-V PV technology, Organic cells, thermo photovoltaics, Dye sensitized solar cell, Third Generation Concepts- Multi-junction solar cells, Spectral conversion, Multi-exciton generation, Intermediate band solar cells, Hot carrier solar cells
Solar PV modules: Series and parallel connection of solar cells, shaded and faulty cell effects
Solar PV systems: Standalone PV system, Hybrid PV system, Grid-connected PV system, grid integration issues

Unit IV

Balance of solar PV system: Batteries for PV systems, Basics of DC-DC converters, charge controllers, Power conditioning and maximum power point tracking (MPPT) algorithms, inverters, inverter protection, cabling, circuit breakers, lightning and surge protection, isolators, mounting systems, system monitoring, metering, net metering, gross metering
Solar Project Execution: site assessment**,** designing grid-connected system, sizing a PV system
installing grid-connected system, commissioning, operation & maintenance, solar micro-grid

Unit V

Marketing and economics of grid-connected PV systems: valuing a PV system, simple payback and financial incentives, feed-in tariff, rebates, tax incentives, renewable portfolio standards and renewable energy certificates, marketing, insurance, policies, regulation, national solar mission, solar village model
Case studies

List of experiments

1. Single PV module I-V and P-V characteristics. (with radiation and temperature changing effect)
2. I-V and P-V characteristics with series and parallel combination of modules.
3. Effect of shading and tilt angle.
4. Battery charging and discharging characteristics.
5. Demo of only DC load system with and without battery. (with variable rated capacity of system)
6. Demo of only AC load system with and without battery.
7. Combine AC and DC load system with and without battery.
8. Find the MPP manually by varying the resistive load across the PV panel.
9. Find the MPP by varying the duty cycle of DC-DC converter.

Text Books

1. Chetan solanki, **'***Solar Photovoltaics : Fundamentals, Technologies And Application',* 2nd edition 2011
2. Jenny Nelson, "*The physics of solar cells'*, Imperial college press 2008

Reference Books

1. SR. Wenham, M.A. Green, M.E. Watt, R.Corkish, A.Sproul, '*Applied Photovoltaics'*. 2nd Edition 2003
2. Antonio Luque, Steven Hegedus, **'***Handbook of Photovoltaic Science and Engineering',Wiley.2007*

Course Outcomes (COs):

At the end of the course, the student will be able to:

1. Comprehend the basic nature of solar radiation and various aspects of sun tracking (PO 1) (PSO 1)
2. Determine the properties of semiconductors and characteristics of solar cells. (PO 1,4) (PSO 1)
3. Analyze the basic design of both stand alone and grid connected systems. (PO 3,5) (PSO 1)
4. Evaluate the requirements for construction, electrical connection, operation and maintenance of PV systems. (PO 1,4) (PSO 1)
5. Gain hands-on experience on solar module characteristics and PV system performance through lab experiments and mini-projects. (PO 3,4, 9) (PSO 1)

ELECTRIC DRIVES

Subject Code: EEE11 **Credit: 4: 0: 0: 0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator/s: Dr.Kodeeswara Kumaran G/ Smt.Archana Diwakar

Course content:

Unit – I

Introduction to Electrical drives

Introduction, advantages of electrical drives, parts of electrical drives, choice of electrical drives, status of dc and ac drives, dynamics of electrical drives, fundamental torque equation, components of load torque, nature and classification of load torques, speed-torque conventions and multi-quadrant operation, equivalent values of drive parameters.

Unit - II

DC Drives

Basic Concepts: Speed torque characteristics, starting, braking and speed control techniques of shunt/separately excited dc motor (theory only).

Rectifier controlled dc drives: Types of rectifiers- review, fully controlled rectifier fed dc drives, half controlled rectifier fed dc drives, multi-quadrant operation of rectifier controlled dc drives.

Chopper controlled dc drives: Types of choppers – review, chopper controlled dc drives – motoring and braking operation, multi-quadrant operation of chopper controlled dc drives.

Unit - III

AC Drives

Basic Concepts: Speed-Torque characteristics of induction motors. Concept of induction motor starting. Types of starter - star delta, auto transformer, reactor, part winding, rotor resistance. Concept of induction motor braking. Methods of braking - regenerative, plugging, dynamic braking (theory only)

Speed control techniques: Rotor resistance control, Stator voltage control, stator frequency control, V/f control.

Static converter control of induction motors: ac voltage regulator control, voltage source inverter control, cycloconverter control.

Unit – IV

Special Machine Drives

Synchronous motors: Construction, operation from fixed frequency supply – starting, pulling in, braking. Synchronous motor variable speed drives. Self-controlled synchronous motor drive employing load commutated thyristor inverter.

DC brushless motors: Construction, speed-torque characteristics, brushless dc motor controllers – rotor position measurement, commutation logic, speed controller.

Unit – V

Stepper Motor Drives: Principle of operation of stepper motor, single stack variable reluctance motors, speed torque characteristics, control of stepper motors, unipolar and bipolar drive circuits

Selection of motor power rating: Thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating.

Selection of parts, control technique for a given drive specification.

Text Book

1. G.K Dubey, *Fundamentals of Electrical Drives*, Narosa publishing house Chennai, 2 Edition, 5th reprint.
2. Mohamed A. El-Sharkawi, *Fundamentals of Electric Drives*, Thomson Learning, 2002

Reference Books

1. Dave Polka, *Motors and Drives: A Practical Technology Guide*, The Instrumentation, Systems and Automation Society, 200.
2. N.K De and P.K. Sen, *Electrical Drives*, PHI, 2007.
3. M.H.Rashid, '*Power Electronics: Circuits, Devices and Applications*', Pearson Education, 3rd Edition.

Course Outcomes (COs):

The course will enable the student to:

1. Describe and analyze the operation of electric drive systems. (PO-1,2)(PSO-1)
2. Elucidate the operating principles of dc and ac drives and solve problems related to it. (PO-1,2) (PSO-1)
3. Explain the functions of drive components and operating principles of special machine drives. (PO-1) (PSO-1)
4. Determine the design parameters for a given drive system specification. (PO-3) (PSO-1)

OPERATIONS RESEARCH

Subject Code: EEE17 **Credits: 4:0:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator/s: Sri. Ramakrishna Murthy

Course content:

Unit I

Introduction: Definition, scope of operations Research (O.R), approach & limitations of O.R Models, Characteristics and Phases of O.R.
Linear programming problems: Mathematical formulation of L.P problems, graphical solution methods, special cases in graphical methods. The simplex method, concept of duality, two phase method, Big M method, dual simplex method, degenerate and procedure for resolving degenerate cases. (Excluding theorems)

Unit II

Transportation Problems: Basic Feasible solutions by different methods, Fixing optimal solutions-stepping stone method, MODI method, degeneracy, unbalanced assignment problems, travelling salesman problems.

Unit III

Game Theory: Two person zero sum game, The Max-Min, Mini-Max principles, game without Saddle Points, graphical Solutions, dominance property.
Waiting Lines: Operating systems & their characteristics, Poisson queues, M/M/1 queuing Systems, M/M/K Model. Application to power systems. (excluding derivations)

Unit IV

Replacement Model: Replacement of items whose maintenance cost increases with time i) When value of money does not changes with time ii) When value of money changes with time, replacement of items that fail suddenly and group replace policy.
Inventory: Deterministic models with & without shortages, replenishment, meantime, ordering cost, carrying cost, EOQ.

Unit V

PERT-CPM Technique: Network constructions, determining critical path, Floats, scheduling by network, project duration, variance under probabilistic modes, prediction of date of completion, crashing of simple networks, resource leveling by network techniques.

Text Books

1. S.D.Sharma, "*Operation Research*", Kedaranath & Ramnath Publications, 5th edtion 2005
2. Kanti Swaroop, "*Operation Research*", Sultan Chand Publications 8th edition 2000.

Reference Books

1. Philip Ravindran, "*Operation Research*", Wiley Publications, 2nd edition 1987.
2. Hamid Taha, "*Introduction to Operation Reaserch*", Pearson 7th edition, 2005.

Course Outcomes (COs):

A student completing this course should be able to:

1. Formulate and solve linear programming models. (PO-1,2,11) (PSO-2)
2. Solve transportation and waiting line models. (PO-1,11) (PSO-2)
3. Obtain PERT network and recognize Critical path for a given project. (PO-1,2,11)_(PSO-2)
4. Apprehend proper strategy for a given game. (PO-1,11)_ (PSO-2)
5. Recognize the replacement period of a machine/equipment and EOQ. (PO-1,11)_ (PSO-2)

GENERATION, ECONOMICS & RELIABILITY ASPECTS OF POWER SYSTEMS

Subject Code: EEE20 | **Credit: 4: 0: 0: 0**
Prerequisites: Nil | **Contact Hours: 56**
Course Coordinator/s: Sri.Vinayaka Rao V

Course content:

Unit I

Generating station: Steam station: Advantages, disadvantages, block diagram, choice of site, efficiency, equipment.
Hydroelectric station: Advantages, disadvantages, block diagram, choice of site, equipment.
Diesel station: Advantages, disadvantages, block diagram.
Nuclear station: Advantages, disadvantages, block diagram, selection of site.
Comparison of various power plants
Environmental pollution and its control: Control of pollutants from steam power plant Nuclear power plant, Socio economic impacts of Power plants, Restructuring of power sectors for the Environmental benefits

Unit II

Economic aspects: Important terms and factors, load curves, types of loads, Numerical. Points in selection of units, advantages of interconnected systems, Numerical.
Economics of power generation: cost of electrical energy, expressions for the cost of electrical energy, methods of determining depreciation, Numerical.
Tariff: Desirable characteristics of Tariff, types of tariff, Numerical,
Power factor improvement :Methods, advantages ,Economics of Power Factor Improvement, Numerical
Introduction to energy market.

Unit III

Reliability aspects : Basic power system reliability aspects: probabilistic evaluation of power systems, adequacy and security, need for power system reliability evaluation, functional zones, hierarchical levels, reliability cost/reliability worth, reliability data, reliability test systems.
Generation system adequacy evaluation: Analysis of IEEE reliability test systems, LOLE analysis of the base case, effect of rounding, derated states, load forecast uncertainty, scheduled maintenance, peak load etc. Numerical.

Unit IV

Montecarlo simulation: modeling, convergence & computing time, advantages and disadvantages.

Composite System adequacy evaluation: Factors in contingency enumeration approach, appropriate network solution technique, appropriate load curtailment philosophies, effect of load curtailment passes, appropriate contingency levels, station originated outages. Comparison between ENEL & U of S approach. Numerical.

Unit V

Distribution System adequacy evaluation: Definition of basic distribution indices, Numerical

Assessment of reliability worth: Interruption costs for commercial, industrial, residential customers. customer damage function. Interruption energy assessment rate.

Smart Grid: Introduction, Functional units of smart grid

Reliability in Smart Grid: Preliminaries on reliability Quantification, System adequacy Quantification, Congestion Prevention: An Economic Dispatch Algorithm**.**

Text books

1. V.K.Mehta, *Principles of power systems,* S Chand Publishers, 2005
2. Roy Billington& Alan, *Reliability Assessment of large power systems*, Kluwer Academic Press 1989.
3. James Momoh, "*SMART GRID Fundamentals of Design and Analysis*", IEEE-press, Wiley Publishers, 2012.
4. K G Boroojeni "*Smart Grids :Security and Privacy Issues*" Springer Publication, 2017

Reference books

1. G.R.Nagapal, *Power plant engineering,* 14th edition, Khanna Publishers, 2000.
2. Arora and Doomkundwar, *A course in power plant engineering*, Dhanpat Rai publishers, 2001.

Course Outcomes (COs):

At the end of the course, the student is able to:

1. Describe and compare different types of power generation, the equipment used, environmental aspects (PO-1,10) (PSO-1,3)
2. Apply the concepts of economic aspects of power generation to determine the cost of electrical energy, depreciation tariffs and Power Factor improvement (PO-1,2) (PSO-1)
3. Apply the reliability concepts to different hierarchy levels of power systems (PO-1,2) (PSO-1)
4. Evaluate the adequacy of HLI, HL II and HL III by determining their reliability indices (PO-1,2) (PSO-1)
5. Assess interruption cost for different types of customers. (PO-1,2) (PSO-1).

DIGITAL IMAGE PROCESSING

Subject Code: EEE24 **Credits: 3: 0: 1: 0**
Prerequisites: Nil **Contact Hours: 70**
Course Coordinator/s: Smt. Kusumika Krori Dutta

Course content:

Unit I

Digital Image Fundamentals: What is Image Processing? Fundamental steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic relationships between Pixels, Linear and nonlinear operations.

Unit II

Image Enhancement in Spatial Domain: Image Enhancement in Spatial Domain, Some basic Gray level transformations, Histogram processing, Enhancement using arithmetic/logic operations.
Transform operations, Multi-spectral image enhancement, false color and Pseudo-color, Color Image enhancement.

Unit III

Spatial Filtering : Basics of Spatial filtering , Smoothing spatial filters, Sharpening spatial filters.
Image Enhancement in frequency domain, Smoothing frequency domain filters, Sharpening frequency domain filters. Constrained least squares filtering , Geometric mean filter.

Unit IV

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, Thresholding region based segmentation. Segmentation using morphological watersheds, Some basic morphological algorithms.
Introduction of Image restoration.

Unit V

Image Transforms: Two-dimensional orthogonal & unitary transforms, properties of unitary transforms, two dimensional discrete Fourier transform, Discrete cosine transform, Sine transform, Hadamard transform, Haar transform, KL transform.

Lab Experiments

1. Basic concepts of Images: Read and display, information about the image.
2. Image display: Basics, bit planes, quantization and dithering.
3. Point processing: Arithmetic operation, image negative.
4. Filtering, create filters, high and low pass filters.
5. Image geometry: Scaling smaller, rotation.
6. The Fourier transform: two dimensional DFT.
7. Image segmentation : thresholding, edge detection.
8. Canny edge detection, second derivatives.

Text Book

1. Rafael C. Gonzalez and Richard E. Woods," Digital Image Processing", Pearson Education, I Ed, 2001 , ISBN-13:9780131687288

Reference Book

1. Anil K. Jain, " Fundamentals of Digital Image Processing", Pearson Education, PHI, 2001, ISBN-13:9780133361650

Course outcomes (COs):

At the end of the course the student will be able to:

1. Describe the processes of Image acquisition and understand processes involved in Image Processing. (PO 1) (PSO-1)
2. Enhance the image in spatial domain extract the information from the given image. (PO 1, 2) (PSO-1)
3. Enhance the image using different filters. (PO 2, 5) (PSO-1)
4. Extract image features, segmentation and texture from an image. (PO 2, 5)(PSO-1)
5. Analyze different types of Image transforms. (PO 2) (PSO-1)

MACHINE LEARNING

Subject Code: EEE27 **Credits: 3: 1: 0: 0**
Prerequisites: Nil **Contact Hours: 70**
Course Coordinator/s: Smt. Kusumika Krori Dutta

Course contents:

Unit I

Introduction: Probability theory, what is machine learning, example machine learning applications
Supervised Learning: Learning a class from examples, VC dimension, PAC learning, Noise, Learning multiple classes, Regression, Model selection and generalization

Unit II

Bayesian Learning: Classification, losses and risks, utility theory MLE, Evaluating an estimator, Bayes estimator, parametric classification
Discriminant functions: Introduction, Discriminant functions, Least squares classification,
Fisher's linear discriminant, fixed basis functions, logistic regression

Unit III

Multivariate methods: Multivariate data, Parameter Estimation, Estimation of Missing Values, Multivariate Normal Distribution, Multivariate Classification, Tuning Complexity,
Discrete Features, Multivariate Regression
Non-parametric methods: Nearest Neighbor Classifier, Nonparametric Density Estimation

Unit IV

Maximum margin classifiers: SVM, Introduction to kernel methods, Overlapping class distributions, Relation to logistic regression, Multiclass SVMs, SVMs for regression
Mixture models and EM: K – means clustering, Mixture of Gaussians, Hierarchical Clustering, Choosing the Number of Clusters

Unit V

Dimensionality reduction: Combining Model Regression with sampling, Bayes classifier, Perceptron algorithm and clustering algorithms.

Text books

1. Ethem Alpaydin, "*Introduction to Machine Learning*", Second Edition, PHI Learning Pvt. Ltd, 2010.
2. Christopher Bishop, "*Pattern Recognition and Machine Learning*", CBS Publishers & Distributors, 2010.

Course Outcomes (COs):

At the end of the course, a student should be able to:

1. Explain the concepts and issues of learning systems. (PO1)(PSO 2)
2. Evaluate decision tree based learning algorithm. (PO2) (PSO 2)
3. Evaluate Bayesian learning algorithm. (PO2) (PSO 2)
4. Determine sample complexity for infinite hypothesis spaces. (PO1) (PSO 2)
5. Evaluate rule- based learning algorithm. (PO1) (PSO 2)

SMART GRID

Subject Code: EEE28 **Credits: 4:0:0:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator/s: Dr. Pradipkumar Dixit

Course content:

Unit I

Introduction: Today's grid versus the smart grid, Computational intelligence, Power system enhancement, Communication and standards, Working definition of the smart grid based on performance, Functions of smart grid components.
Smart Grid Communications and Measurement Technology: Communication and measurement, Monitoring, PMU, smart meters, and measurements technologies, GIS and google mapping tools, Multi-Agent Systems (MAS) technology, Microgrid and smart grid comparison.

Unit II

Performance Analysis Tools for Smart Grid Design: Introduction to load flow studies, Challenges to load flow in Smart Grid, Weaknesses of the present load flow methods, Load flow state of the art: Classical, Extended formulations, and algorithms, Congestion management effect, Load flow for smart grid design, DSOPF application to the smart grid, Static Security Assessment (SSA) and Contingencies and their classification, Contingency studies for the smart grid.
Interoperability, Standards, and Cyber Security: Introduction, Interoperability, Standards, smart grid cyber security, cyber security and possible operation for improving methodology for other users.

Unit III

Stability Analysis Tools for Smart Grid: Introduction to stability, Strengths and weaknesses of existing voltage stability analysis tools, Voltage stability assessment techniques, Voltage stability indexing, Analysis techniques for steady-state voltage stability studies, Voltage stability assessment, Application and implementation plan of voltage stability, Optimizing stability constraint through preventive control of voltage stability, Angle stability assessment (only definition), State estimation (only definition).

Unit IV

Computational Tools for Smart Grid Design: Introduction to computational tools, Decision Support tools (DS), Optimization techniques, Classical optimization method, Heuristic optimization, Evolutionary computational techniques, Adaptive dynamic programming techniques, Hybridizing optimization techniques and applications to the smart grid, Computational challenges.

Unit V

Pathway for Designing Smart Grid: Introduction to smart grid pathway design, Barriers and solutions to smart grid development, General level automation, Bulk power systems automation of the smart grid at transmission level, Distribution system automation requirement of the power grid, End user/appliance level of the smart grid, Applications for adaptive control and optimization.

Textbook

1. James Momoh, "*SMART GRID Fundamentals of Design and Analysis*", IEEE-press, Wiley Publishers, 2012.

Course Outcomes (COs):

A student completing this course should be able to:

1. Identify different communication and measurement technology used in smart grid. (PO – 1) (PSO 1)
2. Understand various aspects of cyber security. (PO-3, 6) (PSO 1)
3. Analyze various available tools for the design and stability aspects of smart grid. (PO-1) (PSO 1)
4. Apply different computational techniques for smart grid design. (PO-1, 3) (PSO 1)
5. Discuss pathway for designing smart grid at transmission and distribution level. (PO-1, 3) (PSO 1)

ELECTRIC VEHICLE TECHNOLOGY

Subject Code: EEE29 **Credits: 4: 0: 0: 0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator/s: Smt. Kusumika Krori Dutta

Course content:

Unit I

Introduction to IC Engines Basics, Energy Consumption for cycles, Limitations with Present Technology - Fuel Shortage, Mechanical Efficiency along with Hybrid & Electric Vehicle Systems.

Introduction to Electric Vehicles: History of Electric Vehicles (EV), Hybrid Electric Vehicles (HEV) , Social and environmental importance of electric and hybrid electric vehicles

Unit II

Modelling & Simulation, Analytical & Mathematical Calculations & Modelling of HEVs, Comparative Study of Analytical vs Actual Working Model of HEV, Need of Simulation & Challenges.

Unit III

Battery Technologies: Types of Batteries, Architecture, Battery Charging & Discharging Cycles, Use of Batteries in Powertrain Battery Modelling & Management Systems (BMS).

Unit IV

Architecture Development of HEVs: Thermal Management for Motor & Batteries.
Control System for HEVs (ECU Architecture, Sensors & Actuators), Control Strategy, Torque Distribution, ABS/ESP

Unit V

Electric Motors, Generators, & Power Electronics:
Electric Motors- AC/DC Motors/ Generators, Brushed DC Motor/ Brushless DC Motor - Torque Characteristics, Actuators & Capacitors., DC-AC & AC-DC Convertors,

Text Books

1. James Larminie, John Lowry, *Electric Vehicle Technology Explained*, John Wiley & Sons Ltd, 2nd ed., 2012.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, *Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design*, CRC Press Taylor & Francis Group, 2004.
3. Iqbal Hussein, *Electric and Hybrid Vehicles: Design Fundamentals*, CRC Press Taylor & Francis Group, 2003.

Reference Books

1. Ali Emadi, *Handbook of Automotive Power Electronics and Motor Drives*, CRC Press Taylor & Francis Group, 2005.
2. C.C. Chan and K.T. Chau, *Modern Electric Vehicle Technology*, Oxford University Press, 2001.
3. Allen Fuhs, *Hybrid Vehicles and the Future of Personal Transportation*, CRC Press Taylor & Francis Group, 2009.

Course Outcomes (COs):

The students will be able to:
1. Recognize the evolution of electric vehicles and explain EV and HEV configurations. (PO1)(PSO1).
2. Understand the working, modeling and analysis of HEV. (PO1) (PSO1).
3. Understand different aspects of Industrial safety and standards. (PO1) (PSO1).
4. Understand Battery Modelling & Management Systems. (PO1,2) (PSO1).
5. Develop architecture of HEV and apply electronic control unit for HEVs. (PO1) (PSO1).
6. Understand different aspects of Electrical machines and power electronic devices used in EV and EHV. (PO1)(PSO1).

Open Electives offered to other Departments

ARTIFICIAL NEURAL NETWORKS

Subject Code: EEOE03 **Credits: 4: 0: 0: 0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator/s: Smt.Kusumika Krori Dutta

Course content:

Unit I

Introduction, Fundamental concepts and Models of Artificial Neural systems, Biological Neural Networks, Typical Architectures, Setting the Weights, Common Activation Functions, Mc-Culloch –Pitts model- AND gate, OR gate, AND-NOT gate, XOR gate.

Unit II

Simple neural nets for Pattern Classification, Hebb net, examples, Single Layer Perceptron Classifiers, Single Layer Feedback Networks, examples, Perceptron learning.

Unit III

Pattern associations, applications, Training algorithm, Hebb rule &Delta rule, Classification of associative memory, Hetero associative neural net architecture, Examples with missing and mistake data, Auto associative net architecture, Examples with missing and mistake data, Storage capacity.

Unit IV

Recurrent linear auto associator, Examples, Discrete Hopfield net, Examples with missing and mistake data, Bidirectional associative net, architecture, Examples with missing and mistake data, Hamming distance, Fixed weight competitive nets, Architecture, applications.

Unit V

Self-organizing maps, architecture, applications, examples, back propagation neural net, architecture, Application, Introduction to Boltzman machines, Example, Applications of neural nets in different fields

Text Books

1. Laurene Fausett, ‘Fundamentals of Neural Networks: Architecture, Algorithms and Applications’, Person Education, 2004.
2. Simon Hayking, ‘Neural Networks: A Comprehensive Foundation’,2nd Ed., PHI.
3. S.N Sivanandam, S Sumathi, S.N Deepa, ‘ Introduction to Neural Net using Matlab 6.0’, TMH, 2008.

Course Outcomes (COs):

The course enables the students to:

1. Describe the relation between real brains and simple artificial neural network models. (PO-1) (PSO-1)
2. Design basic model of logic gates and circuits using Perceptron, Hebbian algorithm and McCulloch -Pitt's models. (PO-1,3) (PSO-1,2)
3. Identify the main implementation issues for common neural network systems (PO-1) (PSO-1)
4. Apply the models of ANN in different areas like optimization of efficiency (PO-1) (PSO-1)
5. Apply ANN models to data compression, pattern identification, etc. (PO-1) (PSO-1)