PRASAD V. POTLURI
SIDDHARTHA INSTITUTE OF TECHNOLOGY
(AUTONOMOUS)
Kanuru.Vijayawada-520007
AICTE approved, NBA & NAAC accredited, An ISO 9001-2008 certified Institution
Permanent Affiliation to JNTUK, Kakinada.
Ph: 0866-2581699, e-mail: principal@pvpsiddhartha.ac.in, web: www.pvpsiddhartha.ac.in

ELECTRICAL AND ELECTRONICS ENGINEERING

SYLLABUS BOOK

(PVP 14)

B.TECH FOUR YEAR DEGREE COURSE

Sponsored by
Siddhartha Academy of General & Technical Education
VIJAYAWADA

Department Vision

To mould young and fresh minds into well disciplined and competent engineers to excel in the field of Electrical & Electronics Engineering to cater the industrial/ societal needs and compete at global level.

Department Mission

- To produce competent and quality technical professionals with strong basics of electrical engineering principles and techniques.
- To facilitate the students to work with modern tools, state of art technologies, innovative research capabilities besides inculcating leadership abilities and ethical values.

Program Educational Objectives

PEO I : Have a strong foundation in engineering fundamentals, mathematics, basic sciences, humanities and modern software tools with ability to apply them to conceive, analyze, design and implement solutions to problems in electrical engineering field.

PEO II : Have a broad based background to practice electrical engineering in the areas of control systems, machines, measurements, power systems, power electronics and their applications in industry and government sectors meeting the growing expectations of stake holders.

PEO III : Have requisite skills to excel in a multidisciplinary engineering environment with awareness of contemporary issues, professional responsibility, impact of technology on society, and the need for life-long learning.

PEO IV : Have an ability to pursue higher studies to meet the needs of global standards and participate in team oriented, open ended activities both as team members and as leaders with professional communication skills to compete in global scenario.

Program Outcomes (POs)

PO1. Ability to exhibit the knowledge of science, mathematics, engineering, communication and programming skills to model and analyze physical systems.

PO2. Ability to achieve competence to identify, formulate and solve electrical engineering problems by applying first principles including open ended problems.

PO3. Ability to design and conduct experiments for electrical systems as well as multidisciplinary systems to analyze and interpret data.

PO4. Ability to have knowledge of contemporary issues in engineering.

PO5. Ability to use modern design, analysis, modeling and simulation techniques, and computing tools necessary for engineering practice.

PO6. Ability to exhibit the knowledge to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PO7. Ability to understand the broad impact of Engineering in a Global, Economic, Environmental, and Societal context

PO8. Ability to develop practical solutions for electrical engineering problems under holistic professional and ethical constraints.

PO9. Ability to function effectively on multidisciplinary teams.

PO10. Ability to communicate, articulately and effectively in both verbal and written forms by using modern communication tools.

PO11. Ability to apply engineering economics and management principles to lead projects effectively.

PO12. Ability to recognize the need of life-long learning and engage in research and self education.

Department of Electrical and Electronics Engineering
Course Structure (effective from Academic Year 2014-15)

I/IV B. Tech - First Semester

Subject Code	Subject	Periods/Week		Marks			Credits
		Theory	Lab/ Practice	Internal	External	Total	
EE1T1	Engineering Mathematics – I	3+1*	-	30	70	100	3
EE1T2	English for communication	3	-	30	70	100	3
EE1T3	Engineering Physics	3+1*	-	30	70	100	3
EE1T4	Environmental studies	3	-	30	70	100	3
EE1T5	Electrical Engineering Materials	3+1*	-	30	70	100	3
EE1T6	Introduction to Electrical engineering	3+1*	-	30	70	100	3
EE1L1	English Language Communication skills lab	-	3	25	50	75	2
EE1L2	Engg Workshops	-	3	25	50	75	2
EE1L3	Engg., Graphics lab		3	25	50	75	2
		22	**9**	**255**	**570**	**825**	**24**

I/IV B. Tech - Second Semester

Subject Code	Subject	Periods/Week		Marks			Credits
		Theory	Lab/ Practice	Internal	External	Total	
EE2T1	Engineering Mathematics –II	3+1*	-	30	70	100	3
EE2T2	Professional Ethics	3	-	30	70	100	3
EE2T3	Engineering Chemistry	3+1*	-	30	70	100	3
EE2T4	Basic Electronic Devices & Circuits	3+1*	-	30	70	100	3
EE2T5	Electrical Circuit Analysis - I	3+1*	-	30	70	100	3
EE2T6	C programming	3+1*	-	30	70	100	3
EE2L1	Physics/Chemistry Lab	-	3	25	50	75	2
EE2L2	Advanced English Communication skills lab	-	3	25	50	75	2
EE2L3	C programming lab	-	3	25	50	75	2
Total		**23**	**9**	**255**	**570**	**825**	**24**

II/IV B. Tech - First Semester

Subject Code	Subject	Periods/Week		Marks			Credits
		Theory	Lab/ Practice	Internal	External	Total	
EE3T1	Numerical methods & differential equations	3+1*	-	30	70	100	3
EE3T2	Electrical Machines – I	3+1*	-	30	70	100	3
EE3T3	Thermal & Hydro prime movers	3+1*	-	30	70	100	3
EE3T4	Electrical Circuit analysis-II	3+1*	-	30	70	100	3
EE3T5	Electromagnetic Fields	3+1*	-	30	70	100	3
EE3T6	Switching Theory and Logic Design	3+1*	-	30	70	100	3
EE3L1	Electrical Circuits lab	-	3	25	50	75	2
EE3L2	EDC Lab	-	3	25	50	75	2
Total		**24**	**6**	**230**	**520**	**750**	**22**

II/IV B. Tech - Second Semester

Subject Code	Subject	Periods/Week		Marks			Credits
		Theory	Lab/ Practice	Internal	External	Total	
EE4T1	Complex variables &special functions	3+1*	-	30	70	100	3
EE4T2	Electrical Machines – II	3+1*	-	30	70	100	3
EE4T3	Electrical Power Generation	3+1*	-	30	70	100	3
EE4T4	Electrical Measurements & Instrumentation	3+1*	-	30	70	100	3
EE4T5	Control systems	3+1*	-	30	70	100	3
EE4T6	Pulse and Digital Circuits	3+1*	-	30	70	100	3
EE4L1	Electrical Machines Lab-I	-	3	25	50	75	2
EE4L2	Electrical Measurements Lab	-	3	25	50	75	2
Total		**24**	**6**	**230**	**520**	**750**	**22**

III/IV B. Tech - First Semester

Subject Code	Subject	Periods/Week		Marks			Credits
		Theory	Lab/ Practice	Internal	External	Total	
EE5T1	Industrial organization and Engineering Economics	3+1*	-	30	70	100	3
EE5T2	Electrical Machines – III	3+1*	-	30	70	100	3
EE5T3	Utilization of electrical energy	3+1*	-	30	70	100	3
EE5T4	Power Electronics	3+1*	-	30	70	100	3
EE5T5	Transmission and distribution	3+1*	-	30	70	100	3
EE5T6	Linear &Digital Integrated Circuit Applications	3+1*	-	30	70	100	3
EE5L1	Electrical Machines Lab-II	-	3	25	50	75	2
EE5L2	LDIC Lab	-	3	25	50	75	2
EE5L3	Control systems Lab	-	3	25	50	75	2
Total		**24**	**9**	**255**	**570**	**825**	**24**

III/IV B. Tech - Second Semester

Subject Code	Subject	Periods/Week		Marks			Credits
		Theory	Lab/ Practice	Internal	External	Total	
EE6T1	Digital signal processing	3+1*	-	30	70	100	3
EE6T2	Electrical Machine Design	3+1*	-	30	70	100	3
EE6T3	Microcontrollers and applications	3+1*	-	30	70	100	3
EE6T4	Power Semiconductor Drives	3+1*	-	30	70	100	3
EE6T5	Power system analysis	3+1*	-	30	70	100	3
EE6T6	Free elective	3+1*	-	30	70	100	3
EE6L1	Electrical Machines lab - III	-	3	25	50	75	2
EE6L2	Power Electronics and drives lab	-	3	25	50	75	2
EE6L3	Personality development / Softskills course	-	3	-	-	-	-
Total		**24**	**9**	**230**	**520**	**750**	**22**

Free elective

EE6T6FE1 MAT Lab programming and Applications (open to all)
EE6T6FE2 Automatic control systems (Except EEE)
EE6T6FE3 Utilization of Electrical Power (Except EEE)
EE6T6FE4 Renewable sources of energy (Except EEE)

IV/IV B. Tech - First Semester

Subject Code	Subject	Periods/Week		Marks			Credits
		Theory	Lab/ Practice	Internal	External	Total	
EE7T1	Power System Operation & Control	3+1*	-	30	70	100	3
EE7T2	HVDC transmission	3+1*	-	30	70	100	3
EE7T3	Switchgear and protection & carrier communication	3+1*	-	30	70	100	3
EE7T4	Flexible AC transmission systems	3+1*	-	30	70	100	3
EE7T5	Elective – I	3+1*	-	30	70	100	3
EE7T6	Elective – II	3+1*	-	30	70	100	3
EE7L1	Microcontrollers Lab	-	3	25	50	75	2
EE7L2	Electrical power systems Lab	-	3	25	50	75	2
EE763	Electrical Simulation lab	-	3	25	50	75	2
Total		**24**	**9**	**255**	**570**	**825**	**24**

Elective - I
EE7T5A Computer methods in Power systems
EE7T5B VLSI
EE7T5C Database managements systems
EE7T5D Oops through JAVA

Elective - II
EE7T6A Electrical Distribution systems
EE7T6B Programmable logic controllers
EE7T6C Power System Deregulation
EE7T6D EHVAC Transmission

IV/IV B. Tech - Second Semester

Subject Code	Subject	Periods/Week		Marks			Credits
		Theory	Lab/ Practice	Internal	External	Total	
EE8T1	Renewable sources of energy	3+1*	-	30	70	100	2
EE8T2	Elective-III	3+1*	-	30	70	100	3
EE8T3	Elective-IV	3+1*	-	30	70	100	3
EE8PW	Project Work	-	9	100	200	300	9
Total		**12**	**9**	**190**	**410**	**600**	**18**

Elective III
EE8T2A – Power Systems Dynamics and Stability
EE8T3B – Power Quality
EE8T3C – Smart Grid
EE8T3D – Energy Audit, Conservation and Management

Elective IV
EE8T4A – Digital Control Systems
EE8T4B – Real Time Control of Power Systems
EE8T4C – Artificial Intelligence Techniques in Elec. Engg.,
EE8T4D – Special Electrical Machines

1/4 B.Tech. FIRST SEMESTER
ENGINEERING MATHEMATICS – I

EE1T1 **Credits: 3**
Lecture: 3 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objectives:

- To achieve skills in differential, integral, vector calculus which will enable them to solve engineering problems
- To get introduction to the concepts of Laplace transforms its applications to various problems

Course Outcomes:

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

1. Solve ordinary differential equations of first ,higher order and solve problems of growth and decay also find orthogonal trajectories of given family of curves..
2. Recall mean value theorems to prove inequalities and able to find maxima, minima of functions of two variables.
3. Apply double integrals to find area of the given region, triple integrals to find volume of the three dimensional objects.
4. Determine gradient of scalar point functions and curl, divergence of vector point functions. Also able to apply Stoke's theorem, Gauss divergence theorem and Green's theorem to evaluate line and surface integrals.
5. Solve improper integrals using beta, gamma functions, able to find the curve of best fit for the given data by method of least squares.

UNIT I

Exact equations, orthogonal trajectories, applications to Newtons Law of cooling, Law of Natural growth and decay.Non-Homogeneous linear Differential equations of second and higher order with constant coefficients with RHS term of the type e^{ax}, sinax, cosax, polynomials in X, e^{ax} V(x), x V(X).

UNIT II

Differential calculus: Rolle's theorem, Lagrange's mean value theorem and Taylor's theorem (without proofs),Taylor's and Macluarin's series for functions of one variable. Maxima and Minima of functions of two variables, Lagrange's method of multipliers.

UNIT III

Multiple integrals -double and triple integrals-change of variables-Change of order of Integration.

UNIT IV

Vector Differentiation: Gradient-Divergence-Curl and their related properties of sums - products- Laplacian and second order operators (proofs of identities not included) Vector Integration -Line integral–work done–Potential function–area-surface and volume integrals.

Vector integral theorems: Greens, Stokes and Gauss Divergence Theorems (Without proof) and related problems

UNIT V

Curve Fitting- Fitting a straight line-Second degree curve- Exponential curve- power curve by method of least squares.

Gamma and Beta functions- properties- Evaluation of improper integrals(applications not included).

Learning Resources

Text Book:

Higher Engineering mathematics by B.S. Grewal , khanna publishers

Reference Books:

1. Higher Engineering Mathematics, N.P. Bali. Laxmi Publications (P) Ltd.
2. Engineering Mathematics, B. V. Ramana , Tata Mc Graw Hill

Web References:

NPTEL, JNTU Co - EeRD

1/4 B.Tech. FIRST SEMESTER
ENGLISH FOR COMMUNICATION
(Common to all branches during I B.Tech., I Semester)

Course Code(s):ME1T2, CE1T2, CS1T2, IT1T2, AE1T2, EE1T2, EC1T2 **Credits: 3**
Internal assessment: 30 marks
Lecture: 3 periods/week **Semester end examination: 70 marks**

Course Objectives:
At the end of course the student will have:
- Exposure to various socio-cultural contexts
- Inculcated human values.
- Strengthened the writing skills.
- Enhanced communicative competence.
- Improved vocabulary
- Well versed in grammar.
- Enhanced comprehensive ability.

Course Outcomes:
At the end of the course the students will be able to:
1. Apply the knowledge of grammar and vocabulary for effective communication.
2. Demonstrate effective communication for interactional and transactional purposes.
3. Comprehend multi-cultural milieu

Unit I
1. Unity of minds-Abdul kalam.
2. Communication
   Process of communication
   Types of communication - Verbal and nonverbal communication, Listening skills.
3. Synonyms, antonyms from the prescribed syllabus.

Unit II
1.'Next Sunday'---R.K.Narayan
2. Tenses
3. Active/passive voice

Unit III
1.'The cop and the anthem'---O.Henry
2. Direct/Indirect speech
3. Letter writing.

Unit IV
1.'Three Questions'----Leo Tolstoy
2. Degrees of comparison
3. Reading comprehension.

Unit V
1. Kalpana chawla-----Biographical sketch
2. Correction of sentences.

Reference Books:

1. Communication skills ------Sanjay kumar&pushpa latha oxford.
2. Communication skills------Leena sen.(PHI)
3. English for engineering students-----G.V.L.N.Sharma.
4. An approach to communication skills----Bhanu ranjan, Dhanpat rai&co.
5. The craft of Business letter writing-----Mathew ,Tata Mac Graw Hill.

Web Resources:

1. http://nptel.ac.in/courses.php
2. http://jntuk-coeerd.in/

1/4 B.Tech. FIRST SEMESTER
ENGINEERING PHYSICS
(Common to EEE, AE, ME, ECE during I B.Tech, I Semester)
(Common to CSE, IT, CE during I B.Tech, II Semester)

CourseCode(s): EE1T3, AE1T3,ME1T3, EC1T3, CS2T3, IT2T3, CE2T3 Credits: 3
Lecture: 3 periods/week Internal assessment: 30 marks
Tutorial: 1 period /week Semester end examination: 70 marks

Course Objectives:
To make student understand

- The concepts of Quantum Physics.
- The theoretical picture about a crystal structure.
- How to determine the different crystal structures by using X-diffraction techniques.
- The properties of different types of solids and to have the knowledge about the energy-band diagram in the materials.
- The advanced topics such as lasers, fibre optics and nano- materials.

Course Outcomes:
After completion of the course the student will be able to

1. Understood the basic concept of Interference
2. Utilize the phenomenon of Diffraction of light.
3. Apply the basic principles of Polarizations and its uses.
4. Understood the crystal structures and experienced how the crystal structure will be.
5. Determine the crystal structure by applying the X-ray diffraction Techniques.
6. Study the concept of Lasers and the applications.
7. Relate the basic concepts of Optical fiber and understand the communication system.
8. Relate the concept of Ultrasonic and learns how they will be used in Non-destructive Testing.

UNIT I
QUANTUM PHYSICS

Planck's black body theory of radiation - Debroglie hypothesis – Properties of matter waves –G.P. Thomson experiment– Davison and Germer experiment – Heisenberg uncertainty principle –Time independent & Time dependent Schrödinger wave equation – physical significance of wave function – Particle in one dimensional potential box.

UNIT II
CRYSTAL STRUCTURE & X-RAY DIFFRACTION:

Introduction – Space lattice – Basis - unit cell - Lattice parameters – Bravais lattices – Crystal systems – Structure and packing fraction of simple , bcc , fcc crystals. Directions and planes in crystals – miller indices –Distance between successive parallel planes- Diffraction of X rays – Bragg's law –Laue method- Powder method.

UNIT III
PHYSICS OF SOLIDS-I

Classical free electron theory-Quantum free electron theory- Fermi Dirac distribution function-Bloch theorem- Kronig penny model(qualitative treatment)- Classification of materials .

Dielectric constant – electronic, ionic and orientation polarizations–internal fields in solids – Clausius Mossotti relation –causes of dielectric breakdown.

UNIT IV
PHYSICS OF SOLIDS-II

Introduction – intrinsic semiconductor and carrier concentration- Fermi level in intrinsic semiconductor conductivity in intrinsic semiconductor– extrinsic semiconductor –carrier concentration- Fermi level in extrinsic semiconductor – Drift and diffusion current – Einstein's relations – Direct and Indirect band gap semiconductors.

Origin of magnetic moment – classification of magnetic materials – Hysteresis curve – soft and hard magnetic materials- applications.

UNIT V
ADVANCED PHYSICS

Lasers Characteristics of lasers – spontaneous and stimulated emission of radiation – population inversion – pumping – Ruby, Helium-Neon & Semiconductor lasers-Applications of lasers.

Fiber optics Principle of optical fiber – Acceptance angle and numerical aperture – Attenuation in optical fibers – applications of optical fibers.

Introduction – Surface to volume ratio- Quantum confinement effect- properties and preparation of nanomaterial – nanotubes – SWNT- MWNT- Applications of nanomaterials.

Learning Resources

Text Books:

1. Solid state Physics by S.O.Pillai. (New Age International Publications)
2. Engineering physics by M.R.Srinivasan (New Age International Publications).

Reference Books:

1. Engineering physics by D.K.Bhattacharya and A.Bhaskaran. (Oxford Publications).
2. Engineering physics by R.K Gaur and S.L. Gupta, Dhanpat Rai Publication

Web Resources:

1. http://nptel.ac.in/courses.php
2. http://jntuk-coeerd.in/

1/4 B.Tech. FIRST SEMESTER
ENVIRONMENTAL STUDIES
(Common to EEE, CE, ME, CSE during I B.Tech., I Semester)
(Common to IT, AE, ECE during I B.Tech., II Semester)

Course Code(s): CEIT4, MEIT4, CSIT4, EE1T4, IT2T4, AE2T6, EC2T4 Credits: 3
Lecture: 3 periods/week Internal assessment: 30 marks
Semester end examination: 70 marks

Course Objectives:

- To develop an awareness, knowledge, and appreciation for the natural environment.
- To understand different types of ecosystems exist in nature.
- To know our biodiversity.
- To understand different types of pollutants present in Environment.
- To know the global environmental problems.

Course Outcomes:

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

1. Develop an awareness, and appreciation for the natural environment.
2. Understand different types of ecosystems existing in nature.
3. Gain the knowledge of biodiversity.
4. Analyze different types of pollutants present in the Environment.
5. Identify the global environmental problems and find appropriate solutions.

UNIT I

NATURAL RESOURCES:

FOREST RESOURCES – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people.

WATER RESOURCES - Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams - benefits and problems.

LAND RESOURCES: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

ENERGY RESOURCES: Renewable and non-renewable resources-Natural resources and associated problems growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies.

MINERAL RESOURCES: Use and exploitation problems, environmental effects of extracting and using mineral resources, case studies.

FOOD RESOURCES: World food problems, changes caused by agriculture and overgrazing,\effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Organic Farming, Bio fertilizers and Bio-pesticides

UNIT II

ECO SYSTEMS: Definition, Scope and importance, Concept of an ecosystem - Structure and function of and ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem -Ecological succession. - Food chains, food webs and ecological pyramids, Flow of energy, Bio-geochemical cycles, Bio-magnification, Ecosystem values, Services and carrying capacity.

BIODIVERSITY AND ITS CONSERVATION: Introduction - Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India, India as a mega-diversity nation, Hot-sports of biodiversity, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic, option values and ecosystem service values. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. - Endangered and endemic species of

India – Conservation of bio diversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution,
Thermal pollution, nuclear hazards

SOLID WASTE MANAGEMENT: Classification and characters of solid waste, factors affecting waste generation, collection and disposal of solid waste. E- Waste and management. Role of an individual in prevention of pollution – Pollution case studies.

UNIT IV

GLOBAL ENVIRONMENTAL PROBLEMS AND GLOBAL EFFORTS: Green house effect, Green house gasses, Global warming, Climate change and their impacts on human environment, ozone layer depletion. International conventions / protocols: Earth summit, Kyoto protocol & Montreal protocol.

TOWARDS SUSTAINABLE FUTURE: From Unsustainable to Sustainable development, Population and its explosion, urban problems related to energy, Consumerism and waste products, Role of IT in Environment and human health. Value Education HIV/AIDS, Environmental ethics, Concept of green buildings and Clean Development Mechanism.

UNIT V

ENVIRONMENTAL IMPACT ASSESSMENT & MANAGEMENT PLANS, ENVIRONMENTAL LAW

Definition of impact, Classification of impacts, Impacts of different components such as: human health, resources, air, water, flora & fauna. Environment management plans (EMP): Technological solutions for pollution control, Green-belt-development, Rain water harvesting, remote sensing and GIS methods.

Environmental law (Air, Water, Wild life, Forest Acts): Objectives of Acts, Institutional arrangements for Implementation and Regulation.

FIELD WORK: Visit to a local area to document environmental assets River /forest grass land/hill/mountain-Visit to a local polluted site Urban/Rural/industrial/ Agricultural Study of common plants, insects, birds. -Study of simple ecosystems pond, river, hill slopes, etc.

Learning Resources:

Text Books:

1. Erach Bharucha, 2010 “Text Book of Environmental Studies”, University Grants Commission, Universities Press (India) Pvt. Ltd., Hyderabad.
2. Text Book of Environmental Sciences and Technology by M. Anji Reddy, BS Publications.

Reference Books:

1. Text Book of Environmental Studies by Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. Text Book of Environmental Science and Engineering by G.Tyler Miller Jr, 2006 Cengage learning
3. Text Book of Environmental Studies from Crisis to Cure by R. RajaGopalan.
4. Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada

Web Resources:

1. http://nptel.ac.in/courses.php,
2. http://jntuk-coeerd.in/

1/4 B.Tech. FIRST SEMESTER

ELECTRICAL ENGINEERING MATERIALS

EE1T5 (Only for EEE during I B.Tech., I Semester) Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objectives:

To effect the economy in manufacturing electrical machines without sacrificing quality, every electrical engineer must have sound knowledge above materials during selection and application.

- To provide knowledge about the conducting materials
- To give knowledge about semiconductor materials
- To give knowledge about the insulating materials and their applications
- To acquire the knowledge about the dielectric materials.
- To have knowledge about magnetic materials
- To have knowledge about special purpose materials.

Course Outcomes:

1. Student will acquire the knowledge about different forms of materials and their properties.
2. Student will acquire complete knowledge about conducting and semiconducting Materials.
3. Students will have complete knowledge about insulating materials and also studies behavior of dielectrics.
4. Student will learn completely about the magnetic properties of the material and special purpose materials.

Unit I

Conducting materials

Introduction – classification of materials – Metals and Non metals, physical, thermal, mechanical and electrical properties of materials – classification of electrical materials – concept of atom – electron configuration of atom, conductors, general properties of conductors, factors effecting, resistivity of electrical materials electrical/mechanical/thermal properties of copper, aluminium, iron, steel, lead, tin and their alloys – applications.

Unit II

Semiconductors and high resistivity conductors

Introduction – semiconductor materials – characteristics of semiconductors – atomic structure p Intrinsic and extrinsic semi condcutors – preparation of semiconductors – Germanium and silicon – doping materials P type and N type crystals – Diode and transistor, their application.

High Resistivity materials – electrical / thermal / mechanical properties of Manganin, Constantan, Nichrome, Tungsten, Carbon and Graphite and their applications in electrical equipment.

Unit III

Dielectrics

Introduction – solid, liquid and gaseous dielectrics, leakage current, permittivity, dielectric constant, dielectric loss – loss angle – loss constant, Breakdown voltage and dielectric strength of – solid, liquid and gaseous dielectrics, effect of break down – electrical and thermal effects, Polarisation – electric, ionic and dipolar polarization. Effect of temperature and frequency on dielectric constant of polar dielectrics. Ferro electric materials and their application, piezo electric property, piezo electric materials and their applications.

Unit IV

Insulating Materials

Introduction – characteristics of a good electrical insulating materials – classification of insulating materials – electrical, thermal, chemical and mechanical properties of solid insulating materials, electrical, thermal and mechanical properties of Micanite, Asbestos, Bakelite, rubber, plastics, thermo plastics. Resins, polystyrene, PVC, porcelain, glass, cotton and paper.

Liquid insulating materials – Mineral oils, synthetic liquids, fluorinated liquids – their electrical, thermal and chemical properties – transformer oil – properties – effect of moisture on insulation properties .

Gaseous insulators – classification based on dielectric strength – dielectric loss, chemical stability properties and their applications.

Unit V

Magnetic materials and special purpose materials

Introduction – classification of magnetic materials, Ferro magnetism – properties of ferro magnetic materials – properties of magnetically soft materials, iron, silicon steel, permalloy, mumetal, perminvar, alnico – magnetic properties of ferrites. B-H curves of soft magnetic materials – effect of temperature – heat treatment and grain orientation on magnetic properties – losses in magnetic materials – Hysterisis loss – factors affecting permeability and hysteresis loss.

Special purpose materials:

Soldering materials – properties, materials for hard soldering and soft soldering.

Fuse materials – properties of fuse materials- re-wirable fuses, HRC fuses.

Contact materials – classification, materials for light and moderately loaded contacts.

Learning Resources

Text Book:

R.K.Rajput , "Electrical engineering Materials", Laxmi Publications

Reference Books:

1. G.K. Mithal, "Electrical Engineering Materials", Khanna Publication 2nd Edition.
2. A.J. Dekker, "Electrical engineering Materials", Prentice Hall of India eprinty 2005
3. C.S. Indulkar and S.Thiruvengadam “An Introduction to electrical engineering materials", S.Chand & Co
4. "Electrical engineering Materials" by T.T.T.I, Madras
5. S.P.Seth, “A course in electrical engineering materials" Dhanapatrai & Sons, New Delhi

Web resources:

1. http://nptel.ac.in/courses.php
2. http://jntuk-coeerd.in/

1/4 B.Tech. FIRST SEMESTER
INTRODUCTION TO ELECTRICAL ENGINEERING
(Only for EEE during I B.Tech., I Semester)

EE1T6 **Credits: 3**
Lecture: 3 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objectives:

- To impart the basic knowledge about the Electric and Magnetic circuits
- To inculcate the understanding about the electrical fundamentals
- To inculcate the understanding about the Relationship between thermal, mechanical and electrical units
- To know about various types of cells and methods of induced EMF, Construction and Characteristics

Course Outcomes:
At the end of the course the students will have:
1. Basic knowledge about the Electric and Magnetic circuits
2. Understanding about the Relationship between thermal, mechanical and electrical units
3. Understanding about various types of cells
4. Understanding about the principle of electrical machines

UNIT I
Fundamentals of Electricity
Introduction – Electric current – Electric Potential difference – Concept of EMF and potential difference – Resistance – Factors upon which Resistance depends – Specific Resistance – Effect of Temperature on Resistance – Temperature coefficient of Resistance– Ohm's law – Resistances in Series – Resistances in Parallel – Series parallel circuit – Kirchhoff's laws – Illustration of Kirchhoff's Laws – Numerical problems on series and parallel circuits & Kirchhoff's laws

UNIT II
Work, Power and Energy
Introduction –S.I Units for unit of power, work and energy – Mechanical work or energy – Electrical power & Electrical energy – Thermal energy – Units of power – Expression for power – Heating Effect of electric current –Relationship between thermal, mechanical and electrical units – Numerical problems.

UNIT III
Electrostatics
Introduction – Coulomb's Law – Absolute and relative permittivity - Electric field – electric flux – Electric Intensity or Field strength(E) – Electric Flux Density – Electric Potential – Electric Potential Difference –Potential Gradient. Capacitor – Capacitance – Dielectric constant – Parallel Plate Capacitor with uniform Medium – Capacitors in Series – Capacitors in Parallel – Energy stored in a capacitor

UNIT IV
Magnetic circuits
Introduction – Magnetic field – Magnetic flux – Magnetic flux density – Magnetizing force – Absolute and relative permeability – Relation between B and H – B H curve - Magnetic circuit – Comparison between magnetic and electric circuits — Magnetic Hysteresis – Importance of Hysteresis Loop-Faraday's Laws of Electromagnetic Induction – Lenz law – Dynamically

induced EMF – Statically induced EMF – Self Inductance – Mutual Inductance - Coefficient of coupling – Inductances in Series – Inductances in parallel – Energy stored in a magnetic field.

UNIT V

Methods of induced EMF

(a) Introduction to secondary cell – Lead acid cell – Construction of a Lead acid cell – Chemical changes during charging and discharging –Characteristics of a lead acid cell – construction of Nickel iron Cell – Construction and Characteristics of nickel cadmium cell-Lithium ion battery-construction and principle-ampere hour & watt hour efficiency of battery

(b) Methods of production of dynamically induced EMF – DC machine principle – production of single phase AC supply - production of three phase supply – Advantages of AC over DC – Advantages of three phase over single phase AC

Learning Resources

Text Books:

1. Principles of Electrical Engineering by V.K Mehta, S.Chand Publications.
2. Elec., Technology by Edward Hughes

Reference Books:

1. Theory and Problems of Basic Electrical Engineering by D.P.Kothari & I.J. Nagrath PHI.
2. Basic Electrical Engineering by Fitzgerald and Higginbotham
3. Electrical Engineering fundamentals by Vincent Del Toro – PHI, New Delhi

Web Resources:

1. http://nptel.ac.in/courses.php
2. http://jntuk-coeerd.in/

1/4 B.Tech. FIRST SEMESTER
ENGLISH LANGUAGE COMMUNICATION SKILLS LAB
(Common to CSE, IT, EEE, CE, ECE during I B.Tech., I Semester)
(Common to ME, AE during I B.Tech., II Semester)
Course Code(s): CE1L3, CS1L1, IT1L1, EE1L1, EC1L1, ME2L2, AE2L2

Credits: 2

Lab: 3 periods/week **Internal assessment: 25 marks**

Semester end examination: 50 marks

Course Objectives:
At the end of course the student will have:
- Communication ability.
- Enhanced general conversational skills in different socio-cultural contexts.
- Strengthened professional skills.
- Confidence and competitive enough to express themselves fluently.
- Exposure the students to various spoken skills.

Course Outcomes:
At the end of the course, the student will be able to
1. Gain knowledge of right pronunciation and accent.
2. Develop an ability to use functional English.
3. Develop analytical skills and problem solving skills.

Task I: Phonetics
Introduction to sounds of English.
Phonetic transcription of simple words.
Word stress or accent.
Intonation.
Task II: Spoken skills
JAM
Public speaking
Debate
Task III : Conversation skills
Introducing
Extending Invitations
Apologizing
Lodging complaints.
Task IV: Describing
Describing an object
Describing a process
Describing situations
Task V: Group Discussion
Dynamics of Group Discussion
Various strategies
Discussion on various topics

Learning Resources

Reference books:
1. Everyday dialogues in English------Robert J.Dixon.
2. Speak well------orient black swan.

1/4 B.Tech. FIRST SEMESTER
ENGINEERING WORKSHOP
(Common to ME, EEE, AE during I B.Tech., I Semester)
(Common to CE, ECE during I B.Tech., II Semester)
Course Code(s): ME1L3, AE1L3, EE1L2, CE2L2,EC2L3

Lab: 3 periods/week **Credits: 2**
Internal assessment: 25 marks
Semester end examination :50 marks

Course Objectives:

- Illustrate about basic hand tools used in various trades such as Carpentry, Tin-Smithy, Fitting House wiring, Black smithy.
- Imparting skills to prepare basic joints in Carpentry.
- Imparting skills to fabricate various objects by using sheet metal.
- Know various basic house wiring connections.
- Imparting skills to fabricate various shapes by using black smithy.

Course Outcomes:

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

1. Prepare basic joints used in carpentry
2. Prepare edges for better joint for fitting
3. Perform basic house wiring connections
4. Prepare various shapes and objects by using Tin smithy and Black smithy.

ANY TWO EXPERIMENTS FROM EACH TRADE

TRADE:	
CARPENTRY	1. T-Lap Joint
	2. Cross Lap Joint
	3. Dovetail Joint
	4. Mortise and Tennon Joint
FITTING	1. Vee Fit
	2. Square Fit
	3. Half Round Fit
	4. Dovetail Fit
BLACK SMITHY	1. Round rod to Square
	2. S-Hook
	3. Round Rod to Flat Ring
	4. Round Rod to Square headed bolt
HOUSE WIRING	1. Parallel / Series Connection of three bulbs
	2. Stair Case wiring
	3. Florescent Lamp Fitting
	4. Measurement of Earth Resistance

TIN SMITHY

1. Taper Tray
2. Square Box without lid
3. Open Scoop
4. Funnel

Learning Resources

Text Books:

1. Work shop Manual - P.Kannaiah/ K.L.Narayana/ Scitech Publishers.
2. Workshop Manual / Venkat Reddy/ BS Publications/Sixth Edition

1/4 B.Tech. FIRST SEMESTER
ENGINEERING GRAPHICS LAB
(Common to CSE, IT, EEE during I B.Tech., I Semester)
Course Code(s): CS1L3, IT1L3, EE1L3

Credits: 2

Lab: 3 periods/week **Internal assessment: 25 marks**

Semester end examination: 50 marks

Course Objectives:

- To improve imagination skills.
- Increase ability to communicate with people.
- Learn to sketch and take field dimensions.
- Learn to take data and transform it into graphic drawings.
- Learn basic engineering drawing formats.
- Prepare the student for future Engineering positions.

Course Outcomes:

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

1. Get acquainted with the knowledge of various lines, geometrical constructions and construction of various kinds of scales, and Ellipse.
2. Improve their imagination skills by gaining knowledge about points, lines and planes.
3. Become proficient in drawing the projections of various solids.
4. Gain knowledge about orthographic and isometric projections.

UNIT I

Polygons-Construction of Regular Polygons using given length of a side; Ellipse- General method and Oblong Methods for Construction of ellipse; Scales-Plain,Vernier and Diagonal Scales.

Introduction to Orthographic Projections; Projections of Points; Projections of Straight Lines parallel to both planes; Projections of Straight Lines-Parallel to one and inclined to other plane.

UNIT II

Projections of Straight Lines inclined to both planes, determination of true lengths, angle of inclinations and traces.

UNIT III

Projections of Planes; Regular Planes Perpendicular / Parallel to one Reference Plane and inclined to other Reference Plane; inclined to both the Reference Planes.

UNIT IV

Projections of Solids-Prisms, Pyramids, Cylinders and Cones with the axis inclined to one Plane.

UNIT V

Conversion of Isometric Views to Orthographic Views.

Conversion of Orthographic Views to Isometric Projections and Views.

Learning Resources

Text Book:

Engineering Drawing by N.D. Bhat, Chariot publications

Reference Books:

1. Engineering Drawing by M.B. Shah and B.C. Rana, Pearson publishers
2. Engineering Drawing by Dhananjay A. Jolhe, Tata McGraw Hill Publishers
3. Engineering Graphics for Degree by K.C. John, PHI Publishers

1/4 B.Tech. SECOND SEMESTER
ENGINEERING MATHEMATICS -II
(Common to all branches during I B.Tech., II Semester)
Course Code(s): CE2T1, ME2T1, CS2T1, IT2T1, AE2T1, EE2T1, EC2T1

Credits: 3

Lecture: 3 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objectives:

- After completion of this course engineers will be able to apply the concepts of matrices, Laplace transforms, Fourier series, Fourier transforms in solving engineering problems.
- Linear algebra in the course cover material which is essential to anyone who does mathematical computation in Engineering and sciences.

Course Outcomes:

At the end of the course student will be able to

1. Solve linear system of equations.
2. Determine the eigen values and eigen vectors of given square matrix and able to find inverse, power of a matrix using Cayley-Hamilton theorem.
3. Find Laplace transforms, inverse Laplace transforms of the given functions and able to apply Laplace transforms to solve differential equations with initial conditions.
4. Write given function in terms of sine and cosine terms in Fourier series and also to get knowledge in Fourier transforms.
5. Solve finite difference equations using Z-transforms.

UNIT I
MATRICES AND LINEAR SYSTEMS OF EQUATIONS:

Rank-Echelon form, Normal form-definition of a vector, linear independence – Solution of Linear System of equations – Direct Methods- Gauss Elimination - Gauss Jordon and Gauss Seidal Methods.

UNIT II
EIGEN VALUES - EIGEN VECTORS:

Eigen values - Eigen vectors - Properties – Cayley-Hamilton Theorem - Inverse and powers of a matrix by using Cayley-Hamilton theorem- some applications of eigen value problems-Diagonalization of a matrix.

UNIT III
LAPLACE TRANSFORMS & INVERSE LAPLACE TRANSFORMS

LAPLACE TRANSFORMS: Laplace transforms of standard functions –Shifting Theorems, Transforms of derivatives and integrals – Unit step function –Dirac's delta function.

INVERSE LAPLACE TRANSFORMS: Convolution theorem - Application of Laplace transforms to ordinary differential equations with given initial conditions.

UNIT IV
FOURIER SERIES AND FOURIER TRANSFORMS:

FOURIER SERIES: Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval– Half-range sine and cosine series.

FOURIER TRANSFORMS: Fourier integral theorem (only statement) – Fourier sine and cosine integrals - Fourier transform – sine and cosine transforms – properties – inverse

transforms – Finite Fourier transforms.

UNIT V

Z-TRANSFORMS:

Introduction, properties of Z-transforms-initial value theorem-final value theorem-inverse Z-transforms-applications to difference equations.

Learning Resources

Text Books:

1. Higher Engineering Mathematics – Khanna Publishers – B.S. Grewal – 42nd Edition.
2. Advanced Engineering Mathematics – Wiley – Erwin Kreyszig- 8th Edition.

Reference Book:

Engineering Mathematics Vol-II, Iyengar,T.K.V, Krishna Gandhi, et.al S.Chand Co. New Delhi.

Web Resources:

1. http://nptel.ac.in/courses.php
2. http://jntuk-coeerd.in/

1/4 B.Tech. SECOND SEMESTER
PROFESSIONAL ETHICS
(Common to all branches during I B.Tech., II Semester)
Course Code(s): CE2T2, ME2T2, CS2T2, IT2T2, AE2T2, EE2T2, EC2T2

Credits: 3

Lecture: 3 periods/week **Internal assessment: 30 marks**

Semester end examination: 70 marks

Course Objectives:

- To inculcate the sense of social responsibility.
- To develop a firm ethical base
- To make the students realize the significance of ethics in professional environment.

Course Outcomes:

At the end of course the student will have:

1. Improved knowledge of ethics
2. High sense of responsibility
3. Environmental awareness
4. Professional outlook
5. Development of a broad culture.

Unit I

Profession-----Definition
Three types of ethics.
Engineering ethics
Rights and responsibilities of an engineer.

Unit II

Evolution of engineering ethics
Code of ethics
Kohlberg's theory
Gilligan's theory

Unit III

Engineering as social experimentation
Engineer's social responsibility

Unit IV

Computer ethics
Ethical hacking
Privacy

UNIT V

Environmental ethics. Livable environment
Technology assessment.

Learning Resources

Reference Books:

1. Ethics in engineering: Mike W.Martin Roland, Mac Grow Hill.Schinzinger
2. Engineering ethics-----M.Govindarajan, S.Natarajan&V.S.Senthil Kumar. Eastern economy Edn.PHI
3. Engineering ethics---Harris pitch and Rabbins, cengage.
4. Caroline whit back---Ethics in engineering practice and research-----Cambridge.

Web Resources:

1. http://nptel.ac.in/courses.php
2. http://jntuk-coeerd.in/

1/4 B.Tech. SECOND SEMESTER
ENGINEERING CHEMISTRY
(Common to CSE, IT, CE, ECE during I B.Tech, I Semester)
(Common to EEE, AE, ME during I B.Tech, II Semester)

Course Code(s): CE1T3, CS1T3, IT1T3, EC1T4, AE2T3, EE2T3, ME2T3 Credits: 3
Lecture: 3 periods/week Internal assessment: 30 marks
Tutorial: 1 period /week Semester end examination: 70 marks

Course Objectives:

- To acquire knowledge about desalination of brackish water and treatment of municipal water.
- To gain the knowledge of conducting polymers, bio-degradable polymers and fiber reinforced plastics.
- To learn significance of green chemistry and green synthesis and the synthesis of nano materials.
- To understand mechanism of corrosion and preventive methods.
- To understand concept of semi conductivity, superconductivity and liquid crystal and solar energy.

Course Outcomes:

At the end of this course, the students will be able to

1. Develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.
2. Substitute metals with conducting polymers and also produce cheaper biodegradable polymers to reduce environmental pollution.
3. Design economically and new methods of synthesis nano materials.
4. Apply their knowledge for protection of different metals from corrosion.
5. Have the knowledge of converting solar energy into most needy electrical energy efficiently and economically to reduce the environmental pollution.

UNIT I

WATER TECHNOLOGY

Introduction, Hardness of water, types of hardness(permanent and temporary)-
Degree of hardness-Numericals-determination of hardness by EDTA Method-softening methods (line-soda, ion exchange and zeolite process)

WATER TREATMENT

Desalination-reverse osmosis-electro dialysis. Municipal water treatment-removal of micro organisms- by irradiation of UV radiation- bleaching powder process-chlorination-break point of chlorination-By using chloramine-By using ozone.

UNIT II

POLYMERS

Introduction - Types of polymers (addition and condensation)- mechanism of addition polymerization (free radical, ionic) – Classification - Methods of polymerisation – Stereospecific polymers - Ziegler Natta catalysis - Properties of polymers – Conducting Polymers-Engineering applications – Biodegradable polymers - Individual polymers(Preparation,Properties, Uses of Poly Styrene, PVC, PTFE, Bakelite's, Cellulose derivatives,PolyCarbonate.

PLASTICS

Types –Compounding of plastics- Moulding(Injection, compression, blow film extrusion and extrusion moulding)- Fiber reinforced plastics (Glass and carbon) – Bullet Proof Plastics– Properties of plastics – Engineering applications.

UNIT III

GREEN CHEMISTRY

Introduction – Principle of green chemistry, methods of green synthesis (aqueous phase,super critical fluid extraction method, phase transfer catalyst, micro wave induced method,ultra sound method.

NANO MATERIALS

Introduction to Nanomaterials-preparation of few Nano materials(Carbon Nano Tubes,Fullerenes etc)-Properities of Nano materials- Engineering applications.

UNIT IV

CORROSION

Defination, causes and consequences of corrosion-mechanism of dry and wet corrosion-galvanicseries,Factors influencing rate of corrosion passivity of metal, types of corrosion (galvonic,differential Aeration,pitting,crevice and stress corrosion).

CORROSION CONTROL

Cathodic protection(sacrificial anodic protection and Impressed current cathodic protection) and Application of protective coating-metallic coatings (galvanization and tinning) organic coatings (paints (mechanism not required),varnishes,lacquers and enamels).

UNIT V

SEMICONDUCTORS & SUPERCONDUCTIVTY

SEMICONDUCTORS-Definition –Types of semiconductors (Stiochiometric, Non Stiochiometric, Organic, Controlled Valency Semiconductors, Doping)-applications.

SUPERCONDUCTIVTY– Definition-Preparation –Properties –Engineering Applications.

LIQUID CRYSTALS & SOLAR ENERGY

LIQUID CRYSTALS- Definition –Types - applications in LCD and Engineering Applications.

SOLAR ENERGY

Introduction – harnessing solar energy – solar heaters – photo voltaic cells – solar reflection – green house concepts.

Learning Resources

Text Books:

1. A text book of Engineering chemistry – byN.KrishnaMurthy N.Y.S.Murthy, V.Anuradha.
2. A text book of Engineering chemistry–II by D.Srinivasulu, Srivastava, Roliverma.
3. A text book of Engineering chemistry by JAIN & JAIN.
4. A text book of Engineering chemistry by C.P.Murthy, C.V.Agarwal. Andra Naidu.

Reference Books:

1. A text book of Engineering chemistry by S.S.DARA.
2. A text book of Engineering chemistry by Dr.C.Daniel Yesud

Web Resources:

1. http://nptel.ac.in/courses.php
2. http://jntuk-coeerd.in/

1/4 B.Tech. SECOND SEMESTER

BASIC ELECTRONIC DEVICES AND CIRCUITS

EE2T4 (Only for EEE during I B.Tech., II Semester) Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objectives:

- To study in detail about construction of several electronic devices.
- To analyse the characteristics of various electronic devices and circuits.
- To analyze Small signal BJT Amplifiers at low & high frequencies
- To analyze different BJT Oscillator circuits

Course Outcomes:

1. Will get knowledge about the Semiconductor Devices like Diode, BJT, Uni-polar devices like JFET, MOSFET.
2. Will be able to analyze rectifiers circuits.

UNIT I

SEMI CONDUCTOR JUNCTION DIODE

PN Junction: Open circuited P N Junction, Forward and Reverse Bias, Current components in PN Diode, Volt-Ampere Characteristics, Diffusion capacitance and Diode Resistance (Static and Dynamic), Energy Band Diagram of PN Diode, Avalanche and Zener Break Down, Zener Diode, Tunnel Diode, Varactor Diode, LED, Photo Diode.

Diode as a Rectifier: Half wave Rectifier, Full wave Rectifier with Center-tapped Transformer, Bridge Full wave Rectifier, derivation of Ripple factor, Form factor, peak factor, Efficiency of Rectifiers. Capacitor filter and Inductor filter.

UNIT II

TRANSISTOR CHARACTERISTICS

Bi-polar Junction Transistor: Construction of BJT, Transistor current components, Transistor as an amplifier, Characteristics of Transistor in Common Base and Common Emitter Configurations, Typical transistor junction voltage values.

Field Effect Transistor: Classification of FET, JFET construction and working , MOSFET construction and working (Enhancement and depletion mode).

UNIT III

TRANSISTOR BIASING

BJT Biasing and Thermal Stabilization: Operating point, Basic Stability, fixed bias, Collector to Base Bias, Self Bias circuits, Stabilization factors S, S', S''(Definitions only), Bias Compensation, Thermistor and Sensitor compensation, Compensation against variations in VBE, Ico. Thermal runaway, Thermal stability.

FET Biasing: Introduction, Fixed Bias, Self Bias, Voltage divider bias.

UNIT IV

SMALL SIGNAL ANALYSIS OF SINGLE STAGE TRANSISTOR AMPLIFIERS(BJT only)

Transistor hybrid model, Analysis of Transistor amplifier using h-parameters, CB,CE and CC amplifiers analysis using exact and approximate analysis.

Transistor at high frequencies, , CB,CE and CC amplifiers analysis at high frequencies,

Determination of high frequency parameters in terms of low frequency parameters.

UNIT V

FEEDBACK AMPLIFIERS & OSCILLATORS (BJT only)

Feedback concept, Feedback topologies, Negative feedback advantages & disadvantages, Analysis of feedback amplifiers. Oscillators principle, Condition for oscillations, types of oscillators, RC phase shift oscillator, Wien bridge oscillator, Hartley oscillator & Colpitt's oscillator.

Learning Resources

Text Books:

1. Electronic Devices and Circuits, J.Milliman, C.C Halkias, Tata Mc-Graw Hill, 2nd Edition, 2007.
2. Integrated Electronics - J.Milliman, C.C Halkias, Tata Mc-Graw Hill, 2nd Edition, 2007.

Reference Books:

1. Electronic Devices and Circuits, David A.Bell, Oxford, 5th edition, 2009.
2. Electronic Devices and Circuits Theory, Boyelstad, Pearson Education, 8th Edition, September 2011.

Web Resources:

1. http://nptel.ac.in/courses.php
2. http://jntuk-coeerd.in/

1/4 B.Tech. SECOND SEMESTER
ELECTRICAL CIRCUIT ANALYSIS-I

EE2T5 (Only for EEE during I B.Tech., II semester) Credits: 3
Lecture: 3 periods/week Internal assessment: 30 marks
Tutorial: 1 period /week Semester end examination: 70 marks

Course Objectives:

Electrical Circuit Analysis-I is the foundation for all subjects of the Electrical Engineering discipline.

- Apply basic laws: Ohms law, KVL, KCL.
- Analyze resistive networks' and simplify complicated networks.
- Use different circuit analysis techniques: Nodal analysis- mesh analysis to find branch currents and node voltages
- Deal with circuit containing energy storage elements.
- Perform Phasor frequency domain analysis.
- Find the Basic Cut-set and Basic Tie-set matrices for planar networks and duality.
- Know the basic concepts of ac circuits, three phase loads and power measurement for both balanced and unbalanced three phase circuits.

Course Outcomes:

1. Apply knowledge of mathematics, science, and engineering to the analysis and design of DC and single phase ac electrical circuits.
2. Identify, formulate, and solve engineering problems in the area of Electrical circuits
3. Design an electric system, or process to meet desired needs within realistic constraint
4. Understand the basic concepts of electrical circuits and also basic laws of electrical circuits and their application to electrical circuits.
5. Learns the basic concepts of single phase AC circuits.
6. Understand the basic concepts of three phase electrical circuits.
7. Can measure the power in both balanced and unbalanced three phase circuits
8. Student can do frequency domain analysis.
9. Student will get the ability to participate and try to succeed in competitive examinations.

UNIT I
Basic Laws and Network topology
Circuit concepts –Resistor(R)-Inductor (L)-Capacitor(C)-Voltage and Current Sources - Voltage, Current relationship for passive bilateral elements - Ohm's law Kirchhoff's laws - voltage division, current division - Source Transformation – wye delta / delta-wye transformation – Definitions – Graph – node – branch – links – twigs - Tree, co-tree Basic Cut-set and Basic Tie-set matrices for planar networks — Duality & Dual networks.

Unit II
Methods of Analysis:
Nodal analysis - mesh analysis - super node and super mesh analysis of Networks with dependent and independent voltage and current sources for both DC and AC excitation

UNIT III
Part A: Single Phase A.C Circuits:
Sinusoidal alternating quantities – Phase and Phase difference – Complex and polar forms of representations, J-notation, R.M.S, Average values and form factor for different periodic wave

forms - Concept of Reactance, Impedance Susceptance and Admittance-Power Factor and significance-Real and Reactive power, Complex Power.

Part B: Locus diagrams & Resonance:
Locus diagrams - series R-L, R-C, R-L-C and parallel combination with variation of various parameters - Resonance-series, parallel circuits, concept of band width and Q factor.

UNIT IV
Balanced Three phase circuits:
Three phase circuits: Phase sequence- Star and delta connection-Relation between line and phase voltages and currents in balanced systems-Analysis of balanced three phase circuits-Measurement of Active and Reactive power in balanced Three Phase systems.

UNIT V
Unbalanced Three phase circuits:
Analysis of Three Phase unbalanced circuits-Loop Method- Application of Millman's Theorem-Star Delta Transformation Technique – Two Wattmeter Method of measurement of three phase active and reactive power.

Learning Resources

Text Books:

1. "Fundamentals of Electric Circuits "Charles K.Alexander, Mathew N.O.Sadiku, Tata McGraw-Hill.
2. Circuits & Networks Analysis & Synthesis by A. Sudhakar and Shyammohan S Palli, Tata McGraw- Hill.
3. 3000 Solved Problems in Electrical Circuit by Schaum's solved problem series Tata McGraw- Hill.
4. Circuit Theory by A.Chakrabarti Danapat Rai & Co publisher.

Reference Books:

1. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley,Mc Graw Hill Company,6 th edition
2. Network Analysis by N.C.Jagan, C.Lakshmi Narayana BS publications 2nd edition
3. Network Analysis: Van Valkenburg; Prentice-Hall of India Private Ltd.

Web Resources:

1. http://nptel.ac.in/courses.php
2. http://jntuk-coeerd.in/

1/4 B.Tech. SECOND SEMESTER

EE2T6 C PROGRAMMING Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objectives:

- Learn the structure, syntax and semantics of C programming.
- Learn different control structures like decision control, loop control and arrays.
- Learn the modular programming concepts and storage classes.
- Learn the limitations of basic data types and learn the concepts of derived data types and user defined data types.
- Learn how to perform various FILEI/O.

Course Outcomes:

After completion of this course the student would be able to:

1. Understand the fundamentals of C programming.
2. Choose the decision making statements, loops and arrays to solve the problem.
3. Use functions to solve the given problem.
4. Allocate dynamic memory using pointers.
5. Apply the structures, unions and files Operations in a specific need.

UNIT I

TOPIC LEVEL OBJECTIVE: Notion of Computer Languages, algorithm, computational procedure, editing and executing programs and C Declarations.

BASICS AND INTRODUCTION TO C:

Basics of Computer, Introduction to C, About ANSI C Standard, Machine, Assembly and High-level Language, Assembler, Compiler and Interpreter, Structure of a C program, Programming Rules, Executing the C Program, Standard Directories, Advantages of C, Header Files, Flow Chart, Algorithm, Analyzing Algorithm, Classification Algorithms.

THE C DECLARATIONS: The C-Character set, Delimiters, Types of Tokens, The C keywords, Identifiers, Constants, Variables, C Data types, dynamic initialization, type modifiers, type conversions, constant and volatile variables. Properties of Operators, Operator Priority ,comma and conditional operators, arithmetic, relational, assignment operators and expressions, logical , bitwise operators. Input and output in c: Formatted and Unformatted functions.

UNIT II

Topic Level Objective: Understanding branching, iteration, data representation using arrays and strings.

DECISION STATEMENTS:

The if statement, if-else, nested if else, if-else-if ladder, break, continue, goto, Switch statement, nested switch case, Switch case and nested ifs.

LOOP CONTROL: for loop, nested for loop, while, do-while, do-while statement with while loop.

ARRAYS:

Array initialization, array terminology, characteristics of an array, 1-D array and its operations, predefined streams, 2-D arrays and operations, Multi -dimensional arrays.

STRINGS: Declaration and initialization of string, string standard functions, string conversion functions, memory functions, application of strings.

UNIT III

Topic Level Objective: Modular programming and recursive solution formulation and storage classes.

FUNCTIONS:
Basics, function definition, return statement, types of functions, call by value ,call by reference, function as an argument, Functions with operators, Function and Decision Statements, Functions and loop Statements, Functions with arrays and Pointers, Recursion-Types of Recursion, Rules for Recursive Function, Recursion versus Iterations, Advantages and Disadvantages of Recursion, Efficiency of Recursion, Library Functions.
STORAGE CLASS: Variable Lifetime, Automatic Variables, External Variables, Static Variables, Register Variables.

UNIT IV
Topic Level Objective: Understanding pointers, dynamic memory allocation and Preprocessor Directives.
POINTERS:
Features of pointers, pointers and address, pointer declaration, void pointers, arithmetic operations with pointers, pointers and arrays, array of pointers, pointers to pointers, pointers and strings. Dynamic memory allocation, memory models, memory allocation functions.
PREPROCESSOR DIRECTIVES:
The #define Directive, Undefining a Macro, Token Pasting and Stringizing Operators, The #include Directive, Conditional Compilation, The Predefined Macros in ANSI and Turbo-C,Standard I/O Predefined Streams in stdio.h, The Predefined Macros in ctype.h.

UNIT V
Topic Level Objective: Understanding derived data types of C and basic of file operations.
STRUCTURE AND UNION: Features of Structures, Declaration and initialization of Structures, Structure within Structure, Arrays of Structure, Pointer to Structure, Structure and functions, typedef,Bit fields, Enumerated Data Type, Union, Union of Structures.
FILES: Streams and File Types, Steps for File Operations, FILE I/O, Structures Read and Write, Other file function, Command line Arguments, Application of command line arguments, Environment variables.

Learning Resources

Text Book:

Programming in C, by Ashok N.Kamthane, (2nd edition), Pearson publications, 2011.

Reference Books:

1. Programming in ANSI C (5th Edition) by E.Balaguruswamy, McGraw-Hill publications.
2. “A first book of ANSI C”, 3rd edition, by Gray J.Brosin, cengagedelmar Learning India P.ltd publications.
3. Problem Solving with C by M.T Somashekara PHI publications.
4. C Programming Language”, (2nd edition) by Brain W.Kernighan & Dennis Ritchie, “, PHI publication.

Web Resources:

1. http://nptel.ac.in/courses.php
2. http://jntuk-coeerd.in/

1/4 B.Tech. SECOND SEMESTER
ENGNEERING PHYSICS &ENGNEERING CHEMISTRY LAB

Course Code: EE2L1 **Credits: 2**
Internal assessment: 25 marks
Lab: 3 periods/week **Semester end examination: 50 marks**

Course objectives:
To make student
- Knowledgeable in different concepts of physics such as Properties of Matter, Sound, Electricity, Optics and Electronics by explaining through experiments.
- Familiar with quality and parameters of water samples, useful for drinking effluent treatment and agriculture purposes.
- Aware of preparation of some plastic material and corrosion kinetics useful in industries.
- Know about the measuring the properties of the lubricants which are industrially useful.

Course Outcomes:
After completion of this course, the student will be able to
1. Understand mechanical properties and determine the rigidity modulus.
2. Comprehend optical phenomena such as interference and diffraction and calculate the wavelength and radius of curvature of planoconvex lens.
3. Acquire the knowledge of electronic principles and evaluate the time constant, energy band gap and Zener breakdown.
4. Determine parameters like hardness , alkalinity, turbidity and D.O of water sample which are useful for domestic, agriculture and industrial purposes.
5. Understand nature of the soil from PH values which is useful for agriculture.
6. Prepare plastics like Bakelite and understand their applications.

ENGINEERING PHYSICS

ANY SIX OF THE FOLLOWING:

MECHANICS:
1. Determine the rigidity modulus of the material of the wire using torsional Pendulum

SOUND:
2. Determine the velocity of sound by volume resonator method.

OPTICS:
3. Determine the wavelength of a source by normal incidence method using diffraction grating
4. Determine the radius of curvature of a plano convex lens by forming Newton's Rings
5. Determine the refractive index of the material of the prism (minimum deviation method) using spectrometer.

ELECTRICITY AND MAGNETISM:
6. Study the variation of magnetic field along the axis of a solenoid coil using Stewat – Gee's apparatus.
7. Determine the time constant for a C-R circuit.

ELECTRONICS:
8. Study of characteristic curves of a zener diode to determine its break down voltage
9. Determine band gap of semiconductor using a p-n junction diode.
10. Draw the characteristic curves and determine thermoelectric coefficient of a Thermistor.

11. Determine the Numerical Aperture of an optical fibre.
12. Determine the attenuation in the optical fibre.

ENGINEERING CHEMISTRY

1. Determination of Total Hardness of water sample using EDTA.
2. Determination of Total alkalinity of water sample.
3. Determination of D.O in water.
4. Measurement of Turbidity of water sample.
5. pH of Soil and fruits.
6. Preparation of Phenol-Formaldehyde resin.

1/4 B.Tech. SECOND SEMESTER
ADVANCED ENGLISH LANGUAGE COMMUNICATION SKILLS LAB
(Only for EEE during I B.Tech., II Semester)

EE2L2 **Credits: 2**
Lecture: -- **Internal assessment: 25 marks**
Lab Practice: 3 periods/week **Semester end examination: 50 marks**

Course Objectives:

- To improve the writing skills of students.
- To give them exposure to e-correspondence
- To enable them to prepare resumes.
- To enable them to improve their presentation skills.
- To make them ready to face the interviews.

Course outcomes:

1. Better pronunciation and accent
2. Gain knowledge of right pronunciation and accent.
3. Develop an ability to use functional English.
4. Develop analytical skills and problem solving skills

Task I : Technical report writing

Task II : Preparing for interviews.
Resume preparation
Interviews skills
Mock interviews.

Task III : Presentation skills.
Preparing PPTs
Presentations.

Task IV : Group Discussion on current affairs.

Task V : Book reviews.

Reference Books:

1. Technical communication---Ashraf rizwi, Tata Mac Graw Hill
2. Communication skills -------- Meenakshi raman oxford
3. Technical writing---- B.N.Basu(PHI)

1/4 B.Tech. SECOND SEMESTER

EE2L3 COMPUTER PROGRAMMING LAB Credits: 2

Lecture: -- Internal assessment: 25 marks

Lab : 3 periods/week Semester end examination: 50 marks

Course Objectives:

- To make the student learn a programming language.
- To learn problem solving techniques.
- To teach the student to write programs in C and to solve the problems.

Course Outcomes:

After Completion of this course the student would be able to:

1. Read, understand and trace the execution of programs written in C language.
2. Write the C code for a given algorithm.
3. Implement Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor.
4. Write programs that perform operations using derived data types.

Exercise 1: Basics

1. Write a program to print sample strings like "hello world", "Welcome to C Programming" with different formats using escape sequences.
2. Write a Program to print different data types in 'C' and their ranges.
3. Write a Program to initialize, assignment & printing variables of different data types.

Exercise 2: Operators

1. Write a Program to demonstrate arithmetic operators. (+,-,*,/,%)
2. Write a Program to demonstrate logical operators.(logical AND, logical OR)
3. Write a Program to read radius value from the keyboard and calculate the area of circle and print the result in both floating and exponential notation.
4. Write a Program to calculate simple interest.
5. Write a Program to convert temperature. (Fahrenheit –Centigrade and vice-versa)

Exercise 3: Operators

1. Write a Program to demonstrate relational operators.(<,>,<=,>=,==,!=)
2. Write a program to check equivalence of two numbers using conditional operator.
3. Write a Program to demonstrate pre increment and post increment.(++a, a++ where a is a value to be initialized)
4. Write a Program to demonstrate pre decrement and post decrement.(--a, a--where a is a value to be initialized)
5. Write a program for computing the volume of sphere, cone and cylinder assume that dimensions are integer's use type casting where ever necessary.

Exercise 4: Decision Statements

1. Write a Program to read marks of a student in six subjects and print whether pass or fail (using if-else).
2. Write a Program to calculate roots of quadratic equation (using if-else).
3. Write a Program to calculate electricity bill. Read starting and ending meter reading. The charges are as follows.

No. of Units Consumed	Rate in(Rs)
1-100	1.50 per unit
101-300	2.00 per unit for excess of 100 units
301-500	2.50 per unit for excess of 300 units
501-above	3.25 per unit for excess of 500 units

Exercise 5: Switch operations

1. Write a Program to perform arithmetic operations using switch case.
2. Write a Program to display colors using switch case (VIBGYOR).
3. Write a Program to display vowels and consonants using switch case.
4. Write a Program to display names of days in a Week using switch case.

Exercise 6: Basic Loop operations

Do the Following Programs Using for, while, do-while loops.

1. Write a program to calculate sum of individual digits of a given number.
2. Write a program to check whether given number is palindrome or not.
3. Write a program to print prime numbers in the given range.
4. Write a program to display multiplication tables from 1 to 10 except 3 and 5.

Exercise 7: Advanced loops

1. Write a program to print the Fibonacci series for given 'N' value.
2. Write a program to check whether a given number is a Fibonacci number or not.
3. Write a program to read 2 numbers x and n then compute the sum of the Geometric Progression. $1+x+x^2+x^3+ \text{- - - - - - - } +x^n$
4. Write a program to print the following formats.

```
1                    *
1 2                  *  *
1 2 3                *  *  *
1 2  3 4             *  *  *  *
```

Exercise 8: 1-D arrays

1. Write a program to store 10 elements in the 1-D array and print sum of the array.
2. Write a program to print minimum and maximum elements in the 1-D array.
3. Write a program to count no. of positive numbers, negative numbers and zeros in the array.
4. Write a program to search the given element by using linear search.
5. Write a program to sort the given elements using bubble sort technique.

Exercise 9: 2-D arrays

1. Write a program to perform matrix addition and matrix subtraction.
2. Write a program to perform matrix multiplication by checking the compatibility.
3. Write a program to print the transpose of a matrix.

Exercise 10: Strings

1. Write a program to perform various string manipulations using built-in functions.
2. Write a program to print the given strings in ascending order.
3. Write a program to verify the given string is palindrome or not (without built-in functions, with using built-in functions).
4. Write a program to concatenate two strings using arrays.

Exercise 11: Math Functions and I/O Funtions

1. Write a program to read values from keyboard and find the values using abs(),sqrt(),floor(),ceil()and pow().
2. Write a program to read and display a value using getch() and putch().
3. Write a program to read and display a value using getchar(), putchar(),gets() and puts().

Exercise 12: Functions

1. Write a program to find sum of two numbers using functions.
2. Write a program to find product of two numbers using functions without arguments, without return type.
3. Write a program to find difference of two numbers using functions without arguments, with return type.
4. Write a program to find sum of two numbers using functions with arguments & without return type.

5. Write a program to find product of two numbers using functions with arguments, with return type.

Exercise13: Functions and Recursion

1. Write a program to swap two numbers using
   a) Call By Value B) Call By Reference.
2. Write a program to calculate factorial, gcd using recursion and non-recursion functions.
3. Write program to perform arithmetic operations using pointer.
4. Write a program matrix addition using pointers.

Exercise14: Structures

1. Write a program to create structure for an account holder in a bank with following Fields: name, account number, address, balance and display the details of five account holders.
2. Write a program to find total marks of individual student and average marks for 10 students using structures.
3. Write a program to create structure called traveler and members of structure are train no, coach no, seat no, source ,destination , gender, age, name and departure date.
4. Write a program to illustrate passing an entire structure to a function.

Exercise15: File operations using command line arguments

1. Write a program which copies the contents of one file to another file using command line arguments.
2. Write a program to reverse the first n characters in a file use command line arguments.

Learning Resources

Text Books:

1. Problem Solving and Program Design in C, Jeri R. Hanly, Ellot B. Koffman, 5th Edition, Pearson.
2. Programming in C by P.Dey & M. Ghosh, Oxford University Press.

Reference Books:

1. Problem Solving and Program Design in C, 4th edition, by jeri R. Hanly and Elli B.Koffman.
2. Programming in C by Pradip Dey, Manas Ghosh 2nd edition Oxford University Press.
3. E.Balaguruswamy, Programming in ANSI C 5th Edition McGraw-Hill
4. A first book of ANSI C by Gray J.Brosin 3rd edition Cengagedelmer Learning India P.Ltd
5. AL Kelly, Iraphol,Programming in C,4th edition Addison-Wesley –professional
6. Brain W.Kernighan & Dennis Ritchie, C Programming Language, 2nd edition, PHI

2/4 B.Tech. THIRD SEMESTER

EE3T1 NUMERICAL METHODS AND DIFFERENTIAL EQUATIONS Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

To find approximate root of algebraic and transcendental equations and get familiarity with interpolation. To get knowledge in solving differentiation and integration problems using numerical methods. To acquire knowledge in basic concepts of partial differential equations and also some applications of partial differential equations

Course Outcomes:

1. Ability in approximating a root of algebraic and transcendental equations.
2. To get the familiarity with interpolation and different interpolation formulae.
3. To have good exposure to numerical differentiation and integration
4. To get knowledge in numerical solution of ordinary differential equations
5. To get knowledge in finding the solution of first order linear and non-linear partial differential equations
6. To get knowledge of applications of partial differential equations

UNIT I

Solution of Algebraic and Transcendental Equations: Introduction – Bisection method – Method of false position – Iteration method – Newton-Raphson's method.

Interpolation: Introduction- Errors in polynomial interpolation – finite differences forward differences- backward differences – central differences – Symbolic relations –Differences of a polynomial - Newton's formulae for interpolation – Interpolation with unevenly spaced points- Lagrange's Interpolation formula.

UNIT II

Numerical Differentiation and Integration: Differentiation using finite differences - Trapezoidal rule – Simpson's 1/3 rule –Simpson's 3/8 rule-Boole's rule and weddle's rule

UNIT III

Numerical solution of Ordinary Differential equations: Solution by Taylor's series method - Picard's Method of successive approximations - Euler's Method - Runge-Kutta Methods– Predictor - Corrector Methods - Milne Thomsons's method.

UNIT IV

Partial Differential Equations: Formation of partial differential equations by elimination of arbitrary constants and by elimination of arbitrary functions –solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations.

UNIT V

Applications of Partial Differential equations: Solutions of linear partial differential equations with constant coefficients. Method of separation of variables, -one dimensional wave equation, one dimensional heat equation- Laplace equation

Learning Resources

Text Books:

1. A Textbook on Mathematical Methods, V. Ravindranath, P. Vijayalaxmi, Himalaya Publishing House-1st Revised Ed., 2011.
2. Higher Engineering Mathematics, B.S. Grewal- Khanna Publishers, 42nd Edition ,2012.

Reference Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley, 8th Edition, 2006
2. A Text Book of Engineering Mathematics, B. V. Ramana, Tata McGraw Hill, 3rd Edition., 2008.

2/4 B.Tech. THIRD SEMESTER

EE3T2 ELECTRICAL MACHINES – I Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

Electrical machines course is one of the important courses of the Electrical discipline. In this course the different types of DC generators and motors which are widely used in industry are covered and their performance aspects will be studied.

Course Outcomes:

Upon completing of the course student should be

1. Able to understand the construction of D.C machine, different windings, their merits and demerits
2. Able to analyze different types of DC generators their characteristics, industrial applications, effect of armature reaction and its assessment
3. Able to interpret the various losses in DC machines and their efficiency
4. Able to explain the principle of DC motor, electrical characteristics and industrial application, purpose of starter and its design.
5. Able to understand special type of DC Generators

UNIT I

D.C. Generators – Construction & Operation:

D.C. Generators – Principle of operation – Constructional Features-E.M.F Equation- Action of commutator – armature windings – lap and wave windings – simplex and multiplex windings –Types of DC generator: separately excited and self excited generators.

Armature reaction – Cross magnetizing and de-magnetizing AT/pole –commutation Process – reactance voltage – methods of improving commutation – Compensating windings – Inter poles.

UNIT II

Characteristics of D.C Generators:

Methods of Excitation - O.C.C– build-up of E.M.F - critical field resistance and critical speed - causes for failure to self excite and remedial measures—Internal & External characteristics of shunt, series and Compound generator-Applications - Name plate details available rating in market approximate cost.

Need for parallel operation - Parallel operation of DC Shunt, Series and Compound generators – use of equalizer bar and cross connection of field windings – load sharing – specific areas of applications

UNIT III

D.C. Motors:

D.C Motors – Principle of operation – Back E.M.F - Torque equation –characteristics of shunt, series and compound motors – Armature reaction and commutation - Application of DC Motors -Principle of 2 point, 3 point and 4 point starters – protective devices – Design of starter elements - Name plate details available rating in market approximate cost

UNIT IV

Speed Control of D.C. Motors:

Speed control of D.C Motors: Armature voltage and field flux control methods, Ward-Leonard system, Introduction to solid state control of D.C motors

Testing of D.C. Machines:
Losses in DC machines – Efficiency as generator and motor – condition for maximum efficiency Methods of testing D.C machines: -Brake test, Indirect testing: Swinburne's test, Hopkinson's test - Field's test for series machines - Retardation test-- separation of losses – expected efficiency levels

UNIT V
Special Type of DC Machines:
Cross Field dynamos Principle, operation and applications of Rosenberg generator, Amplidyne and Metadyne – areas of specific application – name plate details – expected efficiency levels.
Three brush DC generators: construction, principle of operation and its application.
Commutator motors, A.C series motor-modifications in construction –characteristics Universal motors applications.

Learning Resources

Text Books:
1. Electrical Machines – P.S.Bhimbra, Khanna publishers.
2. Performance and Design of DC Machines by Clayton & Hancock, BPB Publishers
3. Electrical Machines (DC) - J.B. Gupta, Kataria Publications

Reference Books:
1. Electrical Machines by D P.Kothari, I .J .Nagarth,Mc GrawHill Publications, 4^{th} edition
2. Electrical Machines by S.K. Bhattacharya
3. Electro mechanics – I (D.C Machines) S. Kamakshaiah Hi-Tech Publishers

2/4 B.Tech. THIRD SEMESTER

EE3T3 THERMAL AND HYDRO PRIME MOVERS Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objectives:

The objectives of the course are:

- To make the students understand the various types of prime movers which can be connected to generators for power production
- To impart the knowledge of various types of pumps.

Course Outcomes:

Upon completion of this course the student will be able to:

1. Describe the basic components of steam power plants and working principles of different types of steam turbines
2. Explain the working principle of different types of gas turbines
3. Identify the main components of diesel power plant and explain the working principle of diesel engines
4. Discuss the working principle of different types of hydraulic turbines
5. Illustrate the working principle of centrifugal and reciprocating pumps

UNIT I

Steam power plants

Boilers- Working principle of Benson boiler and Lamont boilers.

Steam Turbines: Schematic layout of steam power plant, Classification of Steam Turbines- Impulse Turbine and Reaction Turbine, Compounding in Turbines

Condensers- Working principle of jet and surface condensers.

UNIT II

Gas Turbine: Introduction, applications, types of gas turbines, working principle of open and closed cycle gas turbine. Methods to improve thermal efficiency of gas turbine, gas turbine fuels, starting of plant, comparison with diesel and steam power plants.

UNIT III

Diesel Power Plant: Introduction, diesel engine working principle, diesel fuels, diesel electric plant main components, super charging.

UNIT IV

Hydraulic Turbines: Introduction, Classification of hydraulic turbines, working principles of Pelton wheel, Francis turbine, Kaplan Turbine. Governing of Impulse & Reaction Turbine

UNIT V

Pumps:

Centrifugal pumps-types, working principle, Multistage centrifugal pumps. Reciprocating pumps-types, working principle.

Learning Resources

Text Books:

1. Thermal Engineering-by RK Rajput, Lakshmi Pubilcations
2. Fluid Mechanics & Hydraulic Machines – by Modi & Seth, PHI Publications.

Reference Books:

1. Gas Turbines – by V Ganesan, Tata McGraw-Hill Companies
2. Internal Combustion Engines – by V Ganesan, Tata McGraw-Hill Companies.
3. PK Nag – Power Plant Engineering, TMH publication
4. Gas turbine theory-HIH Sarvanmuttoo,H Cohen,GFC Rogers, Pearson Education India

2/4 B.Tech. THIRD SEMESTER

EE3T4 ELECTRICAL CIRCUIT ANALYSIS-II Credits : 3

Lecture: 3 periods/week Internal Assessment: 30 Marks

Tutorial: 1 period /week Semester end examination: 70 Marks

Course Objectives:

Electrical Circuit Analysis-II is the foundation for all subjects of the Electrical Engineering discipline.

- Verifies Circuit Theorems for D.C and A.C Excitation.
- Calculates the Two port network parameters.
- Determine transient and steady state responses of first order and second order circuits including switches for D.C Excitation and sinusoidal excitation.
- Application of Laplace Transforms to electrical circuits with different inputs.
- To do Analysis of Electrical Circuits to non sinusoidal periodic waveforms using Fourier analysis.

Course Outcomes:

1. Apply knowledge of mathematics, science, and engineering to the analysis and design of ac single phase and three phase electrical circuits.
2. Identify, formulate, and solve engineering problems in the area of Electrical circuits
3. Design an electric system, or process to meet desired needs within realistic constraint
4. Gets familiar with the circuit theorems for DC and AC excitation.
5. Can do the time response analysis of electrical circuits for DC and AC excitation and also can derive different network parameters.
6. Can analyse electrical circuits in time domain using Laplace Transforms and Fourier analysis.
7. Student will get the ability to participate and try to succeed in competitive examinations

UNIT I

Circuit Theorems for DC and A.C Excitation.

Linearity Property – Superposition - Thevenin's Theorem, Norton's theorem Superposition Theorem, Maximum Power Transfer Theorem, Millman's theorem, Tellegen's, Reciprocity and compensation theorems.

UNIT II

Two Port Networks

Two port network parameters – Z, Y, ABCD and hybrid parameters and their relations, Interconnection of Two-Port networks

UNIT III

Part A: Laplace Transforms:

Introduction, Definition of Laplace Transforms, Properties of Laplace Transform, Laplace Transform of Step, Ramp, Pulse and Impulse Signals, Laplace Transform of Periodic Signals, Convolution Integral, Application to Circuits, Inverse Laplace Transforms.

Part B. **Fourier analysis of A.C Circuits:**

Trigonometric form and exponential form of Fourier series – conditions of symmetry- line spectra and phase angle spectra, Average Power and RMS Values- Analysis of Electrical Circuits to non sinusoidal periodic waveforms, Fourier transforms.

UNIT IV

Time Response of Circuits (DC Excitation):

Time response of R-L, R-C, R-L-C series circuits for Zero input, Step input, pulse input - Initial conditions-solution method using differential equation and Laplace transforms.

UNIT V

Time Response of Circuits: (Sinusoidal Excitation)

Transient response of R-L, R-C, R-L-C series circuits for sinusoidal excitations-Initial conditions-Solution method using differential equations and Laplace transforms.

Learning Resources

Text Books:

1. "Fundamentals of Electric Circuits" Charles K.Alexander, Mathew N.O.Sadiku, Tata McGraw-Hill.
2. Circuits & Networks Analysis & Synthesis by A. Sudhakar and Shyammohan S Palli, Tata McGraw- Hill.
3. 3000 Solved Problems in Electrical Circuit by Schaum's solved problem series Tata McGraw- Hill.
4. Circuit Theory by A.Chakrabarti Danapat Rai & Co publisher.

Reference Books:

1. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley, McGraw Hill Company, 6^{th} edition
2. Network Analysis by N.C.Jagan, C.Lakshmi Narayana BS publications 2^{nd} edition.
3. Network Analysis: Van Valkenburg; Prentice-Hall of India Private Ltd.

2/4 B.Tech. THIRD SEMESTER

EE3T5 ELECTROMAGNETIC FIELDS Credits: 3

Lecture: 3 periods/week Internal assessment: 30marks

Tutorial: 1 period/week Semester end examination: 70marks

Course Objective:

The objective of this course is to introduce the concepts of electric field and magnetic fields and their applications which will be utilized in the development of the theory for power transmission lines and electrical machines.

Course Outcomes:

1. Compute electric and magnetic fields for symmetrical charge and current configurations.
2. Determine voltage gradients for simple charge and current configurations and the force between charges and currents.
3. Calculate capacitance and inductance of common conductor configurations and the energy stored.
4. Examine time varying fields for torque developed, emf induced and energy stored.

UNIT I

ELECTROSTATICS -I

Review of vector calculus, Cartesian, cylindrical and spherical co-ordinate systems.

Coulomb's law - Electric field due to different charge distributions - Electric flux and flux density - Gauss's Law - Applications of Gauss's Law - Divergence - Maxwell's first Law.

Electrostatic Energy - Electric Potential - Potential Gradient - Calculation of Electric field through Electric Potential for given charge configuration - Energy stored and Energy density in static Electric Field, Laplace's and Poison's equations - Solution of Laplace's equation in one variable.

UNIT II

Electric Dipole - Dipole Moment - Potential and Electric Field due to Dipole - Torque on an Electric Dipole in an Electric field, Conductors.

Behaviour of conductors in an electric field, Current density – conduction and Convection current densities – Ohm's law in point form – Equation of continuity.

Electric field inside dielectric material - concept of Polarization - Boundary conditions between dielectric and conductor - between two dielectrics.

Capacitance - Capacitance of parallel plate – Spherical - Co-axial capacitors with Composite Dielectric.

UNIT III

MAGNETOSTATICS

Static magnetic fields — Oesterd's experiment - Biot-Savart's law -Magnetic field intensity (MFI) – MFI due to a straight current carrying filament – MFI due to circular, square and solenoid current – Carrying wire – Relation between magnetic flux, magnetic flux density and MFI – Maxwell's second Equation, div(B)=0.

Ampere's circuital law and its applications viz. MFI due to an infinite sheet of current and a long current carrying filament – Point form of Ampere's circuital law – Maxwell's third equation, Curl (H)=Jc.

UNIT IV

MAGNETIC FORCES

Magnetic force - Moving charges in a Magnetic field – Lorentz force equation – force on a current element in a magnetic field – Force on a straight and a long current carrying conductor in a magnetic field – Force between two straight long and parallel current carrying

conductors – Magnetic dipole and dipole moment – a differential current loop as a magnetic dipole – Torque on a current loop placed in a magnetic field.

SELF AND MUTUTAL INDUCTANCE

Self and Mutual inductance – determination of self-inductance of a solenoid and toroid and mutual inductance between a straight long wire and a square loop wire in the same plane – energy stored and density in a magnetic field. Circuit representation of coupled coils and its analysis.

UNIT V

TIME VARYING FIELDS

Time varying fields – Faraday's laws of electromagnetic induction – Its integral and point forms – Maxwell's fourth equation, Curl (E)=-∂B/∂t – Statically and Dynamically induced EMFs – Simple problems -Modification of Maxwell's equations for time varying fields – Displacement current – Poynting Theorem and Poynting vector.

Learning Resources

Text Books:

1. "Engineering Electromagnetics" by William H. Hayt & John. A. Buck Mc. Graw-Hill Companies, 7th Editon.2006.
2. "Elements of Electromagnetics", Mathew NO Sadiku, Oxford University Press.

Reference Books:

1. "Introduction to Electro Dynamics" by D J Griffiths, Prentice-Hall of India Pvt.Ltd, 2nd editon
2. "Electromagnetics" by J. D Kraus Mc Graw-Hill Inc. 4th edition 1992.
3. "Electromagnetism-Theory and Applications" by Ashutosh Pramanik, PHI, 2003

2/4 B.Tech. THIRD SEMESTER

EE3T6 SWITCHING THEORY AND LOGIC DESIGN Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objectives:

- To introduce the basic concepts of binary codes, error detecting and correcting codes.
- To study the representation of switching functions using Boolean expressions and their minimization techniques.
- To design and realize various combinational circuits, synchronous and asynchronous sequential logic circuits.
- To analyze various synchronous and asynchronous sequential logic circuits.

Course Outcomes:

Student will be able to

1. Identify the features of various number systems and binary codes.
2. Apply the concepts of Boolean algebra for the analysis & design of various combinational & sequential logic circuits.
3. Design various digital circuits starting from simple ordinary gates to complex programmable logic devices & arrays.
4. Analyze various synchronous and asynchronous sequential circuits.

UNIT I

Number Systems and Binary Codes:

Philosophy of number systems, complement representation of negative numbers, binary arithmetic, binary codes, error detecting & error correcting codes –Hamming codes.

Boolean algebra: Fundamental postulates of Boolean algebra, Basic theorems and properties.

UNIT II

Switching Functions: Switching functions- Canonical and Standard forms, Algebraic simplification, Digital logic gates, Multilevel NAND/NOR realizations, Minimization of switching functions using K-Map up to 5-variables, Tabulation Method, Prime Implicant chart.

UNIT III

Combinational Logic Circuits: Adders, Subtractors, Parallel Binary Adder, BCD adder, Encoder, Decoder, Multiplexer(MUX), Demultiplexer, MUX Realization of switching functions, Parity generator, Magnitude Comparator, Code converters, PROM, PLA, PAL, Realization of switching functions using PROM,PLA and PAL.

UNIT IV

Sequential Logic Circuits: Classification of sequential circuits (synchronous and asynchronous), Basic flip-flops (NAND RS latch, NOR RS latch, RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals), Truth tables and excitation tables, Conversion from one flip-flop to another flip-flop, Design of ripple counters, Design of synchronous counters, Registers, Shift register, Bidirectional Shift register, Universal shift register.

UNIT V

Synchronous Sequential Machines: Finite state machines, Mealy and Moore models, Analysis of Clocked Sequential circuits, Design procedures, State reduction and State assignment, Design and realization of circuits using various Flip-flops.

Learning Resources

Text Book:

Switching and Finite Automata theory, ZviKohavi and Niraj k Jha, Cambridge University Press, 3rd edition, 2010.

Reference Books:

1. Digital Design, Morris Mano, PHI, 3rd Edition, 2001.
2. Fundamentals of Logic Design, Charles H. Roth, Thomson Publications, 5th Edition, 2009.

Web Resources:

1. http://www.ece.ubc.ca/~saifz/eece256.htm
2. http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Guwahati/digital_circuit/frame/index.html

2/4 B.Tech. THIRD SEMESTER

EE3L1 ELECTRICAL CIRCUITS LAB Credits: 2

Lecture: - Internal assessment: 25 marks

Lab : 3 periods/week Semester end examination: 50 marks

Course Objectives:

- Understand how to formulate and solve the basic electrical engineering problems.
- Usage of laboratory tools for measurement and verification of theorems

Course Outcomes:

1. On completion of the lab student will know the verifications of Thevenin's Norton's, superposition, Maximum power, Compensation, Reciprocity, Millman's theorem
2. Student will able to draw Locus diagrams and resonane diagram for series and parallel circuits.
3. Students will be able to find different network parameters and able to measure 3Φ power drawn by different circuits.

Any 10 of the following experiments are required to be conducted:

1) Verification of Thevenin's and Norton's Theorems
2) Verification of Superposition theorem for DC and AC networks
3) Verification of Maximum Power Transfer Theorem
4) Verification of Compensation Theorem
5) Verification of Reciprocity, Millman's Theorems
6) Locus Diagrams of RL and RC Series Circuits
7) Series and Parallel Resonance
8) Determination of Self, Mutual Inductances and Coefficient of coupling
9) Determination of Z and Y Parameters
10) Determination of Transmission and Hybrid parameters
11) Measurement of Active Power for Star connected balanced load
12) Measurement of Reactive Power for balanced load (Star / Delta)
13) Measurement of 3-phase Power by two Wattmeter Method for balanced and unbalanced load (Star / Delta)
14) Time response of RC and RLC circuits

2/4 B.Tech. THIRD SEMESTER

EE3L2 **EDC Lab** **Credits: 2**

Lecture: - **Internal assessment: 25marks**

Lab : 3 periods/week **Semester end examination: 50 marks**

Course Objectives:

- To study basic electronic components
- To observe characteristics of electronic devices

Course Outcomes:

At the end of the course the students can able to

1. Measure voltage, frequency and phase of any waveform using CRO.
2. Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.
3. Analyze the characteristics of different electronic devices such as diodes, transistors etc., and simple circuits like rectifiers, amplifiers etc.,

LIST OF EXPERIMENTS:

PART A: (Only for viva voce Examination)

Electronic Workshop Practice(in 6 lab sessions)*:*

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of Active Devices, Diodes, BJTs, Lowpower JFETs, MOSFETs, Power Transistors, LEDs, LCDs, Optoelectronic Devices, SCR, UJT, DIACs, TRIACs, Linear and Digital ICs.
3. Soldering practice – Simple Circuits using active and passive components.
4. Single layer and Multi layer PCBs (Identification and Utility).
5. Study and operation of
   - Multimeters (Analog and Digital)
   - Function Generator
   - Regulated Power Supplies
6. Study and Operation of CRO.

PART B: (For Laboratory examination – Minimum of 10 experiments)

1. Frequency measurement using Lissajous Figures
2. PN Junction diode characteristics A. Forward bias B. Reverse bias. (Cut-in voltage & Resistance calculations)
3. Zener diode characteristics and Zener as a regulator
4. Transistor CB characteristics (Input and Output) & h Parameter calculations
5. Transistor CE characteristics (Input and Output) & h Parameter calculations
6. Rectifier without filters (Full wave & half wave)
7. Rectifier with filters (Full wave & half wave)
8. FET characteristics
9. SCR Characteristics
10. UJT Characteristics
11. CE Amplifier
12. CC Amplifier (Emitter Follower).

2/4 B.Tech. FOURTH SEMESTER

EE4T1 COMPLEX VARIABLES AND SPECIALFUNCTIONS Credits: 3

Lecture: 3 periods/week **Internal assessment: 30 marks**

Tutorial: 1 period /week **Semester end examination: 70 marks**

Course objective:

After the completion of this course students will learn the concepts of analyticity of complex functions and find complex potential functions. They will be able to solve improper integrals, get familiar with conformal mappings. It enables them to know the solution of Bessel, Legender equations and properties of Bessel function, Legendre polynomials.

Course outcomes:

1. Students able to find complex potential function and know the properties of elementary functions of complex variables.
2. Cauchy's integral formula enables them to solve the integration problems.
3. Able to write series expansions of complex functions, Solve improper integrals.
4. Get knowledge of conformal mappings and find the image of given regions under given transformations.
5. Get knowledge of Bessel functions, Legendre polynomials.

UNIT I

Functions of a complex variables: Continuity –Differentiability –Analyticity –Properties – Cauchy Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions –Milne – Thompson method.

Elementary functions: Exponential, trigonometric, hyperbolic functions and their properties-General power z(c is complex), principal value.

UNIT II

Complex Integration and series expansions:

Line integral – Evaluation along a path and by indefinite integration – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula.

Complex power series: Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. Singular points – Isolated singular point – pole of order m – essential singularity.

UNIT III

Residues and evaluation of improper of integrals: Evaluation of residues by formula and by Laurent series-Residue theorem. Evaluation of integrals of the type

a)improper real integrals $\int_{\infty}^{\infty} f(x)dx$ b)$\int_{0}^{2\pi} f(\cos\theta, sin\theta)d\theta$ c)$\int_{-\infty}^{\infty} e^{imx} f(x)dx$

d) Evaluation of improper integrals by indentation.

UNIT IV

Conformal mapping: Transformation by $e^z, \ln z, z^2, z^n$ $(npositiveinteger)$,sin z,cos z, z+a/z, translation,rotation,inversion and bilinear transformation-fixed point-cross ratio-properties-invariance of circles and cross ratio-determination of bilinear transformation mapping 3 given points.

UNIT V

Special functions: Bessel functions-properties-recurrence relations-orthogonality. Legendre polynomials-properties- Rodrigue's formula-Recurrence relations –orthogonality.

Learning Resources

Text Books:

1. Higher Engineering Mathematics – Khanna Publishers – B.S. Grewal – 42nd Edition: 2012, June.
2. Higher Engineering Mathematics – S.Chand Technical Publishers – H.K Dass.

Reference Book:

Engineering Mathematics (Volume – III) - S. Chand - T. K. V. Iyengar, B. Krishna Gandhi, S. Ranganatham, M.V.S.S.N. Prasad- 9th Revised Edition: 2012

2/4 B.Tech. FOURTH SEMESTER

EE4T2 ELECTRICAL MACHINES – II Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

This is an extension of electrical machines- I course. This subject facilitates to study the performance of Transformers and Induction motors which play major role in power transmission, industrial drives and agricultural pump sets.

Course outcomes:

Upon completing of the course student should be

1. Able to understand construction, working principle, operating characteristics of single phase and 3 phase transformers and solve the problems for various parameters.
2. Able to understand the construction, working principle and characteristics of different types of motors and solve the problems for various parameters.
3. Able to understand double field theory, construction of single phase motor and their characteristics and industrial applications.

UNIT I

Single Phase Transformers: Principle of operation of transformer, constructional details of shell type and core type single-phase and three-phase transformers. EMF equation, operation of practical power transformer under no load and on load (with phasor diagrams). Concept of ideal transformers and commercial transformers.

Equivalent circuit, losses, efficiency, condition for maximum efficiency, all day efficiency. Open circuit and short circuit tests, calculating the parameters of equivalent circuit. regulation, predetermination of efficiency and regulation. Polarity test, Sumpner's test.

UNIT II

Parallel operation of Single Phase Transformers: Need, conditions to be satisfied for parallel operation. Load sharing in case of similar and dissimilar transformers. Auto-transformers (single and three phase)-construction, principle of operation, copper efficiency, merits and de-merits and their applications.

Three Phase Transformers: Introduction, choice between single unit three-phase transformer and bank of single-phase transformers. Transformers connection for three-phase operation-star/star, delta/delta, zigzag/star and vee/vee, choice of connection, phase shift between primary and secondary and vector groups. Scott connection for three-phase to two-phase conversion and its applications. Conditions for parallel operation of three –phase transformers, load sharing, ON load and OFF load tap changers.

UNIT III

Three phase Induction motors: Concept of rotating magnetic field. Principle of operation, construction of stator windings, squirrel-cage &slip-ring rotors. Slip, torque-slip characteristics covering motoring, generating and braking regions of operation, maximum torque, double cage and deep bar rotors. Equivalent circuit and performance evaluation of double cage induction motor. Phasor diagram of induction motor on no-load and on load. Equivalent circuit,

Induction generator- operation of induction generator – self exited and externally exited generators and its Applications

UNIT IV

Testing of three-phase Induction Motor: Losses in three phase induction motor efficiency, no-load and blocked rotor tests. Circle diagram and performance evaluation of motor. cogging and crawling.

Starting methods of Induction Motors: Need for starter. Direct on line (DOL), star-delta and autotransformer starting. Rotor resistance starting, modern methods – introduction to soft starters, principle of induction generator and its industrial applications.
Speed Control of Three-phase Induction Motors: Speed control-voltage, frequency, and rotor resistance, pole changing and cascading of motors, introduction to solid state controllers.

UNIT V
Single Phase Induction Motor: Classification of single phase induction motors – double revolving field theory – working principle of single winding single phase induction motor – cross field theory – equivalent circuit – power developed – construction, working principle – speed torque characteristics - spilt phase capacitor start motor, capacitor start capacitor run motor - shaded pole motor, ratings and their applications –equivalent circuit – testing of motors – efficiency – no load and blocked rotor tests.

Learning Resources

Text Books:
1. Electrical Machines by P.S.Bhimbra, Khanna publishers
2. Electrical Machines by J.B.Gupta, Kataria publications
3. Electrical Machines (AC) by Ashfaq Husain, Dhanpat Rai & Co.
4. Electrical Machinery by A.E. Fitzgerald, C. Kingsley and S. Umans, Mc Graw Hill Companies, 5th edition, 1990.

Reference Books:
1. Performance and design of A.C machines by MG Say, BPB publishers.
2. Theory of Alternating Current Machinery by Langsdorf, Tata Mc Graw Hill, 2nd edition.
3. Electrical Machines by I.J.Nagrath &D.P.Kothari, Tata Mc Graw - Hill publishers.

2/4 B.Tech. FOURTH SEMESTER

EE4T3 ELECTRICAL POWER GENERATION Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

Electrical Power plays significant role in day to day life of entire mankind. The aim is to impart the basic knowledge on different types of power generation & power plants in detail so that it helps them in industry oriented learning.

Course outcomes:

Upon completing this course student will be

1. Familiar with techniques of power generation, operation and maintenance of power plants.
2. Able to know the economical aspects of power generation along with different methods of tariffs.
3. Gain knowledge on different types of substations and their equipments.
4. Able to understand the impact of power solutions on the society and will be aware of contemporary issues.

UNIT I

Hydroelectric power stations

Introduction –General layout of Hydro electric plant, selection of site, classification - run off river plants with pondage and without pondage - storage reservoir plants -pumped storage plants. Hydrology, Catchment area, Mass curve - storage - discharge - station capacity - estimation of power developed from a given catchment area; heads and efficiencies, Merits and demerits of hydroelectric power plant - Numerical Problems.

UNIT II

Thermal Power Stations

General layout of Modern thermal plant, selection of site, coal handling, pulverization of coal, ash handling systems, dust collection systems, ESP system ,draught system-natural and artificial. Brief description of: Economizers, Boilers, Super heaters, Turbines, Condensers, Chimney and cooling towers. Numerical Problems- Comparison of thermal and hydel power plants.

UNIT III

Nuclear Power Plants

Nuclear fuels- Fissile and fertile materials, Nuclear Fission, Chain reaction, Principle of operation of Nuclear reactor – General layout of Nuclear power plant, Reactor Components, Radiation hazards, Brief description of PWR, BWR and FBR.

Introduction to Non Conventional Sources (elementary treatment only):

Solar Energy, Wind Energy, Ocean Energy, Tidal Energy, Wave Energy, Fuel Cells, and Biomass.

UNIT IV

Economic Aspects and Tariffs

Load curve, load duration and integrated load duration curves, load, demand, diversity, capacity, utilization and plant use factors. Generation cost and its classification, interest and depreciation, effect of load factor and diversity factor on cost of energy generated, Numerical Problems.

Tariffs: Base load and peak load stations, load sharing between base load and peak load stations, objectives of tariff ,factors affecting tariff, types of tariffs – block and stepped tariff

– Two part tariff and three part tariff – Frequency dependent tariff- unscheduled interchange based tariff, Numerical problems.

Unit V

Substations

Air insulated substations: Classification of substations-Indoor & Outdoor substations, Substation layout showing the location of all the substation equipment, Bus bar arrangements in the Sub-Stations- single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

Gas insulated substations: Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, Comparison of Air insulated substations and Gas insulated substations.

Learning Resources

Text Books:

1. A course in Electrical Power systems ,J.B. Gupta, Kataria Publications
2. A Text Book on Power System Engineering, M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakrabarti, Dhanpat Rai & Co. Pvt. Ltd.
3. A Text Book on Power System engineering, R.K.Rajput, Laxmi Publication (P) Ltd.

Reference Books:

1. Generation, Distribution and Utilization of Electrical Energy, C.L.Wadhwa,New Age International publishers.
2. Elements of Power Station design and practice, M.V. Deshpande, Wheeler Publishing company.
3. Gas insulated substations, M.S.Naidu, I K International Publishing House.

2/4 B.Tech. FOURTH SEMESTER

EE4T4 ELECTRICAL MEASUREMENTS & INSTRUMENTATION Credits: 3

Lecture: 3 periods/week **Internal assessment: 30 marks**

Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objective:

This course introduces principle of operation of basic analog and digital measuring instruments for measurement of current, voltage, power, energy etc. Measurement of resistance, inductance and capacitance by using bridge circuits will be discussed in detail. It is expected that student will be thorough with various measuring techniques that are required for an electrical engineer.

Course Outcomes:

After completing this course, student will be able to

1. Familiar with various measuring instruments used to detect electrical quantities.
2. Design and test instrument transformers for various electrical applications.
3. Understand and use transducers for measuring the most common physical quantities.
4. Measure electrical parameters using AC and DC bridges.

UNIT I

Measuring Instruments

Classification, deflecting, control and damping torques, Ammeters and Voltmeters, PMMC, moving iron type instruments, expression for the deflecting torque and control torque ,Errors and compensations. Extension of range using shunt and series resistance.

Measurement of Power and Energy

Single phase and three phase dynamometer wattmeter, LPF and UPF, expression for deflecting and control torques, Measurement of active and reactive powers in balanced and unbalanced systems. Single phase induction type energy meter, driving and braking torques, errors and compensations, testing by phantom loading using R.S.S. meter, Three phase energy meter, Trivector meter, maximum demand meters.

UNIT II

Instrument transformers

Current Transformers, Theory, Ratio error and phase angle error, Reduction of errors, construction of C.T, effect of Secondary open circuit, permanent magnetization and demagnetization of cores, testing of Current Transformers. Potential Transformers - Theory, Ratio error and phase angle error, Reduction of errors, Construction of P.T, testing of Potential Transformers, Extension of range of wattmeter using instrument transformers.

UNIT III

Special Meters

Type of P.F meters-Single phase Electrodynamometer Power Factor meter-three phase Electrodynamometer .Power Factor meter and Moving Iron Power Factor meters.

Type of Frequency meters – Mechanical Resonance type Frequency meter, Electrical Resonance type Frequency meter-Weston type Frequency meter-Ratio meter type Frequency meter, Saturable core Frequency meter.

UNIT IV

Resistance Measurements

Method of measuring low, medium and high resistances, sensitivity of Wheat stone's bridge, Carey Foster's bridge- Kelvin's double bridge for measuring low resistance, loss of charge method for measurement of high resistance.

A.C. Bridges

Measurement of inductance, Quality Factor - Maxwell's bridge, Hay's bridge, Anderson's bridge, Owens's bridge. Measurement of capacitance and loss angle, Desauty Bridge, Wien's bridge, Schering Bridge.

UNIT V

Transducers

Principles of transducers, Resistance Thermometers, Thermistors, Thermo couples, Strain Gauge and Linear Variable Differential Transformers.

Digital meters

Introduction to digital meters, Digital Voltmeters-Successive approximation, ramp and integrating type, Digital frequency meter, Digital energy meters and Digital tachometer-Bidirectional meters accuracy class.

Learning Resources

Text Books:

1. A course in Electrical and Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & Co. Publications.
2. Electrical Measurements and measuring Instruments,E.W. Golding and F.C. Widdis, 5th Edition, Wheeler Publishing company.
3. Modern Electronic Instrumentation and Measurement Techniques, Albert D. Helfrick and William D. Cooper, PHI, 2nd Edition.

Reference Books:

1. Principles of Electrical Measurements, H.Buckingham and Price, Prentice, Hall India.
2. Electrical Measurements, Forest Klaire Harris, John Wiley and sons.
3. Electrical Measurements: Fundamentals, Concepts, Applications, Martin.U.Reissland, New Age International Publishers Limited.
4. Electrical and Electronic Measurements, G.K.Banerjee, PHI Learning Private Ltd.

2/4 B.Tech. FOURTH SEMESTER

EE4T5 CONTROL SYSTEMS Credits: 3

Lecture: 1 periods/week Internal assessment: 30 marks

Practice: 3 periods/week Semester end examination: 70 marks

Course Objectives:

In this course it is aimed to provide sound knowledge in the basic concepts of linear control theory, design of control system and giving an exposure to the students on characteristics, stability of linear systems and addresses the analysis of feedback systems and finally to equip the student with the ability to select and design suitable control systems.

Course Outcomes:

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

1. Understand the basic concepts, properties of feedback and applications of control systems in day to day life.
2. Understand the transfer function analysis in mathematical modeling of control systems.
3. Perform time domain and frequency domain analysis of control systems required for stability analysis.
4. Analyze control system design techniques, their limitations and benefits.
5. Present and analyze linear control system using the state space technique.

UNIT I

Introduction

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Effects of feedback. Concept of Transfer function- impulse response. Mathematical models – Differential equations, Finding Transfer function for mechanical systems (Translational and Rotational), electrical systems and electrical analogous of mechanical systems. Transfer Function of DC Servo motor - AC Servo motor, Synchro transmitter and Receiver.

UNIT II

Transfer Function Representation

Block diagram algebra-Reduction techniques – Representation by Signal flow graph - Reduction using Mason's gain formula.

Time Response Analysis

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and static error constants

UNIT III

Stability Analysis in S-Domain

Stability of linear systems- BIBO stability- Concept of absolute stability, Relative stability- Stability analysis using Routh- Hurwitz Criterion.

Root Locus Technique:

The root locus concept - construction of root loci

UNIT IV

Frequency Domain Analysis of Control Systems and Stability

Introduction, Frequency domain specifications- Polar Plots- stability analysis of Nyquist Plots- Bode plots Magnitude vs phase plot – Phase margin and Gain margin

Design of Compensators:
Compensation techniques – Lag, Lead, and Lead-Lag Controllers design in frequency Domain, PID Controllers.

UNIT V
State Space Analysis of Continuous Systems
Concepts of state, state variables and state model, derivation of state models from block diagrams, Conversion of state variable model to transfer function model and vice-versa - Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

Learning Resources

Text Books:
1. "Automatic Control Systems" by 'B. C. Kuo', John Wiley and Sons-8th edition, 2003.
2. "Control Systems Engineering" by 'I. J. Nagrath and M. Gopal', New Age International Pvt.Ltd. Publishers-5th edition, 2009.
3. "Modern Control Engineering" by 'Katsuhiko Ogata', Prentice Hall of India Pvt. Ltd.-3rd edition, 1998.

Reference Books:
1. "Control Systems Engineering" by 'Norman S.Nise', John Wiley 6th Edition 2011.
2. "Modern Control Engineering" by 'K P Mohandas Sanguine', Pearson Revised Edition, 2010.
3. "Modern Control Systems Richard" by 'C. Dorf and Robert H. Bishop Addison' – Wesley, 1999.
4. "Linear Control System Analysis and Design" by 'John J.DAzzo & Constantine H.Houpis', Tata Mc Graw-Hill, Inc., 1995.

2/4 B.Tech. FOURTH SEMESTER

EE4T6 PULSE & DIGITAL CIRCUITS Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objectives:

- To introduce the fundamental concepts of the wave shaping
- To analyze different types of Multi vibrators and their design procedures
- To familiarize the operation of Time-base Generators and logic families

Course Outcomes:

Student will be able to

1. Solve the problems on wave shaping circuits
2. Design the Multivibrator circuits as per the specifications
3. Classify and explain time base generators and logic families

UNIT I

Linear Wave Shaping: Operation of High pass and Low pass RC circuits, Response of High pass and Low pass RC circuits to sinusoidal, step, pulse, square, exponential and ramp inputs, High pass RC circuit as a differentiator, Low pass RC circuit as an integrator.

UNIT II

Nonlinear Wave Shaping: Clipping operation, Series & Shunt Diode clippers, Clipping at two independent levels, analysis of multi-diode clipping circuits, clamping operation, Positive and Negative clampers, biased clampers, steady state response of the clamping circuit to a square wave input, Clamping circuit theorem.

UNIT III

Bistable Multivibrators: Design and Analysis of Fixed-bias& self-bias transistor binary, Commutating capacitors, Triggering of Binary, Non saturating Binary, Transistor Schmitt trigger and its applications.

UNIT IV

Monostable& Astable Multivibrators: Collector coupled Monostable multivibrator-expression for the gate width, waveforms at bases and collectors; Collector coupled Astable multivibrator-expression for the frequency of operation, waveforms at bases and collectors, voltage to frequency convertor; design and analysis related problems on those circuits.

Logic families: DTL, TTL, ECL, MOS and CMOS logic families, Realization of NAND & NOR gates.

UNIT V

Sweep Circuits: General features of a time-base signal, Exponential voltage sweep circuit, basic principles of Miller and Bootstrap time-base generators, transistor Miller voltage sweep generator, transistor bootstrap voltage sweep generator, simple current sweep circuit, linearity correction through adjustment of driving waveform, transistor current time base generator.

Learning Resources

Text Books:

1. Pulse Digital and Switching Waveforms, J. Millman and H. Taub, McGraw-Hill, 2nd Edition 1991.
2. Pulse and Digital Circuits, A. Anand Kumar, PHI, 2nd Edition, 2005.

Reference Books:

1. Digital Logic State Machine Design, David J.Comer Oxford University Press, 3rd Edition, 2008
2. Introduction to System Design Using Integrated Circuits, B S Sonde, New Age International, 2nd Edition, 1992.
3. David A Bell, "Solid State Pulse Circuits", Prentice Hall Inc, Fourth Edition, 2005.

Web Resources:

1. http://notes.smartzmail.com/wp-content/uploads/2013/10/PDC_Notes.pdf
2. http://jntufiles.com/2014/12/13/pulse-digital-circuits-textbook-free-download/
3. http://ftp.utcluj.ro/pub/users/dadarlat/circ_analognumeric-calc/curs8-eng.pdf
4. http://www.talkingelectronics.com/Download%20eBooks/Principles%20of%20electronics/CH-18.pdf

2/4 B.Tech. FOURTH SEMESTER

EE4L1 ELECTRICAL MACHINES LAB – I Credits: 2

Lecture: - Internal assessment: 25 marks

Lab : 3 periods/week Semester end examination: 50 marks

Course Objective:

In this lab students understand the performance of different types of DC generators and motors, and capable to analyze the operation of DC machines under different loading conditions.

Course Outcomes:

After completing the lab course, students will be able to understand and conduct the

1. Load test on different types of DC generators and determines their characteristics.
2. Brake test on different types of DC motors and determines their performance curves.
3. Tests to find efficiency of DC machines

List of experiments

Any 10 of the following experiments are required to be conducted:

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
3. Load test on DC series generator. Determination of characteristics.
4. Load test on DC compound generator. Determination of characteristics.
5. Brake test on DC shunt motor. Determination of performance curves.
6. Brake test on DC compound motor. Determination of performance curves.
7. Brake test of DC series motor. Determination of performance curves.
8. Swinburne's test and predetermination of efficiencies as Generator and Motor.
9. Speed control of DC shunt motor by field and armature control.
10. Hopkinson's test on DC shunt machines. Predetermination of efficiency.
11. Fields test on DC series machines. Determination of efficiency.
12. Retardation test on DC shunt motor. Determination of losses at rated speed.
13. Separation of losses in DC shunt motor.

2/4 B.Tech. FOURTH SEMESTER

EE4L2 ELECTRICAL MEASUREMENTS LAB Credits: 2

Lecture: - Internal assessment: 25 marks

Lab: 3 periods/week Semester end examination: 50 marks

Course Objectives

- To know the procedures for measuring resistance, inductance and capacitance of different ranges.
- To perform experiment to measure three phase power.
- To design experiments for calibration of energy meter.
- To know the industrial practices of measuring earth resistance, dielectric strength of transformer oil & Testing of underground cables

Course Outcomes:

Upon completion of the course student will be able to

1. Calibrate and test single phase energy meter, and LPF wattmeter.
2. Measure resistance, inductance and capacitance.
3. Measure 3-Φ active power and reactive power.
4. Test current transformers and dielectric strength of oil.
5. Calibrate LVDT and resistance strain gauge.

List of Experiments:

Any 10 of the Following Experiments are to be Conducted

1. Calibration of single phase energy meter.
2. Measurement of low resistance using Kelvin's double bridge.
3. Capacitance measurement using Schering bridge.
4. Inductance measurement using Anderson bridge.
5. Measurement of three phase reactive power with single phase wattmeter for balanced loading.
6. Calibration of LPF wattmeter by Phantom testing.
7. Measurement of three phase power with single watt meter and 2 No's of C.T's.
8. C.T. testing using Silsbee's method – Measurement of percentage ratio error and phase angle error of given C.T.
9. Dielectric oil testing using H.T testing Kit.
10. LVDT and capacitance pickup-characteristics and calibration.
11. Resistance strain gauge-strain measurement and calibration.
12. Measurement of parameters of choke coil using three voltmeter and three ammeter method.

3/4 B.Tech. FIFTH SEMESTER

EE5T1 INDUSTRIAL ORGANISATION AND ENGINEERING ECONOMICS Credits: 3

Lecture: 3 periods/week **Internal assessment: 30 marks**

Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objective:

This course introduces the basic concepts of management and organization structure of an industry, concept of Entrepreneurship, Material management cost analysis, engineering economics and project management.

Course Outcomes:

Student shall be able to

1. Illustrate the concepts of Management and organisational structure
2. Appraise the steps required to start their own enterprise with entrepreneurial spirit.
3. Explain the economic and operations management concepts useful in the production process.
4. Apply the project management tools in effective development and implementation of the business activities.

UNIT I

Introduction to Management and Organisational Structures:

Concepts of Management- nature, importance and Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management. Basic concepts related to Organisation - Types of mechanistic and organic structures of organisation and their merits, demerits and suitability.

UNIT II

Industrial Organization and Entrepreneurship

Characteristic features of Industrial organization, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, State/Public Enterprises and their types, Entrepreneurship vs. Management, Roles & Functions of an Entrepreneur, Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

UNIT III

Operations Management &**Materials Management**

Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study -Basic procedure involved in Method Study and Work Measurement, Business Process Reengineering,

Objectives of inventory control Need for Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records. Statistical Quality Control: chart, R chart, c chart, p chart, (simple Problems), Acceptance Sampling, Deming's contribution to quality.TQM, Six Sigma.JIT.

UNIT IV

Introduction to Engineering Economics – Demand, Production and Cost Analysis

Introduction to Engineering and Economics, Micro and Macro Economics, Demand analysis, Law of demand, Elasticity of demand and its measurement, Demand forecasting techniques; Production Function- Iso-quants and Iso-costs, MRTS, Law of variable proportions- Law of returns to scale- Least Cost Combination of Inputs, Cobb-Douglas Production function - Economies of Scale; Cost concepts, Cost Curves, SAC and LAC, Determination of Break-Even Point (simple problems) - Managerial Significance and limitations of BEP

UNIT V

Project Management –Basic Concepts &**PERT/CPM**

Concept and characteristics of a project, importance of project management, types of project, project organizational structure, project life cycle, Statement of Work, Work Breakdown Structure. Feasibility study, technical and financial appraisal, Social cost benefit analysis; Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems)

Learning Resources

Text Books:

1. O.P. Khanna: 'Industrial Engineering and Management ', Dhanpat Rai Publications (p) Ltd, Faridabad, 1999
2. S.A. Siddiqui & A.S. Siddiqui, Mangerial Economics and Financial Analysis, New Age International Publishers, 2011.
3. Suma damodaran- Managerial Economics, Oxford 2011.

Reference Books:

1. Koontz, H and Wihrich.H, "Management", McGraw, New York, 10^{th} Ed., 1995.
2. Ramasamy.T. "Principles of Management", Himalaya Publishing House, New Delhi, 2000.
3. Narayana Reddy: Entrepreneurship. Cengage learning, New Delhi, 2010
4. Rajeev Roy: Entrepreneurship, Oxford University Press, New Delhi, 2010
5. Prasanna Chandra: Projects, Tata McGraw-Hill Education, 2009.

3/4 B.Tech. FIFTH SEMESTER

EE5T2 ELECTRICAL MACHINES-III Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

This subject is an extension of previous machines courses. It deals with the detailed analysis of synchronous generators and motors which are the prime source of electrical power generation and its utilities. This concerns about the different types of single phase motors which are having significant applications in house hold appliances and control systems.

Course Outcomes:

Upon completing of the course student should be

1. Able to understand the constructional details of synchronous machines, their load characteristics, solve the problems on regulation and parallel operation of alternator.
2. Able to understand the working principle ,methods of starting and applications of synchronous motor
3. Able to understand principle operation of BLDC Motor, reluctance motor and stepper motor.

UNIT I

Synchronous Generator

Constructional Features of round rotor and salient pole machines, armature windings, integral slot and fractional slot windings, distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation - harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance –- phasor diagram – load characteristics – problems .All practical ratings and name plate details.

UNIT II

Synchronous Generator Regulation

Experimental determination of synchronous impedance - regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction analysis – experimental determination of X_d and X_q (Slip test), phasor diagrams – regulation of salient pole alternators.

UNIT III

Parallel operation of alternators : Synchronizing of alternators with infinite bus bars current practices– synchronizing power torque – parallel operation and load sharing - effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactance, capability charts.

UNIT IV

Synchronous Motors – Principle of Operation

Theory of operation – phasor diagram – variation of current and power factor with excitation – synchronous condenser – mathematical analysis for power developed - excitation and power circles – hunting and its suppression – methods of starting – synchronous induction motor – synchronous phase modifier and its industrial applications.

UNIT V

Special Machines

Construction -working principle and operation of BLDC motor, Repulsion motor Principle of operation of hysteresis and reluctance motors and its applications.

Stepper Motor-principle, operation of variable reluctance stepper Motor, permanent magnet stepper Motor and their applic**a**tions.

Construction and principle of operation of linear induction motor and applications.

Learning Resources

Text Books:

1. Electrical Machines by PS Bhimbra, Khanna publishers.
2. Electrical Machines by I.J.Nagrath & D.P.Kothari, Tata Mc Graw-Hill Publishers, 7th Edition 2005.
3. Electrical Machinery by A.E. Fitzgerald, C. Kingsley and S. Umans, Tata Mc Graw Hill Companies, 5th edition 1990.
4. Electrical Machines by J.B.Gupta, Kataria publications.

Reference Books:

1. The Performance and Design of A.C.Machines by M.G.Say, ELBS and Pitman & Sons.
2. Theory of Alternating Current Machinery by Langsdorf, Tata Mc Graw Hill, 2nd edition.
3. Electromachanics-III (Synchronous and single phase machines) by S.Kamakashiah, Right Publishers.

3/4 B.Tech. FIFTH SEMESTER

EE5T3 UTILIZATION OF ELECTRICAL ENERGY Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

This subject deals with the fundamentals of illumination and its classification and the electric heating and welding. It gives the detailed study of all varieties of Electric drives and their application to electric traction system.

Course Outcomes:

After completing this course, student is able to

1. Maintain electric drives used in an industries
2. Identify a heating/ welding scheme for a given application
3. Maintain/ Trouble shoot various lamps and fittings in use
4. Figure-out the different schemes of traction schemes and its main components
5. Design a suitable scheme of speed control for the traction systems

Unit I

Electric Drives

Type of electric drive, choice of motor, starting and running characteristics, speed control, selecting motor power rating for continuous, intermittent and short time rating duty, heating and cooling of motors, temperature rise, particular applications of electric drives, type of industrial loads, load equalization ,flywheel and its applications.

Unit II

Electric Heating & Electric Welding

Advantages and methods of electric heating, methods of heat transfer, Stefan's law, resistance heating, design of heating elements, losses and efficiency, construction and working principle of induction furnaces, arc furnaces and dielectric heating and control equipment.

Type of welding, resistance and arc welding, comparison between A.C and D.C Welding.

Unit III

Illumination Fundamentals & Methods

Introduction, Terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light. Incandescent lamps, Discharge lamps, MV and SV lamps, fluorescent lamps-CFL-LED lamps, Induction lamps, effect of voltage variation on lamp efficiency , lamp ratings and efficiency.

Basic principles of light control, Type and design of lighting schemes, factory lighting, flood lighting and street lighting, calculations.

Unit IV

Electric Traction-I

System of electric traction and traction electrification, Diesel electric traction systems in India, Special features of traction motors, methods of electric braking-plugging, rheostatic braking and regenerative braking, Speed-time curves for different services- trapezoidal and quadrilateral speed time curves.

Unit V

Electric Traction- II

Mechanics of train movement ,Calculations of tractive efforts and power output of traction motor, Specific energy consumption for given run, effect of varying acceleration and breaking retardation, adhesive weight and braking retardation and coefficient of adhesion.OHE in traction system, collectors and modern electric locomotive.

Learning Resources

Text Books:

1. Utilization of Electrical Energy - by E. Openshaw Taylor, Orient Longman,2003.
2. Art & Science of Utilization of Electrical Energy - by Partab, Dhanpat Rai & Sons,12th edition,2012.

Reference Books:

1. Utilization of Electrical Power including Electric drives and Electric traction by J.B.Gupta, S.K. Kataria & Sons,10th edition, 2012
2. Generation, Distribution and Utilization of Electrical Energy – by C.L.Wadhwa New Age international (P) Limited,Publishers,2000.

3/4 B.Tech. FIFTH SEMESTER

EE5T4 POWER ELECTRONICS Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

This course covers fundamental principles of semiconductor devices, ac /dc, dc /dc, ac/ac, dc/ac converter sand use of PWM techniques to obtain high quality power supply

Course Outcomes:

Upon completing this course, students should be able to

1. Understand the principle of operation and characteristics of different power semiconductor devices
2. Learn SCR protection schemes, different configurations of 1- Φ & 3 – Φ controlled rectifiers with R, RL and RLE loads
3. Derive the RMS load voltage, current and power factors and know the basic principle of operation for 1-Φ AC voltage controllers and cycloconverters with R and RL loads.
4. Know the basic operation and characteristics of various choppers and inverters.

UNIT I

Power Semiconductor Devices

Power Diode, Power BJT, Power MOSFET, IGBT, GTO, DIAC, TRIAC, Principle of operation and characteristics. Principle of operation of SCR, static, dynamic and gate Characteristics of SCR, two-transistor analogy, triggering methods of SCR- R, RC and UJT firing circuits, commutation techniques.

Snubber Circuits details, series and parallel connections of SCRs–static and dynamic equalizing networks, specifications and ratings of SCRs – numerical problems

UNIT II

Phase Controlled Rectifiers

Phase angle control, single phase half wave controlled rectifiers with R and RL load, single phase full wave controlled rectifiers – midpoint connections and bridge connections – fully controlled bridge rectifier, half controlled bridge rectifier with R, RL loads - Derivation of average load voltage and current, line commutated inverters without and with Freewheeling diode, effect of source inductance, derivation of load voltage and current.

Three phase converters, three pulse and six pulse converters, midpoint and bridge connections, average load voltage with R and RL loads, effect of source inductance, dual converters (both single phase and three phase).

UNIT III

Inverters

Single Phase inverters –Basic series inverter, parallel Inverter, Bridge Inverters, three phase bridge inverter with 120° and 180° conduction, PWM Techniques-single pulse, multiple pulse and sinusoidal PWM, three phase sinusoidal PWM. Introduction to multilevel inverter.

UNIT IV

DC-DC Converters

Choppers – time ratio control and current limit control strategies – step down chopper, derivation of load voltage and currents with R, RL and RLE loads-,step up chopper, load voltage expression, high frequency DC-DC converter – buck, boost, buck-boost, Jones chopper (Principle of operation only) waveforms , AC chopper – problems.

UNIT V

AC Voltage Controllers & Cyclo Converters

Single phase AC voltage controllers –two SCR‘s in anti parallel, Triac with R and RL loads, derivation of RMS load voltage, current and power factor wave forms numerical problems. Cyclo converters – single phase mid-point cyclo converters with resistive and inductive load. Bridge configuration of single phase cyclo converter (Principle of operation only).derivation of rms load voltage and current.

Learning Resources

Text Books:

1. Power Electronics by P.S.Bhimbra, Khanna Publishers.
2. Power Electronics : Circuits, Devices and Applications by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
3. Power Electronics: converters, applications & design by Nedmohan, Tore M. Undeland, Riobbins by Wiley India Pvt. Ltd.
4. Power Electronics MD Singh and K B Khanchandani, Tata – McGraw-Hill Publishing company, 1998.

Reference Books:

1. Power Electronics by Vedam Subramanyam, New Age International (P) Limited.
2. Power Electronics by V.R.Murthy , 1st edition -2005, OXFORD University Press
3. Power Electronics by P.C.Sen,Tata Mc Graw-Hill Publishing.
4. Thyristorised Power Controllers by G. K. Dubey, S. R. Doradra, A. Joshi and R. M. K. Sinha, New Age International (P) Limited Publishers, 1996.

3/4 B.Tech. FIFTH SEMESTER

EE5T5 TRANSMISSION AND DISTRIBUTION Credits: 3

Lecture: 3 periods/week Internal assessment:30marks

Tutorial: 1 period/week Semester end examination:70marks

Course Objective:

This course is an extension of Electrical Power Generation. The aim is to enrich the students with the fair knowledge of transmission line parameters, cables and insulators, distribution systems and also the recent trends in power Transmission and Distribution Systems which helps them in industry oriented learning.

Course Outcomes:

Upon completion of the course students will be able to

1. Analyze the Performance of Transmission Lines and their parameter calculations.
2. Understand the various types of insulators, mechanical design of overhead lines and underground cables.
3. Analyze travelling waves and termination of lines with different types of conditions.
4. Understand basics of Corona, Sag and other problems arise in Transmission Lines.
5. Understands the difference between AC & DC distribution systems

UNIT I

Transmission Line Parameters

Types of conductors, Skin and Proximity effect, calculation of resistance for solid conductors, calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition, Numerical Problems. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT II

Performance of Transmission Lines

Over head lines

Classification of Transmission Lines -Short, medium and long lines and their model representations, regulation and efficiency. Medium lines- Nominal-T, Nominal-Π and End condenser methods. Long lines-rigorous methods of solution, ABCD constants for all types of lines, Ferranti effect, Surge Impedance and SIL of Long Lines, Numerical Problems.

Underground Cables

Construction, Types of Insulating materials, Types of Cables, Calculation of Insulation resistance and stress in insulation, Capacitance of Single and 3-Core belted cables, Grading of Cables, Numerical Problems.

UNIT III

Mechanical design of Overhead lines

Types of Insulators, Methods of improving string efficiency- Capacitance grading and Static Shielding. Corona, factors affecting corona, power loss, Numerical Problems. Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Stringing chart and Sag template, Numerical Problems.

UNIT IV

Travelling waves

Travelling waves -Interpretation of long line equations. Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of lines with different types of conditions - Open

Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions, Numerical Problems.

UNIT V

DC & AC Distribution systems

Classification of Distribution Systems - Comparison of DC distribution vs. AC distribution and Under-Ground cables vs. Over - Head Distribution Systems.

D.C.Distribution Systems-Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal Voltages) and Ring Main Distributor.

A.C.Distribution Systems-Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

Learning Resources

Text Books:

1. A course in Electrical Power systems, J.B. Gupta, Kataria Publications.
2. Principles of Power Systems, V.K Mehta and Rohit Mehta, S.Chand&Company LTD.
3. Power System Analysis, John J Grainger and William D Stevenson Jr, McGraw Hill.

Reference Books:

1. Electrical power systems, C.L.Wadhwa, New Age International (P) Limited, Publishers.
2. A Text Book on Power System Engineering, M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd.
3. Electrical power systems, Dr.S.L.Uppal, Khanna publishers.

3/4 B.Tech. FIFTH SEMESTER

LINEAR AND DIGITAL INTEGRATED CIRCUIT APPLICATIONS

EE5T6 **Credits: 3**

Lecture: 3 periods/week **Internal assessment: 30 marks**

Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objectives:

- To learn about the linear and non-linear applications of Op-amp.
- To understand the applications using 555 timer and PLL.
- To study about the various combinational and sequential digital integrated circuits.

Course Outcomes:

At the end of this course, students will be able to:

1. Build internal design concept of Op-amp related to its characteristics
2. Identify various linear and non-linear applications using op-amp
3. Develop different order active filters and applications using timer and PLL ICs.
4. Validate and verify various combinational and sequential digital ICs

UNIT I

Characteristics of Op-Amps: Introduction to OP-amp, Op-amp Block Diagram, ideal and practical Op-amp specifications, interpreting datasheets.

Linear Applications of Op-Amps: Inverting and Non-inverting amplifier, Integrator and differentiator, Summing and Difference amplifier, Instrumentation amplifier, AC amplifier, V to I, I to V converters, Buffers.

UNIT II

Non-Linear Applications of Op-Amps: Comparators, Multivibrators, Triangular and Square wave generators, sine wave generation: principle, Wien-bridge, phase-shift, quadrature oscillators, Log and Anti log amplifiers, Precision rectifiers, clampers.

Active Filters: Introduction, classification, Butter worth filters – 1st order, 2nd order LPF, HPF, Band pass, Band reject and All pass filters qualitative, quantitative analysis and frequency response, Switched capacitor filters: working principle, advantages and disadvantages

UNIT III

Timers: Introduction to 555 timer, functional diagram, Mono stable and Astable operations and applications, Schmitt Trigger. Voltage controlled oscillator -566, applications.

Phase Locked Loops: PLL - introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL – frequency multiplication and frequency translation

UNIT IV

Combinational Logic Design: Introduction, Design and Analysis procedures, Decoders, encoders, multiplexers and demultiplexers, Code Converters, comparators, adders & sub tractors, Ripple Adder,

Binary Parallel Adder, Binary Adder-Subtractor, Combinational multipliers, ALU Design considerations of the above combinational logic circuits with relevant Digital ICs.

UNIT V

Sequential Logic Design: Introduction, Latches, and flip-flops, Flip-Flop Conversions, Counters, Design of Counters using Digital ICs, Counter applications, Synchronous design methodology, Shift Registers, Modes of Operation of Shift Registers, Ring Counter, Johnson Counter, Design considerations of the above sequential logic circuits with relevant Digital ICs.

Learning Resources

Text Books:

1. Linear Integrated Circuits – D. Roy Chowdhury, New Age International (p) Ltd, 2nd Edition,2003.
2. Digital Design Principles & Practices By John F. Wakerly, PHI Publications, Third Edition., 2005

Reference Books:

1. Op-Amps and Linear Integrated Circuits , - Ramakanth A. Gayakwad, PHI, 4th Edition, 2009
2. Operational Amplifiers & Linear ICs – David A Bell, Oxford Uni. Press, 3rd Edition, 2005.
3. Digital Design By M. Morris Mano, Michael D.Ciletti Pearson Education, 4rd Edition, 2007.

3/4 B.Tech. FIFTH SEMESTER

EE5L1 ELECTRICAL MACHINES LAB – II Credits: 2

Lecture: -- Internal assessment: 25 marks

Lab : 3 periods/week Semester end examination: 50 marks

Course Objective:

In this lab students understand the performance of single phase transformer, parallel operation of transformer, performance of induction motor and equivalent circuit of single phase induction motor.

Course Outcomes:

After completing this lab course, student is be able to

1. Understand the performance of the single phase transformer at no load and full load,
2. Connect transformers in parallel operation
3. Understand the performance of three phase induction motor,
4. Understand the performance of single phase induction motor.

List of experiments:

Any 10 of the following experiments are required to be conducted:

1. O.C. & S.C. tests on single phase transformer
2. Sumpner's test on single phase transformers
3. Scott connection of transformers
4. Parallel operation of two single phase transformers
5. Separation of core losses of a single phase transformer
6. Measurement of harmonics in three phase transformer
7. Brake test on three phase induction motor
8. No-load & blocked rotor tests on three phase squirrel cage induction motor
9. Equivalent circuit of a three phase induction motor and measurement of slip power.
10. Equivalent circuit of a single phase induction motor
11. Brake test on single phase induction motor
12. Speed control of three phase induction motor

3/4 B.Tech. FIFTH SEMESTER

EE5L2 **LDIC Lab** **Credits: 2**

Lecture : -- **Internal assessment: 25 marks**

Lab : 3 periods/week **Semester end examination: 50 marks**

Course Objectives:

- To understand the design procedures for linear and non-linear applications of Op-amp.
- To understand the design concepts industrial timing applications using 555 timer.
- To study about the various types of digital ICs

Course Outcomes:

Student will be able to

1. Build design concept of Op-amp related applications.
2. Develop different order active filters and digital ICs
3. Validate and verify various applications of 555 timer.

NOTE:

Minimum of 10 experiments has to be performed and recorded by the candidate to attain eligibility for External Practical Examination.

List of Experiments:

1. OP -AMP Applications – Adder, Subtractor, Comparator Circuits.
2. Op-amp inverting and non-inverting amplifiers for desired gain and bandwidth.
3. Practical active integrator and differentiator using IC741.
4. IC 741 Wien Bridge Oscillators and phase shift oscillator for the desired frequency.
5. Schmitt Trigger Circuit using IC 741.
6. Function Generator using OP AMPs.
7. Active Filter Applications –Design LPF, HPF (first order) for desired value of gain and bandwidth.
8. IC 555 Timer – Monostable and astable Operation Circuit.
9. Verify the functionality of 3-8 Decoder -74138
10. Verify the functionality of D Flip-Flop 7474
11. Verify the functionality of 8 x 1 Multiplexer -74151
12. Verify the functionality of Decade counter-7490

3/4 B.Tech. FIFTH SEMESTER

EE5L3 CONTROL SYSTEMS LAB Credits: 2

Lecture: -- Internal assessment: 25 marks

Lab: 3 period /week Semester end examination: 50 marks

Course Objective:

This course helps to familiarize modeling, control and simulation experiments on control systems and to expose the students to the concepts, performance characteristics, time and frequency response of linear systems.

Course Outcomes:

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

1. Understand the operating characteristics of servo motors
2. Understand the effects of P, PI & PID controllers used in design of control system.
3. Find the transfer function of motor, generator etc., which helps in mathematical model of control system.
4. Analyze the time response of second order systems.
5. Write programs in MATLAB software for finding the stability etc., and PLC programming which will help them in doing their projects

List of experiments

Any Eight Of The Following Experiments Are To Be Conducted:

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – study and verification of truth tables of logic gates, and application of speed control of motor.
4. Effect of feedback on DC servo motor
5. Transfer function of DC motor
6. Effect of P, PD, PI, PID Controller on a second order systems
7. Lag and lead compensation – magnitude and phase plot
8. Transfer function of DC generator
9. Temperature controller using PID
10. Characteristics of magnetic amplifiers
11. Characteristics of AC servo motor

Any Two of following simulation experiments are to be conducted:

1. Linear system analysis (time domain analysis, error analysis) using MATLAB.
2. Stability analysis (Bode, Root Locus, Nyquist plot) of linear time invariant system using MATLAB
3. State space model for classical transfer function using MATLAB – Verification.

Reference Books:

1. "MATLAB and its tool box user's manual", Mathworks, USA.
2. "Programmable Logic Controllers-Programming Method and Applications" by 'JR.Hackworth &F.DHackworth Jr.', Pearson publications, 2004.

3/4 B.Tech. SIXTH SEMESTER

EE6T1 DIGITAL SIGNAL PROCESSING Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objectives:

- To introduce the concepts and techniques associated with discrete time signals and systems.
- To develop the representation of discrete-time signals in the frequency domain using Discrete Fourier transform (DFT).
- To learn the basic forms of FIR and IIR filters, and how to design filters with desired frequency responses.
- To Study the concepts of Multirate DSP and its applications.

Course Outcomes:

Student will be able to

1. Analyze properties of Discrete time Signals and Systems.
2. Design FFT algorithms.
3. Realize various digital filters for DSP applications..
4. Implement the applications of DSP in speech processing and spectrum analysis.

UNIT I

Discrete Time Signals and Systems:

Introduction to Digital signal processing, Discrete time Signals, Discrete time systems, Analysis of Linear Time-Invariant Systems, Convolution, Causality and Stability.

The Z- Transform: Definition, Properties of Z-Transform, Inverse z Transform, Computation of Frequency Response, Solution of linear constant coefficient difference equations using Z Transforms

UNIT II

The Discrete Fourier Transform (DFT): Introduction to DFT, Properties of the DFT, Circular Convolution, overlap add method, overlap save method, Relationship of DFT to other Transforms. Radix-2 Decimation-In-Time (DIT) and Decimation-In-Frequency (DIF) FFT Algorithms, Inverse FFT

UNIT III

Design ofIIR Digital Filter :

Design procedure for Analog Butterworth and Chebyshev filters, Design of IIR Digital Filters using Bilinear Transformation, Analog Design using Digital Filters, Design of Digital Filters using Digital to Digital Transformation, Impulse Invariant Design.

UNIT IV

Design of FIR Digital Filters: Introduction to FIR Filters, Design of Linear phase FIR Digital Filters using Windows(Rectangular, Bartlett, Blackman, Hamming and Hanning windows) and Frequency Sampling Method.

Realization of Discrete time systems: Realization of IIR and FIR systems-Direct, Cascade, Parallel, Ladder realizations.

UNIT V

Multirate Digital Signal Processing:

Introduction, Decimation and Interpolation by integer factor, Sampling rate conversion by Rational number, Multistage approach to sampling rate Conversion, Applications of Multirate Signal processing.

Learning Resources

Text Books:

1. Digital Signal Processing : Principles, Algorithms and Applications , John G Proakis& D. G. Manolakis, PEARSON, 4th Edition, 2007.
2. Fundamentals of Digital Signal Processing - Lonnie C Ludeman, John Wiley & Sons, 2003

References Books:

1. Introduction to Digital Signal Processing "Johnny R Johnson, PHI Learning , 2011
2. Theory and Application of Digital Signal Processing - Lawrence R Rabiner& Bernard Gold, Prentice Hall.

Web References:

1. www.nptel.iitm.ac.in
2. http://www.ece.cmu.edu/~ee791/
3. http://www.ee.umanitoba.ca/~moussavi/dsp815/LectureNotes/index.html
4. http://cobweb.ecn.purdue.edu/~ipollak/ee438/FALL04/notes/notes.html

3/4 B.Tech. SIXTH SEMESTER

EE6T2 ELECTRICAL MACHINE DESIGN Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

To develop knowledge on principles of designing static and rotating machines. Students will be able to understand the fundamental concepts of design and study the design of various types of electrical machines.

Course Outcomes:

Upon completing the course, students is able to

1. Understand the design of various parts of DC machines and solve the problems of design
2. Understand the design concepts of transformers and know about how to design the parts.
3. Understand the design concepts of synchronous machines and solve the problems related to design.
4. Understands the importance of design of machines based on their applications.

UNIT I

DESIGN OF DC MACHINES

Basic concept of design, limitation in design, standardization, modern trends in design and manufacturing techniques, calculation of total mmf and magnetizing current. Specific permeance and leakage reactance - output equation, choice of specific loading and choice of number of poles, design of main dimensions of DC machines, design of armature slot dimensions, commutator and brushes, magnetic circuit, estimation of ampere turns, design of yoke and poles, main and inter poles, field windings, shunt, series and interpoles.

UNIT II

DESIGN OF SINGLE PHASE TRANSFORMERS

Output equation for single phase, choice of specific loadings, expression for volts/turn, determination of main dimensions of the core, types of windings and estimation of number of turns and conductor cross sectional area of primary and secondary windings, estimation of no load current, expression for leakage reactance and voltage regulation.

UNIT III

DESIGN OF THREE PHASE TRANSFORMERS

Output equation for three phasetransformers, choice of specific loadings, expression for volts/turn, determination of main dimensions of the core, types of windings and estimation of number turns and conductor cross sectional area of primary and secondary windings, estimation of no load current, expression for leakage reactance and voltage regulation. Design of tank and cooling tubes (round and rectangular).

UNIT IV

DESIGN OF INDUCTION MOTORS

Output equation, choice of specific loadings, main dimensions of three phase induction motor, stator winding design, choice of length of the air gap, estimation of number of slots for the squirrel cage rotor, design of rotor bars and end ring, design of slip ring induction motor, estimation of no load current and leakage reactance, circle diagram.

UNIT V

DESIGN OF SYNCHRONOUS MACHINES

Output equation, choice of specific loadings, short circuit ratio, design of main dimensions, armature slots and windings, slot details for the stator of salient and non- salient pole synchronous machines. Design of rotor of salient pole synchronous machines, magnetic circuits, dimensions of the pole body, design of the field winding, and design of rotor of non-salient pole machine, introduction to computer aided design.

Learning Resources

Text Books:

1. A course in Electrical Machine Design by A.K. Sawhney, Dhanpatt Rai & Sons.
2. Design of Electrical Machines by V.N. Mittle, Standard publishers distributors, 2005.

Reference Books:

1. Performance and Design of AC machines by M.G. Say, CBS publishers and Distributors Pvt. Ltd.
2. Performance and Design of DC machines by Clayton and Hancock, BPB publishers.

3/4 B.Tech. SIXTH SEMESTER

EE6T3 MICROCONTROLLERS AND APPLICATIONS Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

Microprocessor and Microcontrollers have become important building blocks in digital electronic design. It is important to understand the architecture of microprocessors and its interfacing with various modules. 8086 microprocessor architecture, programming, interfacing, architecture of 8051 microcontroller and its application in industry are covered in this course.

Course Outcomes:

After completing this course, student is able to

1. Have a clear understanding of the architecture and instruction set of 8086 and 8051.
2. Write 8086 assembly language programs to perform a given task.
3. Understand interrupt service routines for all interrupt types.
4. Write microcontroller programs and interface devices.

UNIT I

INTEL 8086

Introduction and evolution of Microprocessors, Architecture of 8086, Register Organization of 8086, Memory Organization of 8086, Pin diagram of 8086.

Minimum and Maximum mode operations of 8086, General Bus Operation of 8086, Read and Write cycle timing diagram.

UNIT II

ASSEMBLY LANGUAGE PROGRAMMING

Addressing Modes and Instruction set, Assembler Directives, Procedures and Macros, simple assembly language programming.

UNIT III

8051 Microcontrollers

Intel 8051 architecture, memory organization, flags, stack, and special function registers, I/O ports counters and timers, serial data I/O, interrupts.

Addressing modes, 8051 Microcontroller instructions - moving data, logical operations, arithmetic operations, jump and call instructions.

UNIT IV

ASSEMBLY LANGUAGE PROGRAMMING

Microcontroller programming - assembly language programming, timer and counter programming, interrupt programming.

UNIT V

PERIPHERALS AND INTERFACING

Serial and parallel I/O (8251 and 8255), Programmable DMA controller, Programmable interrupt controller.

Applications of Microcontrollers- Interfacing external memory, Interfacing 8051 to LED's, interfacing seven segment display, ADC and DAC interfacing, Waveform generation, Stepper motor control and firing pulse generation.

Learning Resources

Text Books:

1. "Microprocessors and Interfacing", Douglas V. Hall, Tata Mc-Graw Hill, Revised 2nd Edition, 2006.
2. "Advanced Microprocessors and interfacing", A. K. Ray and K. M. Burchandi, Tata Mc-Graw Hill, 2nd edition, 2006.
3. "The 8051 Microcontroller Architecture, Programming and Applications", Kenneth J. Ayala, Thomson Publishers, 2nd Edition, 2004

Reference Books:

1. "Microcontrollers – Theory & Applications", Ajay V. Deshmukh, Tata McGraw Hill, 2005.
2. "The 8086 Microprocessors Architecture, Programming and Interfacing the PC", Kenneth J Ayala, West Publishers, 1995.

3/4 B.Tech. SIXTH SEMESTER

EE6T4 POWER SEMICONDUCTOR DRIVES Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

This course is an extension of power electronics applications. It covers in detail the basic and advanced speed control techniques using power electronic converters that are used in industry. It is equally important to understand the four quadrant operation of electric drives and slip power recovery schemes in induction motors.

Course Outcomes:

Upon completing this course students must be able to

1. Learn electric drive system and multi quadrant operation
2. Understand operation of 1Φ, 3Φ rectifiers fed Dc motors
3. Understand operation of chopper fed DC motors
4. Know the speed control of converter fed induction motor and synchronous motor
5. Analyze ac machine by linear transformation

UNIT I

Introduction to Electric Drives

Parts of electric drives, choice of electric drives, fundamental torque equation, multi quadrant operation, equivalent values of drive parameters.

UNIT II

Control of DC Motors by phase converters

Control rectifier fed dc drives, single phase fully controlled rectifier control, single phase half controlled rectifier control of dc separately excited motor, rectifier control of dc series motor

Three phase fully controlled rectifier control, three phase half controlled rectifier control of dc separately excited motor, multi quadrant operation of separately excited motor fed from fully controlled rectifier, supply harmonics, power factor and ripple in motor current.

UNIT III

Control of DC Motors by Choppers

Introduction to four quadrant operation, motoring, braking (types of braking), single quadrant, two quadrant and four quadrant chopper fed dc separately excited, series motor-continuous current operation and speed-torque characteristics. Four quadrant operation of dc motors by dual converters. Closed loop speed control of dc motor (block diagram only)

UNIT IV

Control of Induction Motors

Stator voltage control- variable frequency control from voltage sources, VSI fed induction motor drives, cascaded H-bridge 5 level inverter fed induction motor (principle of operation only), cyclo-converter control(principle of operation only),variable frequency control for current source inverter, rotor resistance control, slip power recovery schemes-static scherbius, static Kramer drive.

UNIT V

Linear transformation of AC machines

Introduction, transformation from three phases to two phases and vice verse, transformation from rotating axes to stationary axes, physical concepts of park's transformation. Introduction to vector control and direct torque control, introduction to heat dissipation.

Learning Resources

Text Books:

1. Fundamentals of Electric Drives by G K Dubey ,Narosa Publications.
2. Power electronics and Motor control by W.Shepherd, L.N. Hulley and D.T.W.Liang – 2nd edition, 1995, Cambridge University Press
3. Generalized theory of electrical machines by Dr.P.S.Bhimbhra,khanna publications, 5th edition.

Reference Books:

1. Thyristor Control of Electric drives by Vedam Subramanyam, Tata McGraw Hill Publilcations.
2. A First course on Electrical Drives,S KPillai ,New Age International (P) Ltd. 2nd edition
3. Power Electronics – M.D. Singh and K.B. Khanchandani , Tata Mc Graw Hill Publishing company,1998.

3/4 B.Tech. SIXTH SEMESTER

EE6T5 POWER SYSTEM ANALYSIS Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

This course is designed to give students the required knowledge for the design and analysis of electrical power grids. Calculation of power flow in a power system network using various techniques. It also deals with short circuit analysis and analysis of steady state and transient stability.

Course Outcomes:

After completing this course, student is able to

1. Understand and draw single line diagram of the power system.
2. Analyse different types of fault in a power system
3. Learn different load flow techniques.
4. Perform stability analysis of power system

Unit I

Per unit Representation

P.U. Representation: Single line diagram, per unit quantities, per unit impedance diagram of a power system.

Symmetrical fault analysis: Short circuit current and MVA calculations, fault levels, application of series reactors, numerical problems.

UNIT II

Short Circuit Analysis

Symmetrical component theory: Symmetrical component transformation, positive, negative and zero sequence components of voltage, current and impedance.

Sequence Networks: positive, negative and zero sequence networks, numerical problems.

Unsymmetrical fault analysis: LG, LL, LLG faults with and without fault impedance, numerical problems.

UNIT III

Power Flow Studies - 1

Y bus formation by direct inspection method, pie model of off-nominal tap changing transformer, numerical Problems.

Necessity of power flow studies – Data for power flow studies – Derivation of static load flow equations– Load flow solutions using Gauss Seidel Method: acceleration factor, load flow solution with and without P-V buses, algorithm and flowchart. Numerical example for simple power systems (Max. 3-Buses): Determination of bus voltages, injected active and reactive powers (Sample one iteration only) and finding line flows/losses for the given bus voltages.

UNIT IV

Power flow Studies-2

Newton Raphson method in rectangular and polar co-ordinates form: Load flow solution with and without PV buses- Derivation of Jacobian elements, algorithm and flow chart. Decoupled and Fast Decoupled methods, Comparison of Different methods of load flow – DC load Flow.

UNIT V

Power System Stability Analysis

Elementary concepts of steady state, dynamic and transient stabilities. Description of steady state stability power limit, transfer reactance, synchronizing power coefficient, power angle curve and determination of steady state stability and methods to improve steady state stability. Derivation of swing equation and solution by point by point method. Determination of transient stability by equal area criterion, application of equal area criterion, critical clearing angle calculation. Methods to improve stability - auto reclosing and fast operating circuit breakers.

Learning Resources

Text Books:

1. Modern power system analysis by D.P.Kothari and I.J.Nagrath , TMH publications,4 th edition.
2. Power system analysis by J.J.Grainger & W.D.Stevenson. Jr, TMH publications,2007.
3. Elements of Power system analysis by Hadi Saadat – TMH publications, 4th Edition.

Reference Books:

1. Power System Analysis by T.K.Nagsarkar M.S.Sukhija, OXFORD y press,2007
2. Power System Analysis – by A.R.Bergen, Prentice Hall, India, 2nd Edition.
3. Power System Analysis and design by B.R.Gupta, S.Chand Publishers, 4th Edition.
4. Electrical Power Systems by Ashfaq Husain ,CBS Publishers & Distributors, 7th Edition.

3/4 B.Tech. SIXTH SEMESTER

EE6T6FE1 MATLAB Programming and Applications (Free elective) Credits: 3

Lecture: 3 periods/week **Internal assessment: 30 marks**

Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objective:

In this course students will be introduced to programming using MATLAB. This course covers the MATLAB environment, assignment, conditionals, scripts, functions, iterations, arrays and graphics.

Course Outcomes:

After completing the course, student will be able to

1. Have knowledge of writing MATLAB programs for engineering problems
2. Handle graphics and draw plots
3. Interpolate the data and curve fitting
4. Work with arrays, matrices and character strings

UNIT I

Basics of MATLAB – windows, input, output file types, platform dependence commands, general commands, special variables and constants, simple arithmetic calculation, arrays, numbers, printing simple plots, creating, saving and executing script files, function files.

UNIT II

Matrices, vectors, matrix and array operations, arithmetic operations, relational operations, logical operations, matrix functions, specialized matrices, character strings, character string functions.

UNIT III

Built in function – saving and loading data, plotting simple graphs, script files, function files, language specific features, if-end structure, if-else-end structure, if-else if-else-end structure, switch-case statement, for-end loop, while-end loop, break, continue, and return commands, advanced data objects.

UNIT IV

Solving problems in linear algebra, curve fitting and interpolation, data analysis and statistics, integration, ordinary differential equations.

UNIT V

Graphics: Basic 2-D Plots, style options, labels, title, legend, and other text objects, modifying plots with the plot editor, over lay plots, specialized 2-D plots, subplots.
3-D Plots, mesh and surface plots.

Handling graphics: The object hierarchy, object handles, object properties, modifying an existing plot.

Learning Resources

Text Books:

1. Getting started with MATLAB by Rudrapratap, oxford university press, 2009.
2. MATLAB programming for engineers by Stephen J.Chapman, Thomson Learnning.

Reference Books:

1. MATALB: An introduction with applications by Amos Gilad, Wiley student edition.
2. MATLAB programming by Y.Kirani Singh, B.B.Chaudhuri, PHI Private limited, New Delhi 2008

3/4 B.Tech. SIXTH SEMESTER

EE6T6FE2 UTILIZATION OF ELECTRICAL POWER (Free elective) Credits: 3

Lecture: 3 periods/week **Internal assessment: 30 marks**

Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objective:

This subject deals with the fundamentals of illumination and its classification and the electric heating and welding. It gives the detailed study of all varieties of Electric drives and their application to electric traction system.

Course Outcomes:

After completing this course, student is able to

1. Maintain electric drives used in an industries
2. Identify a heating/ welding scheme for a given application
3. Maintain/ Trouble shoot various lamps and fittings in use
4. Figure-out the different schemes of traction schemes and its main components
5. Design a suitable scheme of speed control for the traction systems

Unit I

Electric Drives

Type of electric drive, choice of motor, starting and running characteristics, speed control, selecting motor power rating for continuous, intermittent and short time rating duty, heating and cooling of motors, temperature rise, particular applications of electric drives, type of industrial loads, load equalization ,flywheel and its applications.

Unit II

Electric Heating & Electric Welding

Advantages and methods of electric heating, methods of heat transfer, Stefan's law, resistance heating, design of heating elements, losses and efficiency, construction and working principle of induction furnaces, arc furnaces and dielectric heating and control equipment.

Type of welding, resistance and arc welding, comparison between A.C and D.C Welding.

Unit III

Illumination Fundamentals & Methods

Introduction, Terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light. Incandescent lamps, Discharge lamps, MV and SV lamps, fluorescent lamps-CFL-LED lamps, Induction lamps, effect of voltage variation on lamp efficiency , lamp ratings and efficiency.

Basic principles of light control, Type and design of lighting schemes, factory lighting, flood lighting and street lighting, calculations.

Unit IV

Electric Traction-I

System of electric traction and traction electrification, Diesel electric traction systems in India, Special features of traction motors, methods of electric braking-plugging, rheostatic braking and regenerative braking, Speed-time curves for different services- trapezoidal and quadrilateral speed time curves.

Unit V

Electric Traction- II

Mechanics of train movement ,Calculations of tractive efforts and power output of traction motor, Specific energy consumption for given run, effect of varying acceleration and breaking retardation, adhesive weight and braking retardation and coefficient of adhesion.OHE in traction system, collectors and modern electric locomotive.

Learning Resources

Text Books:

1. Utilization of Electrical Energy - by E. Openshaw Taylor, Orient Longman,2003.
2. Art & Science of Utilization of Electrical Energy - by Partab, Dhanpat Rai & Sons,12th edition,2012.

Reference Books:

1. Utilization of Electrical Power including Electric drives and Electric traction by J.B.Gupta, S.K. Kataria & Sons,10th edition, 2012
2. Generation, Distribution and Utilization of Electrical Energy – by C.L.Wadhwa New Age international (P) Limited,Publishers,2000.

3/4 B.Tech SECOND SEMESTER

EE6T6FE3 AUTOMATIC CONTROL SYSTEMS (Free Elective) Credits :3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

In this course it is aimed to provide sound knowledge in the basic concepts of linear control theory and giving an exposure to the students on characteristics, stability of linear systems and addresses the analysis of feedback systems

Course Outcomes:

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

1. Understand the basic concepts, properties of feedback and applications of control systems in day to day life.
2. Analyze electromechanical systems using mathematical modeling.
3. Determine Transient and Steady State behavior of systems using standard test signals.
4. Perform time domain and frequency domain analysis of control systems required for stability analysis.
5. Present and analyze linear control system using the state space technique.

UNIT I

Introduction

Concepts of Control Systems- Classification of control systems, Different examples of control systems, Open Loop and closed loop control systems, Effects of feedback. Concept of Transfer function- impulse response. Mathematical models – Differential equations, Finding Transfer function for mechanical systems, electrical systems and electrical analogous of mechanical systems

UNIT II

Transfer Function Representation

Transfer Function of DC Servo motor, AC Servo motor, Block diagram algebra-Reduction techniques and Signal flow graph-Overall gain using mason's gain formula.

UNIT III

Time Response Analysis

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications –Steady state error.

Stability

Concept of stability, Relative stability- Stability analysis using Routh- Hurwitz Criterion.

UNIT IV

Root Locus Technique

Introduction, Root-loci theory- Stability analysis of Control System with root locus.

Frequency Domain Analysis

Introduction, Frequency domain specifications- Polar plots –Nyquist Plots-Stability Analysis

UNIT V

Stability Analysis in Frequency Domain

Bode plots –Gain margin phase margin-Stability Analysis from Bode plots

State Space Analysis

Concepts of state, state variables and state model, TF to SS and SS to TF conversion- Solution of state Equations- State Transition Matrix and it's Properties. Conditions for Controllability and Observability.

Learning Resources

Text Books:

1. Automatic Control Systems– by B. C. Kuo 2003– John wiley and son's., 8th edition
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited 2009, Publishers, 5th edition.
3. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

Reference Books:

1. Control Systems Engineering. By NORMAN S.NISE 6th Edition – John Wiley
2. Control systems by A. Nagoorkani –RBA Publications, 2 nd edition.

3/4 B.Tech. SECOND SEMESTER
RENEWABLE ENERGY SOURCES
(FREE ELECTIVE)

EE6T6FE4 **Credits: 3**
Lecture: 3 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objective:
It introduces basics of solar energy like solar radiation, collection, storage and application. It also introduces the wind energy, biomass energy, geothermal energy and ocean energy as alternative energy sources.

Course Outcomes:
After completing this course, student is able to
1. Apply knowledge of mathematics physics and engineering to the analysis and design of renewable energy systems.
2. Identify, formulate, and solve engineering problems in the area of renewable energy system for clean, reliable and efficient electrical power
3. Design an electric system, or process to meet desired needs within realistic constraint for wind, solar thermal, solar PV, bio mass geothermal and ocean energy systems
4. Get the knowledge on modern issues in electrical power generation.
5. Get the ability to function effectively on multidisciplinary teams.

UNIT I
Principles of Solar Radiation and Solar Energy Collection
Role and potential of new and renewable source, the solar energy option, environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data. Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT II
Solar Energy Storage, Applications and Photovoltaic Energy Conversion
Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications solar heating/cooling technique, solar distillation and drying.
Solar cell fundamentals, solar cell classification, performance of solar cell- power from solar module.

UNIT III
Wind Energy and Bio-Mass
Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.
Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking.

UNIT IV
Energy and Ocean Energy
Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, principles of utilization, setting of OTEC plants, thermodynamic cycles.

Tidal and wave energy: Potential and conversion techniques.

UNIT V

Energy Conversion

Principles DEC, MHD generators, principles, MHD power generation systems. Fuel cells, principles, of fuels and operating conditions, merits and demerits of different types of fuel cells, mini-hydel power plants and their economics.

Learning Resources

Text Books:

1. Non-Conventional Energy Sources by G.D. Rai, Khanna publishers, 5th edition,2014.
2. Renewable Energy resources, Tiwari and Ghosal, Narosa,2005
3. Science and Technology of Photo Voltaics by Jayarama Reddy, BS publications, 2nd edition,2012

Reference Books:

1. Non-Conventional Energy by Ashok V Desai, New age, 2005.
2. Non-Conventional Energy Sources by B.H.Khan, Tata Mc Graw-hill Publishing Company, 2nd edition,2013.

3/4 B.Tech. SIXTH SEMESTER

EE6L1 ELECTRICAL MACHINES LAB – III Credits: 2

Lecture: -- Internal assessment: 25 marks

Lab : 3 periods/week Semester end examination: 50 marks

Course Objective:

In this lab students understand the performance of alternator, regulation of alternator, performance of synchronous motor, performance of induction generator and performance of special machines.

Course Outcomes:

After completing this lab course, student is able to

1. Understand the starting and connecting procedures of synchronous generators and performance of the alternator at different loads
2. Synchronize the given alternator across the supply lines
3. Obtain the 'V' & ' **Λ** ' curves of synchronous motor
4. Understand the performance of special machines such as three phase squirrel cage induction generator and three phase schrage motor.

List of experiments:

The following experiments are required to be conducted:

1. Regulation of a three-phase alternator by synchronous impedance method
2. Regulation of a three-phase alternator by mmf method.
3. Regulation of a three-phase alternator by Z.P.F. method
4. Regulation of a three-phase alternator by A.S.A method
5. Load test on three phase Alternator.
6. Measurement of sequence impedance of a three-phase alternator.
7. ' **V** ' & '**Λ** ' curves of a three-phase synchronous motor.
8. Determination of X_d and X_q of a salient pole synchronous machine
9. Brake test on three phase squirrel cage induction generator.
10. Brake test on three phase Schrage motor.

3/4 B.Tech. SIXTH SEMESTER

EE6L2 POWER ELECTRONICS & DRIVES LAB Credits: 2

Lecture: -- Internal assessment: 25 marks

Lab: 3 periods/week Semester end examination: 50 marks

Course Objectives:

- To make the students to design triggering circuits of SCR.
- To introduce power electronics components and to obtain the characteristics of SCR, TRIAC, IGBT and MOSFET.
- To perform the experiments on various converters.

Course Outcomes:

Upon completing this lab students must be able to

1. Correlate theoretical and practical analysis of AC-AC converter
2. Correlate theoretical and practical analysis of DC-AC converters
3. Correlate theoretical and practical analysis of converter fed AC and DC drives.
4. Analyze the characteristics of MOSFET, IGBT, SCR,
5. Study SCR firing circuits and commutation techniques.

Any 10 of the following Experiments are to be conducted

1. Study of characteristics of SCR, MOSFET & IGBT
2. Gate firing circuits of SCR‘s
3. Forced commutation circuits (Class A, Class B, Class C, Class D& Class E)
4. Single phase fully controlled bridge converter with R and RL loads
5. Single phase AC Voltage controller with R and RL loads
6. Single phase cyclo-converter with R and RL loads
7. Single phase bridge inverter with R and RL loads
8. Single phase series inverter with R and RL loads
9. Single phase Parallel inverter with R and RL loads.
10. Single phase dual converter with R, RL and RLE loads
11. Three phase half controlled bridge converter with RL-Load
12. IGBT based four quadrant chopper controlled DC motor drive
13. VSI fed three phase induction motor drive
14. Buck and Boost Converters.

4/4 B.Tech. SEVENTH SEMESTER

EE7T1 POWER SYSTEM OPERATION AND CONTROL Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

This subject deals with economic operation of power systems, hydrothermal scheduling, modeling of turbines, generators and automatic controllers. It emphasizes on single area and two area load frequency control and reactive power control.

Course Outcomes:

After completing the course the student shall be able to

1. Explain the functional content of economic load dispatch and load frequency control
2. Create simple architectures for simple area load frequency control and two area load frequency control
3. Understand importance of reactive power compensation
4. Exhibit knowledge of emerging trends in systems used for power system operation and control.

Unit I

Economic Operation of Power Systems

Optimal operation of generators in thermal power stations, heat rate curve, cost curve, incremental fuel and production costs, input-output characteristics of steam unit, optimum generation allocation with line losses neglected. Optimum generation allocation including the effect of transmission line losses, loss coefficients, general transmission line loss formula.

Unit II

Hydrothermal Scheduling

Optimal scheduling of hydrothermal system, hydroelectric power plant models, types of scheduling problems, short term hydrothermal scheduling problem.

Unit III

Load Frequency Control

Modeling of speed governing system, steam turbine, hydro turbine and generator. Necessity of keeping frequency constant, definitions of control area, single area control, block diagram representation of an isolated power system, steady state analysis, dynamic response, proportional plus integral control of single area and its block diagram representation, steady state response. Load frequency control of 2- area system, tie-line bias control, comparison between load frequency control and economic dispatch control.

Unit IV

Power factor and Voltage Control

Causes of low p.f, methods of improving p.f, static capacitor and synchronous condensers, phase advancers, most economical p.f. for constant KW load and constant KVA type loads, voltage control, shunt capacitors, series capacitors and their location in the power system, numerical problems.

Unit V

Reactive Power Control

Overview of reactive power control, reactive power compensation in transmission systems, advantages and disadvantages of different types of compensating equipment for transmission systems, load compensation, specifications of load compensator, uncompensated and compensated transmission lines, shunt and series compensation.

Learning Resources

Text Books:

1. Power system stability and control by Prabha Kundur TMH Publishers
2. Modern Power System Analysis by I.J.Nagrath & D.P.Kothari TMH Publishers, 2nd edition.
3. Generation of electrical energy by B. R. Gupta , S. Chand and Company.

Reference Books:

1. Power System Analysis and Design by J.Duncan Glover and M.S.Sarma., Thomson Publishers, 3rd Edition.
2. Electric Energy systems Theory by O.I.Elgerd, TMH Publishers, Second edition.
3. Power System Analysis by Grainger and Stevenson, TMH Publishers.
4. Power System Analysis by Hadi Saadat, TMH Publishers.

4/4 B.Tech. SEVENTH SEMESTER

EE7T2 HVDC TRANSMISSION Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

This subject deals with the importance of HVDC transmission, analysis of HVDC converters, faults and protections, harmonics and filters.

Course Outcomes:

After completing this course, student is able to

1. Evaluate HVDC transmission, list out the various applications and recognize the technical planning issues of HVDC transmission systems.
2. Analyze converter configurations used in HVDC systems.
3. Understand controllers for controlling the power flow through a DC link.
4. Understand converter faults and protection in converter station and abale to control reactive power in HVDC system.
5. Analyze the generation of harmonics and design of filters in HVDC systems.

UNIT I

HVDC Transmission

Introduction, comparison of AC & DC transmission, application of DC transmission, description of DC transmission system, planning for HVDC transmission system, modern trends in DC transmission.

UNIT II

Analysis of HVDC Converters

Pulse number, choice of converter configurations, analysis of Graetz circuit (6-pulse converter), voltage waveforms, converter bridge characteristics, characteristics of 12 Pulse converters, detailed analysis of converters.

UNIT III

Converter & HVDC System Control

Principles of DC link control, converter control characteristics, system control hierarchy, firing angle control, current and extinction angle control, starting and stopping of a DC link, power control.

UNIT IV

Converter Faults & Protection

Converter faults, protection against over currents, over voltages in a converter station, Protection against over voltages.

Reactive Power Control

Reactive power requirements in steady state, sources of reactive power.

UNIT V

Harmonics & Filters

Generation of harmonics, characteristic harmonics & Non-Characteristic harmonics. Types of AC filters, design of single tuned filters, design of high pass filter, analysis of double tuned filter.

Learning Resources

Text Books:

1. HVDC Power Transmission Systems - K. R. Padiyar, New Age International Publishers, Third Edition.
2. Direct Current Transmission - E.W.Kimbark, Wiley-Interscience.

Reference Books:

1. EHV-AC, HVDC Transmission & Distribution Engineering - S. Rao, Khanna Publishers, Third Edition.
2. HVDC Transmission – J.Arrillaga, The Institution of Engineering & Technology.

4/4 B.Tech. SEVENTH SEMESTER

EE7T3 SWITCHGEAR PROTECTION & CARRIER COMMUNICATION Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Practice: 1 periods/week Semester end examination: 70 marks

Course Objective:

This course introduces basic electrical protection using circuit breakers, relays and substation layout. It emphasizes on generator, transformer, feeder and bus bars protection schemes**.**

Course Outcomes:

After completing this course, student is able to

1. Understand different protection schemes adopted in power system
2. Understand operation of various switchgear equipment
3. Understand protection of different electrical equipments.
4. Implement various grounding practices and insulation coordination in the power system.

UNIT I

Circuit Breakers

Circuit Breakers: Elementary principles of arc interruption, Restriking voltage and Recovery voltages - Restriking phenomenon, average and max. RRRV, numerical problems - current chopping and resistance switching - CB ratings and specifications, auto reclosures -Numerical Problems.

Types of circuit breakers: Minimum oil circuit breakers , Air blast circuit breakers, Vacuum and SF6 circuit breakers.

UNIT II

Fundamentals of Protective Relaying

Protective relaying, fundamental principles of protective relaying, protection against other abnormal conditions, functional characteristics of protective relaying, evaluation of protective relaying.

Principle of operation and construction of attracted armature, balanced beam, induction disc and induction cup relays. Introduction to static relays -phase and magnitude comparators-level detectors. Numerical relays - phase and magnitude comparators- level detectors. Comparison of electromagnetic, static and numerical relays.

UNIT III

Application of Relays

Universal torque equation, over current relay, direction relays, differential relays and percentage differential relays-electromagnetic-static. Relays Classification: Instantaneous, DMT, IDMT types and under voltage relays. Distance relays: impedance, reactance, mho and Off-Set mho relays. Characteristics of distance relays and comparison-Electromagnetic only.

UNIT IV

Generator, Transformer and Bus bar Protection

Protection of generators against stator faults, rotor faults, and abnormal conditions. Restricted earth fault and inter-turn fault protection. Numerical Problems on percentage winding unprotected. Protection of transformers: Percentage differential protection, numerical problem on design of CT's ratio, Buchholtz relay protection.

Protection of Lines: Over current, carrier current and three-zone distance relay protection using impedance relays, translay relay. Protection of bus bars – differential protection.

UNIT V

Protection Against Over Voltages

Grounded and ungrounded neutral systems.- Effects of ungrounded neutral on system performance. Methods of neutral grounding: solid, resistance, reactance - arcing grounds and grounding practices. Protection of transmission lines, stations and substations against direct lightning strokes-protection against travelling waves-Insulation coordination.

Learning Resources

Text Books:

1. Switchgear and Protection by Sunil S Rao, Khanna Publlishers
2. Power System Protection and Switchgear by Badari Ram , D.N Viswakarma, TMH Publications, 2nd edition.
3. Switchgear and Protection by J.B.Gupta, S.Chand publications, 2nd edition.

Reference Books:

1. Fundamentals of Power system protection by Paithankar and S.R.Bhide.,PHI, 2003, 2nd edition.
2. Electrical power systems – by C.L.Wadhwa, New Age International (P) Limited, Publishers, 4th edition
3. A Text book on Power system engineering by B.L.Soni, Gupta, Bhatnagar, Chakrabarthy, Dhanpat Rai & Co

4/4 B.Tech. SEVENTH SEMESTER

EE7T4 FLEXIBLE AC TRANSMISSION SYSTEMS Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

The main objective is to impart the knowledge of FACTS controllers, series, shunt compensation and also the concept of voltage source and current source converters

Course Outcomes:

After completing this course, student will be able to

1. Understand the concepts of various FACTS controllers
2. Analyze and design reactive power compensation systems
3. Solve real and reactive power flow problems
4. Evaluate the impact of flexible AC transmission systems on modern power systems.

Unit I

Transmission interconnections, power flow in an AC System, loading capability limits, power flow and dynamic stability considerations, importance of controllable parameters. Basic types of FACTS controllers, benefits from FACTS controllers.

Unit II

Basic concept of voltage source converter, single phase full wave bridge converter, single phase-leg (pole) operation, square-wave voltage harmonics for a single phase bridge and three phase full wave bridge converters, basic concept of current source converters, comparison of current source converters with voltage source converters.

Unit III

Objectives of shunt compensation, midpoint voltage regulation for line segmentation, end of line voltage support to prevent voltage instability, methods of controllable var generation, variable impedance type static var generators – TCR and TSR, TSC, FC-TCR, TSC-TCR, switching converter type var generators, hybrid var generators.

Unit IV

SVC and STATCOM: The regulation slope - transfer function and dynamic performance, transient stability enhancement and power oscillation damping, operating point control and summary of compensation control.

Unit V

Static series compensators: Concept of series capacitive compensation, improvement of transient stability, power oscillation damping. GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC), control schemes for GSC, TSSC and TCSC. Introduction to UPFC and IPFC and their role in power system operation.

Learning Resources

Text Books:

1. Understanding FACTS, N.G.Hingorani and L.Guygi, Delhi IEEE Press 2001
2. Flexible AC transmission system (FACTS) by YONG HUE SONG and ALLAN T JOHNS, Institution of Electrical Engineers, London

(ELECTIVE – A/I)
4/4 B.Tech. SEVENTH SEMESTER

EE7T5A COMPUTER METHODS IN POWER SYSTEMS Credits:3
Lecture: 3 periods/week Internal assessment: 30 marks
Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:
This course is designed to give students the required knowledge for the design and analysis of electrical power system. Calculation of power flow in a power system network using various techniques, formation of Ybus, Zbus and its importance are covered in this course. It also deals with analysis of transient stability.

Course Outcomes:
After completing this course, student is able to
1. Analyse fault using Z-bus.
2. Develop computer programs for different load flow techniques.
3. Analyse security of the power system.
4. Perform stability analysis of power system

UNIT I
Network Topology
Incidence and network matrices: Introduction, graphs, incidence matrices, primitive matrices, types of network matrices, formation of network matrix, π-representation of off-nominal tap transformers, Y-bus formation by singular transformation, examples of formation of incidence matrices, formation of Ybus by inspection method.

UNIT II
Analysis Of Faulted Power System
Algorithms for formation of Z-bus matrix: Step by Step algorithm for formation of Z-bus. Modification of Z-bus matrix for changes in the network, numerical Problems. Short circuit analysis of large power systems using Z bus, analysis of open circuit faults.

UNIT III
Power Flow Analysis
Introduction, sparsity technique for Ybus , power flow solution algorithms, Gauss-Seidal method , Newton Raphson load flow method, Fast decoupled load flow method and dc load flow method, numerical examples.

UNIT IV
Security and Contingency Analysis
Introduction, factors affecting power system security, contingency analysis- linear sensitivity factors , contingency selection.

UNIT V
Stability Analysis
Classification of power system stability, classical model of synchronous machines(SMIB) - excitation and power system stabilizer(PSS) representation. Numerical integration methods -Runge Kutta fourth order methods and modified Euler‘s method. Transient stability algorithm using modified Euler‘s method and fourth order Runge Kutta method.

Learning Resources

Text Books:

1. Computer Techniques in Power System Analysis, Pai, M. A- TMH Publishers, 2nd edition, 2006.
2. K.U.Rao: Computer Techniques and Models in Power Systems, I.K.International Pvt.Ltd.
3. Modern Power System Analysis, Nagrath, I. J., and Kothari, D. P, TMH,4th edition, 2003.

Reference Books:

1. Advanced Power System Analysis and Dynamics, Singh, L. P,New Age International (P) Ltd, New Delhi, 2001, 5th Edition.
2. Power System Analysis, Haadi Sadat, TMH, 2nd Edition, 4th edition, 2007

(ELECTIVE – B/I)
4/4 B.Tech. SEVENTH SEMESTER

EE7T5B **VLSI** **Credits: 3**
Lecture: 3 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objectives:

- Understand VLSI Design Flow
- Learn Transistor-Level CMOS Logic Design
- Understand VLSI Fabrication
- Learn to analyze Functionality and Timing Characteristics of Logic Gates

Course Outcomes:

Student will be able to

1. Gain knowledge of different VLSI fabrication processes and CMOS Logic Design.
2. Design different MOS logical circuits.
3. Analyze the effects of Scaling.
4. Program PLDs, CPLDs and FPGAs.

UNIT I

Basic Electrical Properties of MOS Circuits and Fabrication

Introduction to IC Technology, The IC Era, MOS and related VLSI Technology, Basic MOS Transistors. Enhancement and Depletion modes of transistor action, MOS and CMOS Fabrication process, BiCMOS Technology, Comparison between CMOS and Bipolar technologies. Id versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans-conductance and Output Conductance, MOS transistor Figure of Merit, The Pass transistor. The nMOS Inverter, The CMOS Inverter, Latch-up.

UNIT II

Layout diagrams: Layout Design rules, Layout Diagrams of CMOS inverter and different logic functions.

Basic Circuit Concepts: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters,Area Capacitance of Layers, Standard unit of capacitance, Some area Capacitance Calculations, The Delay Unit Inverter Delays, Driving large capacitive loads, Propagation Delays, Wiling Capacitances, Fan-in and fan-out characteristics, Realization of gates using nMOS, pMOS and CMOS technologies.

UNIT III

Scaling of MOS Circuits

Scaling model s and scaling factors, Scaling factors for device parameters, Limitations of scaling, Limits due to sub threshold currents, Limits on logic levels and supply voltage due to noise, Limits due to current density, Introduction to Switch Logic and Gate Logic.

UNIT IV

Programmable Logic Devices (PLDs)

Programmable Logic Arrays (PLA), Programmable Array Logic (PAL). Implementation approaches in VLS1 Design- full Custom Design, Semicustom Design, Gate Arrays, and Standard Cells,FPGAs

UNIT V

Test Principles

Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques, System-level Test Techniques.

Learning Resources

Text Books:

1 Essentials of VLSI Circuits and Systems- Kamran Eshraghian, Douglas and APucknell, PHI. Private Limited, 2005.

2 Principles of CMOS VLSI Design - Weste and Eshraghian, Pearson Education, 1999.

Reference Books:

1 Chip Design for Submicron VLSI: CMOS Layout & Simulation, - John P. Uyemura, Thomson Learning,2005.

2 Introduction to VLSI Circuits and Systems - John .P. Uyemura, JohnWiley, 2003.

3 Digital Integrated Circuits - John M. Rabaey, PHI, EEE, 1997.

4 Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.

5 VLSI Technology – S.M. SZE, 2nd Edition, TMH, 2003.

6 Fundamentals of Logic Design with VHDL– Stephen. Brown and ZvonkoVranesic, TMH, 2005

(ELECTIVE – C/I)
4/4 B.Tech. SEVENTH SEMESTER

EE7T5C DATABASE MANAGEMENT SYSTEMS Credits: 3
Lecture: 3 periods/week Internal assessment: 30 marks
Tutorial: 1 period /week Semester end examination: 70 marks

Course Objectives:

- The main objective of this course is to enable students to the fundamental concepts of database analysis and design.
- To recognize the importance of database analysis and design in the implementation of any Database application and to understand the process of drawing the ER-Diagrams.
- It also gives the knowledge of the roles of transaction processing and concurrency control.

Course Outcomes:

1. Understand the basic principles of database management systems.
2. Draw Entity-Relationship diagrams to represent simple database application scenarios.
3. Write SQL queries for a given context in relational database.
4. Discuss normalization techniques with simple examples.
5. Describe transaction processing and concurrency control concepts.

UNIT I

Introduction to Databases: Characteristics of the Database Approach, Advantages of using the DBMS Approach, A Brief History of Database Applications.
Overview of Database Languages and Architectures: Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, Database System environment, Centralized and Client-Server Architecture for DBMSs

UNIT II

Conceptual Data Modeling : High-Level Conceptual Data Models for Database Design, A Sample Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions and Design Issues, Relationship Types of Degree Higher Than Two.

UNIT III

Relational Model: The Relational Model Concepts , Relational Model Constraints and Relational Database Schemas.
SQL : Data Definition and data types, Constraints, Basic retrieval Queries, INSERT, DELETE AND UPDATE statements and Views(Virtual Tables) in SQL.

UNIT IV

Database Design Theory : Functional Dependencies, Normal forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form.

UNIT V

Transaction Processing: Introduction, Transaction and System Concepts, Desirable Properties of Transactions, Transaction Support in SQL.

Concurrency Control: Two-phase locking techniques for concurrency control, Concurrency control based on Timestamp Ordering

Learning Resources

Text Book:

Database Systems Models, Languages, Design and Application Programming, 6th Edition, Ramez Elmasri , Shamkant B.Navathe , Pearson.

(ELECTIVE – D/I)

4/4 B.Tech. SEVENTH SEMESTER

EE7T5D OBJECT ORIENTED PROGRAMMING THROUGH JAVA Credits:3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

The main objective of this course is to understand the Object Oriented programming issues in developing software designs. Students will also learn the advantages of Object Oriented programming over the normal and old paradigm structured programming languages. Examples which are demonstrated using java helps the students to understand the concepts and apply the features of Object Oriented programming. This helps students to keep their skills up to date.

Course Outcomes:

1. Understand the key features of the Java programming language
2. Apply essential object-oriented programming concepts like dynamic polymorphism, abstract (virtual) methods using Java
3. Students will apply the principles behind good object-oriented design.
4. Should get exposure to the latest trends in java language and its compatibility in handling numerous complex domains.

UNIT I

Java Basics and Anatomy:

Java Basics: OOP‘s principles, Java History, advantages, Data types, operators, expressions, control statements, methods and recursion, sample programs.

Java Anatomy: Java Objects and References, Constructors, this keyword, Arrays (single and multi-dimensional), String and its immutability, Buffer &Builder Classes, String Tokenizer

UNIT II

Inheritance (Extending and Implementing)

Introduction Derived Classes, Advantages and Types of Inheritance, Member Accessibility. Overriding, Super, Abstract classes and Methods, Final Classes and Final Methods, Polymorphism, Dynamic Binding.

Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, variables in interface, extending interfaces

UNIT III

Packaging and Java API

Packages: Defining, Creating and Accessing a Package, importing packages, access controls (public, protected, default, and private). Wrapper Classes and Auto Boxing, I/O classes

UNIT IV

Exception handling and Multithreading

Concepts of exception handling, benefits of exception handling, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception.

Threads: Thread life cycle, creating threads, synchronizing threads

UNIT V

Graphical User Interaction

Graphical User Interaction: Swings- Introduction, limitations of AWT, components, containers, exploring swing-Frame and JComponent, Icons and Labels, text fields.Layout managers– border, grid Event Handling: Events, Event Delegation Model, Event classes, Listeners, handling mouse and keyboard events,

Learning Resources

Text Book:

Java Fundamentals, A Cpomprehensive Introduction, Herbert Schildt, 2014, McGraw-Hill.

Reference Books:

1. Introduction to Java Programming 7/e, Brief version, Y.Daniel Liang, Pearson
2. Java: The complete reference, 7/e, Herbert Scheldt, TMH.
3. Java How to Program, 7/E: Paul Deitel, Deitel & Associates, Inc.

(ELECTIVE – A/II)
4/4 B.Tech. SEVENTH SEMESTER

EE7T6A ELECTRICAL DISTRIBUTION SYSTEMS Credits:3
Lecture: 3 periods/week Internal assessment: 30 marks
Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:
This course discusses the basic fundamentals of the distribution systems planning and automation. It enhances the practical knowledge about electrical distribution systems for the student. It enriches the knowledge about transmission of power from generating stations to distribution substation. It also deals the voltage control.

Course Outcomes:
After completing this course, student is able to
1. Understand different loads and their characteristics and design the distribution feeders.
2. Design substations and their optimal location
3. Know functions of various protective devices and their co-ordination
4. Know control aspects power factor and voltage

Unit I
Distribution Systems Planning And Load Characteristics:
Introduction, distribution system planning, factors affecting system planning, present distribution planning techniques, distribution system planning in the future, future nature of distribution planning, central role of the computer in distribution planning, load characteristics, definitions, relationship between the load and loss factors, load growth, rate structure.

Unit II
Distribution Transformers, Design Of Sub Transmission Lines and Distribution Substations:
Different types of distribution transformers, regulation and efficiency. sub-transmission systems, distribution substation, sub-station bus schemes, sub-station location, rating of a distribution substation. Substation service area with 'n' primary feeders, comparison of four and six feeder patterns.

Unit III
Design Considerations on Primary and Secondary Systems:
Introduction: Radial type and loop type primary feeders, primary network, primary feeder voltage levels, primary feeder loading, radial feeders with uniformly distributed load and non-uniformly distributed loads
Secondary voltage levels, secondary banking, and secondary networks, secondary mains voltage drops and power loss calculations; three phase balanced primary lines, non three phase primary lines.

Unit IV
Power Factor Improvement and Voltage Control
Power capacitors, shunt and series capacitors, effect of series and shunt capacitors (fixed and switched), power factor correction, economic justification of capacitors, procedure to determine the best capacitor location. voltage regulators, effect of AVB/AVR, line drop compensation.

Unit V

Distribution system protection.

Basic definitions, over current protection devices-fuses, automatic circuit reclosers, automatic line sectionalizers, automatic circuit breakers. Objectives of distribution system protection, co-ordination of protective devices- fuse to fuse co-ordination, recloser to recloser coordination, fuse to circuit breaker, recloser to fuse co-ordination, recloser to circuit breaker co-ordination.

Learning Resources

Text Books:

1. Electric Power Distribution system Engineering by Turan Gonen, CRC press, 3rd edition, 2014.
2. Electric Power Distribution by A.S.Pabla, Tata Mc Graw-hill Publishing Company,6th edition,2011.

Reference Books:

1. Electrical Power Distribution and Automation by S.Sivanagaraju,V.Sankar,Dhanpat Rai&Co, 2014
2. Electrical Power Distribution Systems by V.Kamaraju, Overseas Publishers,Hyderabad, 3rd edition, 2008.

(ELECTIVE – B/II)
4/4 B.Tech. SEVENTH SEMESTER

EE7T6B PROGRAMMABLE LOGIC CONTROLLERS Credits: 3
Lecture: 3 periods/week Internal assessment: 30 marks
Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

This course concentrates on the fundamental concepts, methods of analysis of programmable logic control and systems including basic concepts, programming, applications, troubleshooting of ladder logic, and interfacing of equipment.

Course Outcomes:

After completing this course, student is able to

1. Understand the purpose, functions, and operations of a PLC
2. Identify the basic components of the PLC and how they function.
3. I/O configuration of PLC.

UNIT I

PLC - An Introduction

Definition& history, advantages and disadvantages, PLC overall system and CPU processor, input output modules and interfacing, PLC as a computer.

PLC programming procedure: programming equipment, programming formats, construction of PLC ladder diagrams, devices connected to input output modules.

UNIT II

PLC Programming

Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation, digital logic gates, programming in the boolean algebra system, conversion examples.

Ladder Diagrams for process control: ladder diagrams & sequence listings, ladder diagram construction and flowchart for spray process system.

UNIT III

Basic PLC Functions

PLC Registers: characteristics of registers, module addressing, holding registers, input registers, output registers.

PLC Functions: Timer functions & industrial applications, counters, counter function industrial applications.

UNIT IV

Intermediate and Data Handling Functions

Arithmetic functions: Number comparison functions, number conversion functions. Data handling functions: SKIP, master control Relay, jump, move, FIFO, FAL, ONS, CLR & sweep functions and their applications.

UNIT V

PLC Functions Working with Bits and Advanced PLC Functions

Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two-axis & three axis robots with PLC, matrix functions. Analog PLC operation: analog modules& systems, analog signal processing, multi bit data processing, analog output

application Examples, PID principles, position indicator with PID control, PID modules, PID tuning, PID functions.

Learning Resources

Text Books:

1. "Programmable Logic Controllers- Principles and Applications" by John W.Webb & Ronald A. Reiss", PHI publications-Fifth Edition.
2. "Programmable Logic Controllers- Programming Method and Applications" by 'J.R.Hackworth &F.D Hackworth Jr.', Pearson, 2004.

Reference Book:

"Programmable Logic Controllers" by W.Bolton", Newnes publications -Fourth Edition

(ELECTIVE – C/II)
4/4 B.Tech. SEVENTH SEMESTER

EE7T6C POWER SYSTEM DEREGULATION Credits:3
Lecture: 3 periods/week Internal assessment: 30 marks
Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:
The aim of this course is to impart knowledge on fundamental concepts of deregulated electrical market systems, power business and technical issues involved in a restructured power system of both Indian and world scenario

Course Outcomes:
At the end of the course the student will be able to:
1. Understand the developments in restructuring of power systems
2. Explore issues like congestion management, transmission pricing, ancillary services management.
3. Analyze the concepts of locational marginal pricing and financial transmission rights.
4. Understand typical issues in electricity markets and how these are handled world-wide in various markets

UNIT I
Need and conditions for deregulation: Introduction of market structure, market architecture, spot market, forward markets and settlements. Review on concepts of marginal cost of generation, least-cost operation, incremental cost of generation. Comparison between old and new power system operation

UNIT II
Electricity sector structures and ownership /management: The forms of ownership and management. Different structure models like monopoly model, purchasing agency model, wholesale competition model, retail competition model.

UNIT III
Locational marginal pricing: Framework and methods for the analysis of Bilateral and pool markets, LMP based markets, auction models and price formation, price based unit commitment.

UNIT IV
Transmission network and market power: Power wheeling transactions and marginal costing, transmission costing. Congestion management methods- market splitting, counter-trading, effect of congestion on LMPs.

UNIT V
Ancillary Services and System Security in Deregulation: Classifications and definitions, ancillary services management in various markets, regulatory issues involved in the deregulation of the power industry.

Learning Resources

Reference Books:

1. Power System Economics: Designing markets for electricity by S. Stoft, John Wiley & Sons Inc Publishers, 2002
2. Operation of restructured power systems by K. Bhattacharya, M.H.J. Bollen and J.E. Daalder, Kluwer academic publishers, 2001
3. Market operations in electric power systems by M. Shahidehpour, H. Yamin and Z. Li John Wiley & Sons Inc Publishers, 2002
4. Fundamentals of power system economics by S. Kirschen and G. Strbac John Wiley & Sons, Ltd

(ELECTIVE – D/II)
4/4 B.Tech. SEVENTH SEMESTER

EE7T6D **EHVAC TRANSMISSION** **Credits:3**
Lecture: 3 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objective:

This subject deals with the detailed analysis of line parameter calculation in EHVAC transmission. Information about voltage gradients of conductors and electro static field in addition with corona effects and voltage control.

Course Outcomes:

After completing this course student is able to

1. Evaluate EHVAC transmission system with all parameters
2. Understand electrostatic effects in EHVAC transmission
3. Understand effects of Corona in EHVAC transmission
4. Select a suitable voltage controller for a EHVAC transmission system

UNIT I

Introduction -Transmission line Trends

Necessity of EHV AC transmission, advantages and problems, power handling capacity and line losses, mechanical considerations, resistance of conductors, temperature rise of conductors and current-carrying capacity, properties of bundled conductors – problems.

UNIT II

Line and Ground Reactive Parameters

Inductance of EHV line configurations, line capacitance calculation, sequence inductances and capacitances, line parameters for modes of propagation, resistance and inductance of ground return.

UNIT III

Voltage Gradients of Conductors

Electrostatics, field of sphere gap, field of line changes and properties, charge - potential relations for multi-conductors lines, surface voltage gradient on conductors, distribution of voltage gradient on sub-conductors of bundle, effect of high electro static field on Humans, animals and plants.

UNIT IV

Corona Effects

I^2R loss and corona loss, corona-loss formulae, charge-voltage (q–V) diagram and corona loss, attenuation of travelling waves due to corona loss, audible noise: generation and characteristics, limits for audible, audible noise measurement and meters, formulae for audible noise and its use in design, relation between single-phase and three-phase AN levels examples.

UNIT V

Power-Frequency Voltage Control:

Problems at power frequency, generalized constants, no-load voltage conditions and charging current, power circle diagram and its use, voltage control using synchronous condensers, cascade connection of components, shunt and series compensation, sub-synchronous resonance in series-capacitor compensated lines, static reactive compensating systems (static VAR'S).

Learning Resources

Text Book:

EHVAC Transmission Engineering - Rakosh Das Begamudre, New Age International Publishers, Third Edition.

Reference Book:

EHV-AC, HVDC Transmission & Distribution Engineering - S. Rao, Khanna Publishers, Third Edition.

4/4 B.Tech. SEVENTH SEMESTER

EE7L1 MICROCONTROLLERS LAB Credits: 2
Lecture: Internal assessment: 25 marks
Tutorial: 3 period /week Semester end examination: 50 marks

Course Objective:
To train the students to use micro-processor and micro-controller for computational and logical applications. Also this course prepares the students to provide solutions to real-time problems.

Course Outcomes:

1. Accomplish arithmetic and logical operations with 8086 micro-processors and8051 micro-controllers.
2. Illustrate various interfacing techniques related to real time applications, using 8086 micro-processors.
3. Perform multiprocessor communication.
4. Analyze and document the experiments carried out.

List of experiments

I. Introduction to MASM/TASM.

II. Microprocessor 8086

i. Arithmetic operation – Multi byte addition and subtraction, Multiplication and Division, ASCII – arithmetic operation.
ii. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.
iii. String Operations – Sorting

III. Microcontroller 8051

i. Arithmetic operations
ii. Checking 5^{th} bit
iii. Display string
iv. Serial communication implementation.
v. Programs using special instructions like swap, bit/byte, set/reset etc.

IV. Interfacing

i. 8259 – Interrupt Controller
ii. Traffic light Interface
iii. Stepper Motor Interface
iv. ADC Interface
v. Keyboard Interface

4/4 B.Tech. SEVENTH SEMESTER

EE7L2 ELECTRICAL POWER SYSTEMS LAB Credits: 2

Lecture: -- Internal assessment: 25 marks

Lab : 3 periods/week Semester end examination: 50 marks

Course Objective:

The aim of this course is to impart the basic knowledge on different types of faults in power systems and to expose the students to the equipment in electrical engineering practice so that it helps them in industry oriented learning

Course Outcomes:

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

1. Have hands on experience on various power system studies and different techniques used for system planning.
2. Determine the parameters of various machines used in power systems
3. Understand the characteristics of different relays used in electrical Industry.
4. Determine parameters, loading capability, compensation equipment required in practical transmission network.
5. Design and analyze modern power system networks by using simulink and MATLAB softwares

List of Experiments

Conduct any TEN experiments

1. Determination of sub-Transient reactance of a salient pole machine.
2. Determination of sequence impedances of an alternator.
3. Fault Analysis under occurrence of LG Fault & LL Fault.
4. Determination of regulation of non salient pole alternator by EMF, MMF and ZPF methods.
5. Characteristics of microprocessor based under voltage relay.
6. Characteristics of microprocessor based over voltage relay.
7. Characteristics of electromagnetic type IDMT over current relay.
8. Characteristics of static negative sequence relay.
9. Characteristics of static biased differential relay.
10. Evaluation of ABCD parameters for transmission line.
11. Evaluation of surge impedance loading of transmission line.
12. Equivalent circuit of a three winding transformer.
13. Formation of Y-Bus by direct inspection method using MAT LAB
14. Transient stability studies using MAT LAB
15. Simulation of power system stabilizer using SIMULINK
16. Simulation of single area and two area systems using SIMULINK

Reference Books:

1. MATLAB and its Tool Books user‘s manual by Math works, USA.
2. Fundamentals of Switchgear and Protection by J.B.Gupta , S.K. Kataria & Sons,2014.
3. Modern power system analysis by D.P.Kothari and I.J.Nagrath , TMH Publications.
4. Electrical power systems by C.L.Wadhwa, New Age International (P) Limited.

4/4 B.Tech. SEVENTH SEMESTER

EE7L3 ELECTRICAL SIMULATION LAB Credits: 2

Lecture: -- Internal assessment: 25 marks

Lab : 3 periods/week Semester end examination: 50 marks

Course Objective:

The objective of this lab is to appreciate and use various software tools in electrical engineering for modeling and simulation of different power systems and power electronic circuits in lesser time.

Course Outcomes:

After successful completion of the course, the students shall be

1. Able to use the MATLAB, PSIM and PSCAD.
2. Able to program the Modeling and Simulation of various Electrical circuits.
3. Exposed to use of Graphical User Interfaces like SIMULINK etc., for the Modeling and Simulation.

List of Experiments:

1. Analysis of three phase circuit representing the generator, transmission line and load using PSCAD
2. PSPICE simulation of single – phase full converter using RLE loads and single phase AC voltage controller using RL& RLE loads
3. Simulation of D. C. circuit for determining thevenin‘s equivalent & norton‘s equation using MAT LAB
4. Response of an RLC circuit by parametric analysis using PSPICE
5. Finding stability for a given pulse transfer function using bode plot in MAT LAB
6. Power Flow solution of a power system using MATLAB
7. Fault analysis of a power system using PSCAD
8. Simulation of Buck Chopper & Resonant Pulse Commutation Circuit using PSIM
9. Simulation of single phase inverter with PWM control using PSIM
10. Simulation of op- Amp based integrator & differentiator circuits using MATLAB
11. PID –open loop & closed loop control in PSIM
12. Modeling of electrical machine in PSCAD

4/4 B.Tech. EIGHTH SEMESTER

EE8T1 RENEWABLE SOURCES OF ENERGY Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objectives:

It introduces basics of solar energy like solar radiation, collection, storage and application. It also introduces the wind energy, biomass energy, geothermal energy and ocean energy as alternative energy sources.

Course Outcomes:

After completing this course, student is able to

1. Apply knowledge of mathematics physics and engineering to the analysis and design of renewable energy systems.
2. Identify, formulate, and solve engineering problems in the area of renewable energy system for clean, reliable and efficient electrical power
3. Design an electric system, or process to meet desired needs within realistic constraint for wind, solar thermal, solar PV, bio mass geothermal and ocean energy systems
4. Get the knowledge on modern issues in electrical power generation.
5. Get the ability to function effectively on multidisciplinary teams.

Unit I

Principles of Solar Radiation and Solar Energy Collection

Role and potential of new and renewable source, the solar energy option, environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data. Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Unit II

Solar Energy Storage, Applications and Photovoltaic Energy Conversion

Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications solar heating/cooling technique, solar distillation and drying.

Solar cell fundamentals, solar cell classification, performance of solar cell- power from solar module.

Unit III

Wind Energy and Bio-Mass

Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking.

Unit IV

Energy and Ocean Energy

Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, principles of utilization, setting of OTEC plants, thermodynamic cycles.

Tidal and wave energy: Potential and conversion techniques.

Unit V

Energy Conversion

Principles DEC, MHD generators, principles, MHD power generation systems. Fuel cells, principles, of fuels and operating conditions, merits and demerits of different types of fuel cells, mini-hydel power plants and their economics.

Learning Resources

Text Books:

1. Non-Conventional Energy Sources by G.D. Rai, Khanna publishers, 5th edition,2014.
2. Renewable Energy resources, Tiwari and Ghosal, Narosa,2005
3. Science and Technology of Photo Voltaics by Jayarama Reddy, BS publications, 2nd edition,2012

Reference Books:

1. Non-Conventional Energy by Ashok V Desai, New age, 2005.
2. Non-Conventional Energy Sources by B.H.Khan, Tata Mc Graw-hill Publishing Company, 2nd edition, 2013.

4/4 B.Tech. EIGTH SEMESTER

EE8T2A POWER SYSTEMS DYNAMICS & STABILITY Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

To study the modeling of synchronous machine, stability analysis, multi machine stability and different excitation system

Course Outcomes:

After completing the course the student

1. Able to understand modeling of synchronous machine, induction motor and load.
2. Able to understand the system dynamics.
3. Able to understand stability, stability limits, multimachine stability
4. Able to understand excitation systems in power system

Unit I

System Dynamics and Synchronous machine model in state space form, computer representation for excitation and governor systems, modeling of loads and induction machines.

Unit II

Stability and stability limit, steady state stability limit, transient state stability limit, dynamic stability limit, transient state stability studies.

Unit III

State space representation of synchronous machine connected to infinite bus, concept of multi machine stability, multi machine transient stability under different faulted conditions.

Unit IV

Excitation systems- rotating self-excited exciter with direct acting rheostatic type voltage regulator – rotating main and pilot exciters with indirect acting rheostatic type voltage regulator.

Unit V

Rotating main exciter rotating amplifier and static voltage regulator – static excitation scheme – brushless excitation system.

Learning Resources

Text Books:

1. Power System control and stability by Anderson and Fund, Galgotia Publications, 1981, 1 st edition.
2. Power System Dynamics Stability and Control by K.R.Padiyar, Second edition B.S.Publications 2002.
3. Power System Analysis by ,Hadi Saadat, Tata McGraw Hill Publications
4. Advanced power system analysis and dynamics by L.P.Sing, 5th edition, New age International publishers

Reference Books:

1. Power System Stability by Kimbark Vol. I&II, III , Dover Publication Inc, New York 1968.
2. Computer Applications to Power Systems by Glenn.W.Stagg & Ahmed. H.El.Abiad
3. Power Systems Analysis & Stability by S.S.Vadhera Khanna Publishers.

4/4 B.Tech. EIGHTH SEMESTER

EE8T2B	**POWER QUALITY**	**Credits: 3**
Lecture: 3 periods/week		**Internal assessment: 30 marks**
Tutorial: 1 period /week		**Semester end examination: 70 marks**

Course Objective:

This course covers general classes of power quality problems, voltage sags and interruptions, fundamental principles of protection, distributed generation and basic problems related to wiring and grounding.

Course Outcomes:

After the completion of this course, student is able to

1. Understand various power quality problems related to voltage, current and frequency.
2. Learn various sources of sags & interruptions
3. Provide solutions at the end user level to protect the system against various power quality problems
4. Gain knowledge about distributed generation and various operating conflicts related to DG
5. Learn about various wiring and grounding problems.

Unit I

Power and Voltage Quality

General classes of power quality problems, Power quality terms, Power frequency variations, power quality evaluation procedure. Voltage quality -- Transients, long and short duration voltage variations, Voltage imbalance, Waveform distortion, Voltage flicker.

Voltage sags and Interruptions -Sources of sags and interruptions, Estimating Voltage sag performance.

Unit II

Fundamental Principles of Protection

Solutions at the end-user level, Evaluating economics of different ride-through alternatives, Motor-Starting Sags.

Unit III

Fundamentals of Harmonics

Harmonic distortion, Voltage versus current distortion, Harmonic indices, Harmonic sources from commercial loads, Harmonic sources from industrial loads, Locating harmonic sources, System response characteristics, Effects of harmonic distortion.

Unit IV

Distributed Generation and Power Quality

Resurgence of DG, DG technologies, Interface to the utility System, Power Quality Issues, Operating conflicts, DG on distribution networks, Siting DG distributed generation, Interconnection standards.

Unit V

Wiring and Grounding

Resources, Definitions, Reasons for grounding, Typical wiring and grounding problems, Solutions to wiring and grounding problems.

Learning Resources

Text Books:

1. Electrical Power Systems Quality by Roger C.Dugan, Mark F. Mc Granaghan, Surya Santoso, H. Wayne Beaty, Third edition, TMH publishers,2012
2. Understanding Power Quality Problems by Math H.J. Bollen, Wiley-IEEE press, 1999

Reference Books:

1. Power Quality enhancement using custom power devices by Arindam Ghosh, Gerard Ledwich, Springer International series in Engineering and computer science,2002
2. Power Quality in Power Systems and Electrical Machines, Ewald F.Fuchs, Mohammad A.S. Masoum, Elsevier Academic Press,2008

4/4 B.Tech. EIGHTH SEMESTER

EE8T2C **SMART GRID** **Credits: 3**

Lecture: 3 periods/week **Internal assessment: 30 marks**

Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objective:

In this course, students will learn the fundamentals of smart grid, its purpose, its objectives, its technologies, its architecture and its management. Students will also learn many of the challenges facing the smart grid as part of its evolution.

Course Outcomes:

After completing this course, student is able to

1. Understand various aspects of smart grid
2. Know how a smart grid can be used to meet the needs of a utility
3. Create a frame work for knowledgeable power engineers to operate the grid more effectively.
4. Use various computational tools available to analyze smart grid.

Unit I

Introduction to Smart Grid

Computation intelligence, stake holder roles and function, definition of smart grid, functions of smart grid components.

Unit II

Communication and Measurement

Introduction, wide area monitoring system, phasor measurement unit, smart meters and appliances, advanced metering infrastructure, GIS technology, MAS technology, comparison between micro grid and smart grid.

Unit III

Performance Analysis Tools For Smart Grid Design

Load flow studies in smart grid, challenges, load flow state, congestion management effect, contingencies, classification, steady state contingency analysis, performance indices, sensitivity based approaches, contingency studies for smart grid.

Unit IV

Stability Analysis for Smart Grid

Introduction to stability, voltage stability assessment types, voltage stability assessment technique, voltage stability indexing, analysis techniques.

Unit V

Computational Tools for Smart Grid

Introduction, decision support tools, optimization techniques, classical optimization techniques, linear programming, non linear programming, integer programming, dynamic programming, stochastic programming, chance constant programming.

Learning Resources

Text Book:

Smart Grid – Fundamentals of design and analysis by James Mamoh, Wiley – IEEE press

Reference Book:

Smart Grid Technology and Application by Janaka Ekanakye, Kithsiri Liyanage, Jianzhang Wu, Akiihiko Yokoyama and Nick Jeenkins , Wiley publications

4/4 B.Tech. EIGTH SEMESTER

EE8T2D ENERGY AUDIT, CONSERVATION & MANAGEMENT Credits: 3

Lecture: 3 periods/week **Internal assessment: 30 marks**

Tutorial: 1 period /week **Semester end examination: 70 marks**

Course Objective:

It introduces principles of energy audit & energy management, lighting systems, power factor improvement and various energy Instruments. It also introduces space heating and ventilation; analysis of economic aspects and computation**.**

Course Outcomes:

After completing this course, student is able to

1. Assess the benefits and drivers of an energy audit.
2. Have knowledge of the energy audit process and the elements that make up the process.
3. Understand how to plan and carry out an energy audit.
4. Know the process of reviewing energy data and analysis in the energy audit process
5. Have knowledge of the equipment and key considerations required when carrying out an energy audit.

UNIT I

Basic Principles of Energy Audit & Energy Management

Energy audit – definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, energy conservation schemes, and energy saving potential.

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting, energy manager, qualities and functions, language, questionnaire- check list for top management.

UNIT II

Lighting

Modification of existing systems-replacement of existing systems – priorities: definition of terms and units, luminous efficiency – polar curve- calculation of illumination level-illumination of inclined surface to beam – luminance or brightness – types of lamps – types of lighting – electric lighting fittings(luminaries) – flood lighting – white light LED and conducting polymers – energy conservation measures.

UNIT III

Power Factor and Energy Instruments

Power factor – methods of improvement, location of improvement, location of capacitors, Pf with non linear loads, effect of harmonics on p.f., motor controllers

Energy instruments – watt – hour meter, data loggers, thermocouples pyrometers, lux meters, tong testers, power analyzer.

UNIT IV

Space Heating and Ventilation

Ventilation, air – Conditioning (HVAC) and water heating: Introduction- heating of buildings-transfer of Heat- space heating methods- ventilation and air – conditioning-insulation – cooling load – electric water heating systems- energy conservation methods.

UNIT V

Economic Aspects and Analysis & Computation

Economics analysis- depreciation methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis – energy efficient motors(basic concepts).

calculation of simple payback method, net present worth method- power factor correction, lighting – applications of life cycle costing analysis, return on investment.

Learning Resources

Text Books:

1. Energy management by W. R. Murphy & F. McKay Butter worth, Elsevier publications. 2012.
2. Electric Energy Utilization and Conservation by S C Tripathy , Tata McGraw hill publishing company Ltd. New Delhi.

Reference Books:

1. Energy management by Paul o' Callaghan, Mc- graw Hill Book company- 1st edition, 1998.
2. Energy management hand book by W. C. Turner. John wiley and sons
3. Energy efficient electric motors by John. C. Andreas, Marcel Inc Ltd- 2nd edition. 1995.

4/4 B.Tech. EIGTH SEMESTER

EE8T3A DIGITAL CONTROL SYSTEMS Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

This course covers the basic difference between continuous and discrete time signals and provides an introduction to analysis and design of computer-controlled systems. This course not only focuses on mathematical concepts in digital control, including Z-transform, pulse transfer functions, state space models and digital controllers design by conventional methods, state feedback controllers and observers.

Course Outcomes:

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

1. Understand the basic knowledge of A/D and D/A conversion, issues faced in sampling digital data and discrete time systems.
2. Understand the basics of Z- Transforms and mathematical models of linear discrete-time control systems using pulse transfer functions, state-space models and tests for controllability and Observability.
3. Determine the stability analysis of digital control systems
4. Analyze control system design techniques, their limitations and benefits.
5. Analyze the performance of digital control systems and design feedback controllers to meet the required performance system specifications.

UNIT I

Sampling and reconstruction

Introduction to continuous and discrete time signal and its properties. Examples of data control systems – digital to analog conversion and analog to digital conversion, block diagram representation of S/H Device, mathematical modeling of the sampling process, sampling theorem, sample and hold operations.

UNIT II

Z-Transform and Pulse Transfer Functions

Z- Transform – theorems and properties, inverse Z-transforms, solving difference equations, pulse transfer function, block diagram analysis of sampled data systems, mapping between S-plane and Z-plane.

UNIT III

Stability analysis

Mapping between the S- Plane and the Z-Plane, primary strips and complementary strips, constant frequency loci, constant damping ratio loci, stability analysis of closed loop systems in the Z-plane. Jury stability test – stability analysis using bilinear transformation and Routh criterion.

UNIT IV

State space analysis

State space representation of discrete time systems, pulse transfer function matrix, solving discrete time state equations, solution of LTI discrete time state equations, state transition matrix and its properties, methods for computation of State transition matrix, Discretization of continuous time state space equations.

UNIT V

Controllability and Observability

Concepts of controllability and observability, tests for controllability and observability. Duality between controllability and observability, conditions for Pulse Transfer Function.

State feedback controllers and observers

Design of state feedback controller through pole placement – necessary and sufficient conditions, Ackerman‘s formula

Learning resources

Text Books:

1. “Digital control systems” by ‘B.C. KUO’, Saunders college publication-second edition, 1992.
2. “Discrete-Time Control systems” by ‘K. Ogata’, Pearson Education/PHI-2nd Edition.

Reference Book:

“Digital Control and State Variable Methods” by ‘M. Gopal’ ,Tata McGraw – Hill Companies,1997.

4/4 B.Tech. EIGTH SEMESTER

EE8T3B REAL TIME CONTROL OF POWER SYSTEMS Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

This course introduces the need of power system state estimation**,** security measurement and assessment. It emphasis on the concept of SCADA, voltage stability, application of AI, ANN and PMU techniques in power systems.

Course Outcomes:

After completion of course, student will be able to

1. Understand the different types of state estimation, bad data detection and elimination.
2. Understand the security and contingency analysis.
3. Understand the need of computer control of power system in real time using SCADA system.
4. Analyze voltage stability problems and application of AI, ANN and PMU techniques in power systems.

Unit I

State Estimation

Different types of State Estimations, Theory of WLS state estimation, sequential and non-sequential methods to process measurements. Bad data Observablility, Bad data detection, identification and elimination.

Unit II

Security and Contingency Evaluation

Security concept, Security Analysis and monitoring, Contingency Analysis for Generator and line outages by iterative linear power flow method, Fast Decoupled model and network sensitivity methods.

Unit III

Computer Control of Power Systems

Need for real time and computer control of power systems, operating states of a power system, SCADA - Supervisory control and Data Acquisition systems implementation considerations, energy control centres, software requirements for implementing the above functions.

Unit IV

Voltage Stability

What is voltage stability, voltage collapse and voltage security. Voltage stability analysis, `P-V‘ curves and `Q-V‘ curves, power flow analysis for voltage stability – research areas.

Unit V

Application of AI and ANN in Power System

Basic concepts and definitions, algorithms for load flow, short term load forecasting. Applications of PMU in power systems.

Learning Resources

Text Books:

1. Power System Stability and Control by Prabha Kundur – Tata McGraw-Hill Edition 2006
2. Power System Analysis by John J.Grainger and William D.Stevenson , Jr- Tata McGraw-Hill Edition 2003
3. Computer Modelling of Electrical Power Systems by Arilaga J., Arnold C.P. and Horker B.J., Wiley, 1984.

Reference Books:

1. Power system Generation, Operation and Control by Allen J. Wood and Bruce F. Wollenberg, Wiley India Edition 2010
2. Power systems voltage stability by C.W.Taylor McGraw Hill, 1994
3. Real Time Control of Electric Power Systems by Handschin, E., Elsevier, 1972.

4/4 B.Tech. EIGHTH SEMESTER

ARTIFICIAL INTELLIGENCE TECHNIQUES IN ELECTRICAL ENGG.

EE8T4C **Credits: 3**

Lecture: 3 periods/week **Internal assessment: 30 marks**

Tutorial: 1 period/week **Semester end examination: 70 marks**

Course Objective:

This course covers artificial intelligence (Artificial Neural Network and Fuzzy systems, Genetic algorithm) basic principles and the concepts along with the application of these tools in the power systems areas. It emphasizes on real world power system problems like load forecasting, economic load dispatch using GA.

Course Outcomes:

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

1. Differentiate between Algorithmic based methods and knowledge based methods.
2. Understand back propagation networks and associative memory concepts.
3. Use appropriate Fuzzy set framework for solving power system problems
4. Apply GA to power system optimization problems.
5. Apply AI Techniques to solve problems in electrical engineering.

UNIT I

Fundamentals of Neural networks

Introduction: Human brain, model of artificial neuron, neural network architectures, characteristics of neural networks, learning methods, Rosenblatt's perceptron model, ADALINE network, MADALINE network

UNIT II

Back propagation networks and associative memory:

Back prorogation learning, algorithm, auto corelator, hetero corelator, Wang et al's multiple training encoding strategy, exponential BAM, associative memory for real coded pattern pairs

UNIT III

Fuzzy Set theory and fuzzy systems

Fuzzy Vs Crisp, operation, properties of crisp sets, fuzzy sets, membership functions, properties, operations, relations of fuzzy set, fuzzy Cartesian product

Fuzzy systems: Crisp Logic, predicate logic, fuzzy logic, and fuzzy rule based system, defuzzification methods

UNIT IV

Genetic Algorithms and Genetic modeling

Introduction – creation of off spring, working principle, encoding – fitness function – reproduction operators

Genetic Modeling: Inheritance operators – cross over, inversion and deletion, mutation operator, bit wise operator, – convergence of genetic algorithm, differences and similarities between GA and other traditional methods, advances in GA

UNIT V

Application of AI techniques

Electrical Load forecasting, economic load dispatch, reactive power control, speed control of ac and dc motors.

Learning Resources

Text Books:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by S. Rajasekaran and G. A. Vijayalakshmi Pai – PHI Publication, 2003.
2. Introduction to Artificial Neural Systems – Jacek M. Zuarda, Jaico Publishing House, 1997.

Reference Books:

1. Neural Networks, Algorithms, Applications and Programming Techniques by James A. Freeman, David M. Skapura. Pearson Education, 1991.
2. Introduction to Neural Networks using MATLAB 6.0 by S N Sivanandam, S Sumathi, S N Deepa. Tata McGraw-Hill Education ,2006.

4/4 B.Tech. EIGHTH SEMESTER

EE8T4D SPECIAL ELECTRICAL MACHINES Credits: 3

Lecture: 3 periods/week Internal assessment: 30 marks

Tutorial: 1 period /week Semester end examination: 70 marks

Course Objective:

The objective of this course is to provide thorough knowledge in the emerging field of special electrical machines. In this course the principle of operation, design aspects and control of different types of special electrical machines will be studied.

Course Outcomes:

Upon completing of the course student shall be

1. Able to understand the principle of operation and power converter for switched reluctance motor and stepper motor
2. Able to understand construction, principle of operation, theory of torque production in brushless DC motor
3. Able to understand construction, principle of operation of linear induction drive for electric traction and permanent magnet motors
4. Able to explain the control aspect of special electrical machines.
5. Able to understand the features of electric motors for traction applications.

UNIT I

Switched Reluctance Motor

Principle of operation, design of stator and rotor pole arc, power converter for switched reluctance motor.

Stepper Motors

Construction, principle of operation, theory of torque production, hybrid stepping motor, variable reluctance stepping motor.

UNIT II

Brushless DC Motor

Construction, principle of operation, theory of brushless DC motor as variable speed synchronous motor.

UNIT III

Linear Induction Motor

Construction, principle of operation, application of linear induction drive for electric traction.

Permanent Magnet Motors

Hysteresis loop, permanent magnet DC Motors, equivalent circuit, electrically commutated DC Motor.

UNIT IV

Control of special machines-I

Stepper motors (open loop control, closed loop control). Characteristics of stepper motor in open–loop drive. Comparison of open loop and closed loop systems.

Control of special machines-II

Control of switched reluctance motor for fraction type load. Control of brushless dc motor, rotor position sensing and switching logic for brushless dc motor.

UNIT V

Electric Motors for traction drives

AC motors, DC motors, single sided linear induction motor for traction drives, comparison of AC and DC traction.

Learning Resources

Text Books:

1. Special electrical Machines by K. Venkata Ratnam, University press, 2009, New Delhi.
2. Brushless Permanent magnet & reluctance motor drives by T. J. E. Miller, Clarenden press, 1989, Oxford.

Reference Book:

A Course in Electrical Technology by J.B.Gupta, S.K.Kataria & Sons,12th Edition.

4/4 B.Tech. EIGHTH SEMESTER

EE8PW **PROJECT WORK** **Credits: 9**

Lecture: -- **Internal assessment:100 marks**

Practice: 12 periods/week **Semester end examination: 200 marks**

Course Objective:

The major project spans for about 16 weeks duration involving verification and/or validation of the concepts or small research studies in any civil engineering disciplines and areas. A report is to be submitted by the students and present a seminar in the final year second semester. The report will be evaluated both internally and externally.

Course outcomes:

At the end of major project the student will have:

1. The experience to understand the statement of a problem and to solve the same with a group of people.
2. Ability to find an integrated solution to a problem.
3. The skill to prepare a Project report