UTTAR PRADESH TECHNICAL UNIVERSITY
LUCKNOW

SYLLABUS

Bachelor of Electrical and Electronics Engineering

3rd Year (V & VI Semester)

(Effective from Session 2015-16)

STUDY AND EVALUATION SCHEME OF ELECTRICAL & ELECTRONICS ENGINEERING

Third Year

Semester-V

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
						Sessional Assessment			ESE		
			L	T	P	CT	TA	Total			
THEORY SUBJECT											
1	NEE-501	Elements Of Power System	3	1	0	30	20	50	100	150	4
2	NEE 502	Power Electronics	3	1	0	30	20	50	100	150	4
3	NEE-503	Control System	3	1	0	30	20	50	100	150	4
4	NEE-504	Microprocessor & Its Applications	3	1	0	30	20	50	100	150	4
5	NEC-508	Fundamentals of E.M. Theory	2	1	0	15	10	25	50	75	3
6	NHU-501	Engineering Economics	2	0	0	15	10	25	50	75	2
PRACTICAL/DESIGN/DRAWING											
7	NEE-551	Power Electronics Lab	0	0	3	10	10	20	30	50	1
8	NEE 552	Control System Lab	0	0	3	10	10	20	30	50	1
9	NEE-553	Microprocessor Lab	0	0	2	10	10	20	30	50	1
10	NEE 554	Simulation Based Minor Project	0	0	2	10	10	20	30	50	1
11	NGP 501	GP						50		50	1
		TOTAL	16	5	10					1000	26

STUDY AND EVALUATION SCHEME OF ELECTRICAL & ELECTRONICS ENGINEERING

Third Year

Semester-VI

S. No.	Subject Code	Name of the Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Assessment			ESE		
						CT	TA	Total			
THEORY SUBJECT											
1	NEE-601	Power System Analysis	3	1	0	30	20	50	100	150	4
2	NEE 602	Switchgear & Protection	3	1	0	30	20	50	100	150	4
3	NEN-603/ NEC 501	Integrated Circuits	3	1	0	30	20	50	100	150	4
4	NEN-011- NEN-14	Departmental Elective-I	3	1	0	30	20	50	100	150	4
5	NEN-021-NEN-024	Departmental Elective-II	2	1	0	15	10	25	50	75	3
6	NHU-601	Industrial Management	2	0	0	15	10	25	50	75	2
PRACTICAL/DESIGN/DRAWING											
7	NEC-651	IC Lab	0	0	2	10	10	20	30	50	1
8	NEN-652	Electrical & Electronics CAD Lab	0	0	3	10	10	20	30	50	1
9	NEN-653	Minor Project	0	0	2	10	10	20	30	50	1
10	NEN- 654	Seminar	0	0	3		50	50		50	1
11	NGP-601	GP						50		50	1
		TOTAL	16	5	10					1000	26

Elective-I

NEE – 011: Digital Control System
NEE - 012: Fundamentals of Digital Signal Processing
NEE - 013: Neural Networks and Fuzzy System
NEE - 014: Power Theft and Energy Management

Elective-II

NEE – 021: High Voltage Engineering
NEE -022: Intelligent Instrumentation
NEE -023: Conventional & CAD of Electrical Machines
NEE -024: Smart Energy Delivery Systems

VISION

To achieve excellence in imparting education in the field of electrical and electronics engineering by creating competent professionals for industry and socio economic development to meet national and international needs.

MISSION

To provide students with supportive environment that facilitates learning to solve the problems in the field of electrical and electronics engineering and to prepare them to be successful and ethical human beings as well as professionals as they move to industry academia and other professions.

PROGRAM EDUCATIONAL OBJECTIVES

There are following Program Educational objectives:

1) To educate students in mathematical, scientific, electrical and electronics engineering concepts necessary to formulate, analyze and solve engineering problems faced by society.

2) To prepare students to communicate effectively, work harmoniously in teams with professional ethics and learn to adopt an integrated approach to problems in the field of electrical and electronics engineering by using latest and advanced technology tools.

3) To prepare students to have broad understanding of the engineering and management principles and apply the acquired knowledge in solving complex and multidisciplinary engineering problems.

4) To equip students with the knowledge to design and develop engineering solutions to the problems faced by society for its sustainable development with the help of environment friendly technologies.

5) To inculcate the ability among the students to explore and learn by themselves, the changes taking place continuously in the field of engineering and technology as part of lifelong learning process.

PROGRAM OUTCOME

There are following Program outcomes:

(a) Apply knowledge of mathematics, science, and electrical & electronics engineering.

(b) Identify, formulate, and solve electrical & electronics engineering problems

(c) Design and conduct experiments of electrical & electronics engineering, as well as to analyze and interpret data

(d) Design an electrical & electronic system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(e) Use the techniques, skills, and modern engineering tools necessary for electrical & electronics engineering practice.

(f) Understand the impact of electrical & electronics engineering solutions in a global, economic, environmental, and societal context

(g) Understand professional and ethical responsibility, while pursuing engineering practices.

(h) Visualize and work in laboratory and understanding of individual and team responsibilities, also imparting knowledge of contemporary issues.

(i) Communicate effectively on complex engineering activities with engineering community and with society at large.

(j) Demonstrate the knowledge and understanding of management principles and to function on multidisciplinary teams

(k) Recognize the need for, and an ability to engage in lifelong learning.

NEE-501: ELEMENTS OF POWER SYSTEM

L T P 3 1 0

1. Preamble: To provide sound knowledge of basic concepts and functioning of Electrical Power System. The syllabus is providing adequate knowledge of various elements of Power System, its design, Corona and Grounding.

2. Course Educational Objectives:

1. Development of the knowledge about Various elements of electrical power system.
2. Development of the skills in calculation of various parameter of transmission lines, use of proper cable, knowledge of corona and Earthing.
3. To serve as a pre-requisite for Power System Analysis and for higher studies/research in Electrical Power System.

3. Course Outcomes: On successful completion of this course students will be able to:

1. Explain the Complete layout of Electrical Power System..
2. Calculate various parameters of Transmission Lines.
3. Explain the Phenomenon of corona and interference with communication lines.
4. Design the mechanical part of transmission lines.
5. Design the electrical part of different types of transmission lines.

4. Pre-Requisite: Knowledge of three phase and single phase ac systems, different generators, electrical circuits and some basic electrical principles governing electrical circuits.

5. Links to other Courses: This subject is linked with Basic Electrical Engineering, Electromechanical Energy Conversion-I, Electromechanical Energy Conversion-II and Power System Analysis.

6. Course Content:

Unit-I

Power System Components:
Single line Diagram of Power system, Brief description of power system Elements: Synchronous machine, transformer, transmission line, bus bar, circuit breaker and isolator.

Supply System:
Different kinds of supply system and their comparison, choice of transmission voltage.

Transmission Lines:
Configurations, types of conductors, resistance of line, skin effect, Kelvin's law. Proximity effect.

Unit-II

Over Head Transmission Lines:
Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit transmission lines, representation and performance of short, medium and long transmission lines, Ferranti effect. Surge impedance loading.

Unit-III

Corona and Interference:
Phenomenon of corona, Corona formation, Calculation of potential gradient, Corona loss, Factors affecting corona, Methods of reducing corona and interference, Electrostatic and electromagnetic interference with communication lines.

Overhead line Insulators:
Type of insulators and their applications, Potential distribution over a string of insulators, Methods of equalizing the potential, String efficiency.

Unit-IV

Mechanical Design of transmission line:
Catenary curve, Calculation of sag & tension, Effects of wind and ice loading, Sag template, Vibration dampers.

Insulated Cables:
Type of cables and their construction, Dielectric stress, Grading of cables, Insulation resistance, Capacitance of single phase and three phase cables, Dielectric loss, Heating of cables

Unit-V

Neutral grounding:
Necessity of neutral grounding, Various methods of neutral grounding, earthing transformer, Grounding practices

Electrical Design of Transmission Line:
Design consideration of EHV transmission lines, Choice of voltage, Number of circuits, Conductor configuration, Insulation design, Celection of ground wires.

EHV AC and HVDC Transmission:
Introduction to EHV AC and HVDC transmission and their comparison, use of bundle conductors, Kinds of DC links, and incorporation of HVDC into AC system

Text Books:
1. W. D. Stevenson, "Element of Power System Analysis", McGraw Hill,
2. C. L. Wadhwa, "Electrical Power Systems" New age international Ltd. Third Edition
3. Asfaq Hussain, "'Power System", CBS Publishers and Distributors,
4. B. R. Gupta, "Power System Analysis and Design" Third Edition, S. Chand & Co.
5. M. V. Deshpande, "Electrical Power System Design" Tata Mc Graw Hill.

Reference Books:
1. M. V. Deshpandey, "Elements of Power System Design", Tata McGraw Hill,
2. Soni, Gupta & Bhatnagar, "A Course in Electrical Power", Dhanpat Rai & Sons,
3. S. L. Uppal, "Electric Power", Khanna Publishers
4. S.N.Singh, " Electric Power Generation, Transmission& distribution." PHI Learning.

NEE-502: POWER ELECTRONICS

L T P 3 1 0

1. Preamble: Power electronics belongs partially to power engineers and partly to electronics engineers. Power electronics is a subject that concerns the application of electronic principles in to situations that are rated at power level rather than signal level. It is that the fact that technique used in the design of high efficiency and high energy level power electronic circuit are quite different from those employed in the design of low efficiency electronic circuit at signal level.

2. Course Educational Objectives:

1. Describe the role of Power Electronics as an enabling technology in various applications such as flexible production systems, energy conservation, renewable energy, transportation etc.
2. Identify a switching power-pole as the basic building block and to use Pulse Width Modulation to synthesize the desired output.
3. Learn the basic concepts of operation of dc-dc converters in steady state in continuous and discontinuous modes and be able to analyze basic converter topologies.
4. Using the average model of the building block, quickly simulate the dynamic performance of dc-dc converters and compare them with their switching counterparts.
5. Design controllers for dc-dc converters in voltage and peak-current mode.
6. Learn the role of Power Electronics in utility-related applications which are becoming extremely important.

3. Course Outcome: Student will be able to

1. Have a thorough understanding of the characteristics and specifications of switches, types of power electronic circuits.
2. To understand, formulate and solve problems related to GTO, MCT and TRIAC.
3. To understand the usage of engineering tools to study Principles and classification of choppers.
4. To study, understand and execute the application of single phase, three phase and dual converter.
5. Ability to identify the application of the single and three phase inverters and their industrial implications

4. Pre-Requisite:

1. Knowledge of Engineering Physics.
2. Knowledge on basic electronics.
3. Knowledge on solid state devices.

5. Link to Other Courses:

1. Power System
2. Electrical Machines.
3. Electrical Drives.

6. Course Content:

Unit-I

Power Semiconductor Devices:

Power semiconductor devices their symbols and static characteristics, Specifications of switches, Types of power electronic circuits, Operation, Steady state & switch characteristics & switching limits of Power transistor operation and steady state characteristics of Power MOSFET and IGBT.

Thyristor – Operation V- I characteristics, two transistor model, methods of turn-on Operation of

GTO, MCT and TRIAC

Unit-II

Power Semiconductor Devices (Contd.)

Protection of devices, Series and parallel operation of thyristors Commutation techniques of thyristor

DC-DC Converters:

Principles of step-down chopper, step down chopper with R-L load Principle of step-up chopper, and operation with RL load, classification of choppers and their various applications.

Unit-III

Phase Controlled Converters

Single phase half wave controlled rectifier with resistive and inductive loads, Effect of freewheeling Diode, Single phase fully controlled and half controlled bridge converters, Performance parameters three phase half wave converters, Three phase fully controlled and half controlled bridge converters, Effect of source impedance Single phase and three phase dual converters.

Unit-IV

AC Voltage Controllers

Principle of On-Off and phase controls, Single phase ac voltage controller with resistive and inductive loads, Three phase ac voltage controllers (various configurations and comparison only) Single phase transformer taps changer, industrial applications.

Cyclo Converters

Basic principle of operation, Single phase to single phase, Three phase to single phase and three phase to three phase cyclo converters, Output voltage equation and their applications.

Unit-V

Inverters

Single phase series resonant inverter, Single phase bridge inverters, Three phase bridge inverters Voltage control of inverters, Harmonics reduction techniques, Single phase and three phase current source inverters.

Text Books:

1. M.H. Rashid,"Power Electronics: Circuits, Devices & Applications", Prentice Hall of India Ltd. 3rd Edition,2004.
2. M.D. Singh and K.B.Khanchandani, "Power Electronics "Tata MC Graw Hill, 2005.
3. V.R. Moorthy, " Power Electronics : Devices, Circuits and Industrial Applications" Oxford University Press.

Reference Books:

1. M.S. Jamil Asghar, "Power Electronics" Prentice Hall of India Ltd.
2. Chakrabarti & Rai, "Fundamentals of Power Electronics &Drives"Dhanpat Rai & Sons.
3. Ned Mohan, T.M.Undeland and W.P.Robbins, "Power Electronics:Converters, Applications and Design", Wiley India Ltd,2008.
4. S.N.Singh, "A Text Book of Power Electronics" Dhanpat Rai & Sons.

NEE-503: CONTROL SYSTEM

L T P 3 1 0

1. Preamble: This course provides fundamental concepts of classical Control system in terms of its types design, analysis. Besides classical control system the subject also provides knowledge about the state space analysis of systems.

2. Course Educational Objective:

1. To understand the types of system and its control with its mathematical modeling.
2. To study the time domain specification based analysis of different types of systems.
3. To study and learn different types of stability methods for any control system.
4. To understand the frequency domain analysis methods for different types of system
5. Design and analysis of system with the help of state space analysis method.

3. Course Outcome:

1. Apply knowledge of mathematics to find closed loop transfer functions of control system by Block Diagram Reduction Algebra and Signal flow graph.
2. Apply knowledge of electrical engineering and use techniques of modern engineering tools to find the Time response of first and second order systems, steady state errors and dynamic error constants.
3. Apply knowledge of mathematics and electrical engineering to find the transfer function of control system components and use modern techniques to find stability in time domain by Root Locus method.
4. Apply knowledge of mathematics and use modern technique to find stability in frequency domain by Polar plot, Nyquist plot and Bode's plot
5. Design compensators for control system to meet the desired needs within realistic constraints such as economic, manufacturability and sustainability.

4. Prerequisites:

Basic System Analysis, Network Analysis and Synthesis.

5. Course Contents:

Unit-I

Open loop & closed control; servomechanism, Physical examples, Transfer functions, Block diagram algebra, Signal flow graph, Mason's gain formula Reduction of parameter variation and effects of disturbance by using negative feedback.

Unit-II

Time Response analysis: Standard test signals, Time response of first and second order systems, Time response specifications, Steady state errors and error constants design specifications of second order systems: Derivative error, Derivative output, Integral error and PID compensations, Design considerations for higher order systems, Performance indices.

Unit-III

Control System Components:
Constructional and working concept of ac servomotor, Synchros and stepper motor.

Stability and Algebraic Criteria: Concept of stability and necessary conditions, Routh-Hurwitz criteria and limitations.

Root Locus Technique:
The root locus concepts, construction of root loci.

Unit-IV

Frequency response Analysis: Frequency response, Correlation between time and frequency responses, Polar and inverse polar plots, Bode plots , stability in frequency domain: Nyquist stability criterion, Assessment of relative stability: gain margin and phase margin, Constant M&N circles

Unit-V

Introduction to Design: The design problem and preliminary considerations lead, lag and lead lag networks, design of closed loop systems using compensation techniques in time domain and frequency domain**.**

Review of state variable technique: Review of state variable technique, Conversion of state variable model to transfer function model and vice-versa, Diagonalization, Controllability and observability and their testing.

Text Book:

1. Nagrath& Gopal, "Control System Engineering", 4th Edition, New age International.
2. K. Ogata, "Modern Control Engineering", Prentice Hall of India.
3. B.C. Kuo & Farid Golnaraghi, "Automatic Control System" Wiley India Ltd, 2008.
4. D.Roy Chaudhary, "Modern Control Engineering", Prentice Hall of India.

Reference Books:
1. Norman S. Mise, Control System Engineering 4th edition, Wiley Publishing Co.
2. Ajit K Mandal, "Introduction to Control Engineering" New Age International, 2006.
3. R.T. Stefani, B.Shahian, C.J.Savant and G.H. Hostetter, "Design of Feedback Control Systems" Oxford University Press.
4. N.C. Jagan, "Control Systems", B.S. Publications, 2007.

NEE-504: MICROPROCESSORS

L T P 3 1 0

1. **Preamble:** A microprocessor is a computer processor that incorporates the functions of a computer's central processing unit (CPU) on a single integrated circuit (IC) or at most a few integrated circuits. The microprocessor is a multipurpose, programmable device that accepts digital data as input, processes it according to instructions stored in its memory, and provides results as output. This course provides the knowledge of 8-bit and 16-bit microprocessors along with their instruction set, addressing modes and programming. The course also explains the interfacing of I/O devices with microprocessors.

2. **Course Educational Objectives**

    1. To enrich the students with fundamentals and programming knowledge of microprocessors.
    2. To provide the students' knowledge about interfacing of various peripheral devices with microprocessors.

3. **Course Outcomes**

On successful completion of this course students will be able to:

1. Understand about digital computer, its working, instruction execution, programming, addressing modes and various processes related to microprocessors.

2. Gain thorough knowledge about 8-bit microprocessors including architecture, addressing modes, instruction set and instruction classification.

3. Learn about 16-bit microprocessors, their architecture, instruction set and various types of interrupts.

4. Know about programming of microprocessors, development of algorithms and flowcharts in terms of structure.

5. Understand the concept for interfacing of various I/O devices like 8237 DMA, 8255 PPI, and 8259 PIC with microprocessors.

4. **Pre-Requisites**

    1. Knowledge of mathematics
    2. Knowledge of digital electronics

5. **Links to Other Courses**

    1. Power electronics
    2. Electric drives
    3. Project

6. Course Content

Unit-I

Introduction to Digital Computer and Microprocessor:

Digital Computers: General architecture and brief description of elements, Instruction execution, Instruction format, and Instruction Set, addressing modes, Programming system, Higher lever languages.

Buses and CPU Timings: Bus size and signals, machine cycle timing diagram, instruction timing, processor timing.

Microprocessor and Microprocessor Development Systems: Evolution of Microprocessor, Microprocessor architecture and its operations, memory, inputs-outputs (I/Os), data transfer schemes interfacing devices, architecture advancements of microprocessors, typical microprocessor development system.

Unit-II

8-bit Microprocessors
8085 microprocessor: Pin configuration, internal architecture timing & signals: control and status, interrupt: ALU, machine cycles

Instruction Set of 8085:
Addressing Modes: Register addressing, direct addressing; register indirect addressing, immediate addressing, and implicit addressing.
Instruction format, op-codes, mnemonics, no. of bytes, RTL, variants, no. of machine cycles and T states, addressing modes.
Instruction Classification: Data transfer, arithmetic operations, logical operations, branching operation, machine control; Writing assembly Language programs, Assember directives.

Unit-III

16-bit Microprocessors:
Architecture:
Architecture of INTEL 8086 (Bus Interface Unit, Execution unit), register organization, memory addressing, memory segmentation, Operating Modes
Instruction Set of 8086
Addressing Modes**:** Instruction format:
Discussion on instruction Set: Groups: data transfer, arithmetic, logic string, branch control transfer, processor control.
Interrupts: Hardware and software interrupts, responses and types.

Unit-IV

Fundamental of Programming: development of algorithms, flowcharts in terms of structures, (series, parallel, if-then-else etc.)
Assembler Level Programming: memory space allocation (mother board and user program) Assembler level programs (ASMs)

Unit-V

Peripheral Interfacing:
I/O programming: Programmed I/O, Interrupt Driven I/O, DMA I/O interface: serial and parallel communication, memory I/O mapped I/Os. Peripheral Devices: 8237 DMA controller, 8255 Programmable peripheral interface, 8253/8254 Programmable timer/counter. 8259 programmable Interrupt Controller.

Text Books:

1. Gaonkar, Ramesh S, "Microprocessor Architecture, programming and applications with the 8085" Pen ram International Publishing 5th Ed.
2. Uffenbeck, John, "Microcomputers and Microprocessors" PHI/ 3rd Edition.
3. Ray, A.K. & Burchandi, K.M., "Advanced Microprocessors and Peripherals: Architecture, Programaming and Interfacing" Tata Mc. Graw Hill.
4. Krishna Kant, "Microprocessors and Microcontrollers" PHI Learning.

Reference Books:

1. Brey, Barry B. "INTEL Microprocessors" Prentice Hall (India)
2. ADitya P Mathur, "Introduction to Microprocessor" Tata Mc Graw Hill
3. M. Rafiquzzaman, "Microprocessors- Theory and applications" PHI
4. B. Ram, "Advanced Microprocessor & Interfacing" Tata McGraw Hill
5. Renu Singh & B.P.Singh, "Microprocessor and Interfacing and applications" New Age International
6. Hall D.V., "Microprocessors Interfacing" Tata Mc Graw Hill
7. Liu and Gibson G.A., "Microcomputer Systems: The 8086/8088 Family" Prentice Hall (India).

NEC-508 FUNDAMENTAL OF E.M. THEORY

L T P 2 1 0

1. **Preamble:** Subject is aimed to provide the knowledge of field electric and magnetic field & mathematical analysis of these fields. FEMT also give information of electromagnetic wave and its transmission and reflection parameter.

2. **Course Educational Objectives:** Student will be able to:

1. Understand the basic concepts of electric and magnetic fields.
2. Understand the concept of conductors, dielectrics, inductance and capacitance.
3. Gain knowledge on the nature of magnetic materials.
4. Understand the concept of static and time varying fields

3. **Pre-Requisite:**

1. Knowledge of Engineering Physics.
2. Knowledge of engineering mathematics.

4. **Links to Other Courses:**

1. Elements of power systems
2. Electric machines
3. Antenna and wave propagation

5. **Course Outcomes:**

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

1. Calculate electric field, force, flux density, total charge, energy from various charges and charge distributions.
2. Calculate electric current density, electric current and resistance of conductors.
3. Calculate capacitance and polarization of dielectric materials and also solve Laplace's equation and find capacitance and resistance of coaxial cables.
4. Calculate inductances, reluctance and magnetic flux through magnetic cores.
5. Calculate displacement current and motion of particles and conductors in time varying fields and Maxwell's equations for electromagnetic wave propagation.

6. Course Content

Unit – I

Review of Vector analysis, Rectangular, Cylindrical and Spherical coordinates and their transformation, divergence, gradient and curl in different coordinate systems, Electric field intensity, Electric Flux density, Energy and potential.

Unit – II

Current and conductors, Dielectrics and capacitance, Poisson's and Laplace's equations.

Unit - III

Steady magnetic field, magnetic forces, materials and inductance, Time varying field and Maxwell's equation.

Unit - IV

Uniform Plane waves, Plane wave reflection and dispersion

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics"
2. Mayt, W.H. and Buck, J.A., "Engineering Electromagnetic" Tata Mc.Graw Hill Publishing

Reference Books:

1. Jordan E.C. and Balmain K.G., "Electromagnetic Wave and radiating Systems" Prentice Hall International, 2nd Edition.
2. Kraus, F. "Electromagnetic" Tata Mc. Graw Hill 5th Edition Ramo S, Whinnery T.R. and Vanduzer T, "Field and Waves in Communication Electronics" John Wiely and Sons 3rd

NHU-501: ENGINEERING ECONOMICS

L T P 2 0 0

UNIT-1

Introduction to Engineering Economics and Managerial Economics

Concept of Efficiency, Theory of Demand , Elasticity of Demand, Supply and Law of Supply indifference Curves, Budget Line, Welfare Analysis, Scope of Managerial Economics, Techniques andApplications of Managerial Economics.

UNIT-2

Market Structure

Perfect Competitions Imperfect- Monopolistic, Oligopoly, duopoly sorbent features of price determination and various market conditions.

UNIT-3

Demand Forecasting and cost Estimation
Characteristics of Forecasts, Forecasting Horizons, Steps to Forecasting, Forecasting Methods, Seasonal Adjustments, Forecasting Performance Measures, Cost Estimation, Elements of cost, Computation of Material Variances Break-Even Analysis.

UNIT-4

Management Aspects
Functions of Management, Project Management, Value Engineering, Project Evaluation, Decision Making.

Text Book : T.N. Chabra Khanna Publisher, 2nd Edition

NEE-551: POWER ELECTRONICS LAB

L T P 0 0 3

NOTE: The minimum of 10 experiments is to be performed out of which at least three should be software based.

1. To study V-I characteristics of SCR and measure latching and holding currents.
2. To study UJT trigger circuit for half wave and full wave control.
3. To study single-phase half wave controlled rectified with (i) resistive load (ii) inductive load with and without free wheeling diode.
4. To study single phase (i) fully controlled (ii) half controlled bridge rectifiers with resistive and inductive loads.
5. To study three-phase fully/half controlled bridge rectifier with resistive and inductive loads.
6. To study single-phase ac voltage regulator with resistive and inductive loads.
7. To study single phase cyclo-converter
8. To study triggering of (i) IGBT (ii) MOSFET (iii) power transistor
9. To study operation of IGBT/MOSFET chopper circuit
10. To study MOSFET/IGBT based single-phase series-resonant inverter.
11. To study MOSFET/IGBT based single-phase bridge inverter.

Software based experiments (PSPICE/MATLAB)

1. To obtain simulation of SCR and GTO thyristor.
2. To obtain simulation of Power Transistor and IGBT.
3. To obtain simulation of single phase fully controlled bridge rectifier and draw load voltage and load current waveform for inductive load.
4. To obtain simulation of single phase full wave ac voltage controller and draw load voltage and load current waveforms for inductive load.
5. To obtain simulation of step down dc chopper with L-C output filter for inductive load and determine steady-state values of output voltage ripples in output voltage and load current.

NEE– 552: CONTROL SYSTEM LAB

L T P 0 0 3

Note: The minimum of 10 experiments are to be performed from the following, out of which at least three should be software based.

1. To determine response of first order and second order systems for step input for various values of constant 'K' using linear simulator unit and compare theoretical and practical results.
2. To study P, PI and PID temperature controller for an oven and compare their performance.
3. To study and calibrate temperature using resistance temperature detector (RTD)
4. To design Lag, Lead and Lag-Lead compensators using Bode plot.
5. To study DC position control system
6. To study synchro-transmitter and receiver and obtain output vs input characteristics
7. To determine speed-torque characteristics of an ac servomotor.
8. To study performance of servo voltage stabilizer at various loads using load bank.
9. To study behavior of separately excited dc motor in open loop and closed loop conditions at various loads.

Software based experiments (Use MATLAB, LABVIEW software etc.)

1. To simulate PID controller for transportation lag.
2. To determine time domain response of a second order system for step input and obtain performance parameters.
3. To convert transfer function of a system into state space form and vice-versa.
4. To plot root locus diagram of an open loop transfer function and determine range of gain 'k' fir stability.
5. To plot a Bode diagram of an open loop transfer function.
6. To draw a Nyquist plot of an open loop transfers functions and examine the stability of the closed loop system.

Reference Books:

1. K.Ogata,"Modern Control Engineering" Prentice Hall of India.
2. Norman S.Nise, "Control System Engineering", John Wiley & Sons.
3. M.Gopal, "Control Systems: Principles & Design" Tata Mc Graw Hill.

NEE-553: MICROPROCESSOR LAB

L T P 0 0 2

A. Study Experiments

1. To study 8085 based microprocessor system
2. To study 8086 and 8086A based microprocessor system
3. To study Pentium Processor

B. Programming based Experiments (any four)

1. To perform computation of square root of a given number
2. To perform floating point mathematical operations (addition, subtraction, multiplication and division)
3. To develop and run a program for finding outthe largest/smallest number from a given set of numbers.
4. To develop and run a program for arranging in ascending /decending order of a set of numbers
5. To perform multiplication /division of a given numbers
6. To perform conversion of temperature from Fahrenheit to Celsius and vice versa.

C. Interfacing based Experiments (any four)

1. To obtain interfacing of RAM chip to 8085/8086 based system
2. To obtain interfacing of keyboard controller
3. To obtain interfacing of DMA controller
4. To obtain interfacing of PPI
5. To obtain interfacing of UART/USART
6. To perform microprocessor based stepper motor operation through 8085 kit
7. To perform microprocessor based traffic light control
8. To perform microprocessor based temperature control of hot water.

NEE-601: POWER SYSTEM ANALYSIS

L T P 3 1 0

1. **Preamble:** This course, Switchgear & Protection provides knowledge for the switching devices that form the backbone of modern electrical distribution systems. It provides basic design, operation, and protection of switchgears, including circuit breakers, transformers, relays, switches, and fuses.

2. **Course Educational Objectives:** To introduce the application of power system protection and switchgear

3. **Course Outcomes:**

   1. Knowledge on various earthing practices usage of symmetrical components to
   2. Estimate fault current and fault MVA.
   3. Study of Relays & Study of protection scheme, solid state relays.
   4. To understand instrument transformer and accuracy.
   5. To understand the method of circuit breaking various arc theories Arcing phenomena – capacitive and inductive breaking.
   6. Types of circuit breakers.

4. **Pre-requisites:**
   1. Power System Analysis
   2. Power Systems

5. **Link to other courses:** Provides an extensive knowledge to pursue higher education on Power System.

Course Contents:

UNIT-I

Representation of Power System Components:
Synchronous machines, Transformers, Transmission lines, One line diagram, Impedance and reactance diagram, per unit System

Symmetrical components:
Symmetrical Components of unbalanced phasors, power in terms of symmetrical components, sequence impedances and sequence networks.

UNIT-II

Symmetrical fault analysis:
Transient in R-L series circuit, calculation of 3-phase short circuit current and reactance of synchronous machine, internal voltage of loaded machines under transient conditions

Unsymmetrical faults:
Analysis of single line to ground fault, line-to-line fault and Double Line to ground fault on an unloaded generators and power system network with and without fault impedance. Formation of Z_{bus} using singular transformation and algorithm, computer method for short circuit calculations

UNIT-III

Load Flows
Introduction, bus classifications, nodal admittance matrix (Y_{BUS}), development of load flow equations,load flow solution using Gauss Siedel and Newton-Raphson method, approximation to N-R method, line flow equations and fast decoupled method.

UNIT-IV

Power System Stability
Stability and Stability limit, Steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion and step-by-step method. Factors affecting steady state and transient stability and methods of improvement.

UNIT-V

Traveling waves
Wave equation for uniform Transmission lines, velocity of propagation, surge impedance, reflection and transmission of traveling waves under different line loadings. Bewlay's lattice diagram, protection of equipments and line against traveling waves.

Text Books:

1. W.D. Stevenson, Jr. " Elements of Power System Analysis", Mc Graw Hill.
2. C.L. Wadhwa, "Electrical Power System", New Age International.
3. Chakraborthy, Soni,Gupta & Bhatnagar, "Power System Engineering", Dhanpat Rai & Co.
4. T.K Nagsarkar & M.S. Sukhija, "Power System Analysis" Oxford University Press,2007.

Reference Books:

1. O.I. Elgerd, "Electric Energy System Theory" Tata McGraw Hill.
2. Hadi Sadat; "Power System Analysis", Tata McGraw Hill.
3. D.Das, " Electrical Power Systems" New Age International.
4. J.D. Glover, M.S. Sharma & T.J.Overbye, "Power System Analysis and Design" Thomson.
5. P.S.R. Murthy " Power System Analysis" B.S. Publications.
6. Stagg and El-Abiad, "Computer Methods in Power System Analysis" Tata Mc Graw Hill
7. Kothari & Nagrath, "Modern Power System Analysis" Tata Mc. Graw Hill.

NEE – 602: SWITCHGEAR AND PROTECTION

L T P 3 1 0

1. **Preamble:** This course, Switchgear & Protection provides knowledge for the switching devices that form the backbone of modern electrical distribution systems. It provides basic design, operation, and protection of switchgears, including circuit breakers, transformers, relays, switches, and fuses.

2. **Course Educational Objectives:** To introduce the application of power system protection and switchgear

3. **Course Outcomes:**

- Knowledge on various earthing practices usage of symmetrical components to
- Estimate fault current and fault MVA.
- Study of Relays & Study of protection scheme, solid state relays.
- To understand instrument transformer and accuracy.
- To understand the method of circuit breaking various arc theories Arcing phenomena – capacitive and inductive breaking.
- Types of circuit breakers.

4. **Pre-requisites:**
   - Power System Analysis
   - Power Systems

5. **Link to other courses:** Provides an extensive knowledge to pursue higher education on Power System.

6. **Course Content:**

UNIT I

Introduction to Protection System:
Introduction to protection system and its elements, functions of protective relaying, protective zones, primary and backup protection, desirable qualities of protective relaying, basic terminology.

Relays:
Electromagnetic, attracted and induction type relays, thermal relay, gas actuated relay, design considerations of electromagnetic relay.

UNIT-II

Relay Application and Characteristics:
Amplitude and phase comparators, over current relays, directional relays, distance relays, differential relay

Static Relays:
Comparison with electromagnetic relay, classification and their description, over current relays, directional relay, distance relays, differential relay.

UNIT-III

Protection of Transmission Line:
Over current protection, distance protection, pilot wire protection, carrier current protection, protection of bus, auto re-closing,

UNIT-IV

Circuit Breaking:
Properties of arc, arc extinction theories, re-striking voltage transient, current chopping, resistance switching, capacitive current interruption, short line interruption, circuit breaker ratings.
Testing Of Circuit Breaker:
Classification, testing station and equipments, testing procedure, direct and indirect testing

UNIT-V

Apparatus Protection:
Protection of Transformer, generator and motor.
Circuit Breaker:
Operating modes, selection of circuit breakers, constructional features and operation of Bulk Oil, Minimum Oil, Air Blast, SF6, Vacuum and d. c. circuit breakers.

Text Books:

1. S. S. Rao, "Switchgear and Protection", Khanna Publishers.
2. Ravindranath and M. Chander, Power system Protection and Switchgear,Wiley Eastern Ltd.

Reference Books:

1. Ram and D. N. Vishwakarma, "Power System Protection and Switchgear", Tata Mc. Graw Hill
2. Y. G. Paithankar and S R Bhide, "Fundamentals of Power System Protection", Prentice Hall of India.
3. T.S.M Rao,"Power System Protection: Static Relays with Microprocessor Applications" Tata Macgraw Hill".
4. A.R. Van C. Warringtaon , " Protective Relays- Their Theory and Practice, Vol. I & II" Jhon Willey & Sons.

NEN-603/EEC 501: INTEGRATED CIRCUITS

L T P 3 1 0

1. Preamble: This course linear integrated circuits, provides an introduction to the basics of Integrated circuits, knowledge of op-amp and its characteristics. Filter design and Special IC's and their influence in other circuits.

2. Course Educational Objectives:

1. To enrich the students with the knowledge of op amp characteristics and its frequency response and Widlar Current source and Cascade current Mirror.
2. To provide the knowledge of peak detector and S/H circuits and Square and Triangular wave generator and sinusoidal oscillators.
3. To introduce the students to active filters, First order and second order Low pass and High Pass filters, Band pass filters, Band Reject filter and KHN, Tow-Thomas and State Variable Biquad filters.
4. To provide the knowledge of CMOS Logic MOS realization of Inverters AND, OR, NAND and NOR Gates, combinational & sequential logic circuits.
5. To use special IC 555 timer and non linear application of op-amp in electrical and electronics circuits.

3. Course Outcomes: On successful completion of this course:

1. Students will be able to analyze the ideal and practical characteristics of Op amp and its frequency response.
2. Student will be able to analyze Integrator, Differentiator and Instrumentation Amplifier and their characteristics.
3. Student will be able to design and analyze Low Pass and High Pass, Band Pass and Band Reject Filters
4. Students will be able to describe about special IC's, switching regulator and A/D and D/A converters.

4. Pre-Requisite: Knowledge of Op-amp 741 and its characteristics.

5. Links to Other Courses: Analog and digital communication and Fundamentals of digital signal processing

6. Course Content

UNIT-I

Analog Integrated circuit Design: an overview: Current Mirrors using BJT and MOSFETs, Simple current Mirror, Base current compensated current Mirror, Wilson and Improved Wilson Current Mirrors, Widlar Current source and Cascade current Mirror.

The 741 IC Op-Amp: Bias circuit, short circuit protection circuitry, the input stage, the second stage, the output stage, and device parameters; DC Analysis of 741: Small Signal Analysis of input stage, the second stage, the output stage; Gain, Frequency Response of 741; a Simplified Model, Slew Rate, Relationship between F_t & S_r.

UNIT-II

Linear Applications of IC op-amps: An Overview of Op-Amp (ideal and non ideal) based Circuits V-I and I-V converters, generalized Impedance converter, simulation of inductors.
Filters: First and second order LP, HP, BP BS and All pass active filters, KHN, Tow-Thomas and State Variable Biquad filters; Sinusoidal oscillators.

UNIT-III

Digital Integrated Circuit Design-An Overview: CMOS Logic Gate Basic Structure
CMOS realization of Inverters, AND, OR, NAND and NOR Gates.
Latches and Flip flops: The Latch, The SR Flip-flop, CMOS Implementation of SR Flip-flops, A Simpler CMOS Implementation of the Clocked SR Flip-flop, D Flip-flop Circuits.

UNIT-IV

Non-Linear applications of IC Op-amps: Log–Anti Log Amplifiers, Precision Rectifiers, Peak Detectors, Simple and Hold Circuits, Analog Multipliers and their applications. Op-amp as a comparator, Zero crossing detector, Schmitt Trigger, Astable multivibrator, Monostable multivibrator, Generation of Triangular Waveforms.

UNIT-V

D/A and A/D converters Integrated Circuit Timer: The 555 Circuit, Implementing a Monostable Multivibrator Using the 555 IC, Astable Multivibrator Using the 555 IC.
Phase locked loops (PLL): Ex-OR Gates and multipliers as phase detectors, Block Diagram of IC PLL, Working of PLL and Applications of PLL.

Text Book:

1. Sedra and Smith, "Microelectronic Circuits", Oxford University Press.

Reference Books:

1. Michael Jacob, `Applications and Design with Analog Integrated Circuits', PHI, 2006.
2. Jacob Milliman and Arvin Grabel, "Microelectronics", TMH, 2008.

NHU-601: INDUSTRIAL MANAGEMENT

L T P 2 0 0

1. Preamble: Industrial and management engineering is an engineering discipline resulting from a meld of such fields as engineering, economics, information, organization and management. The industrial and management engineer applies the principles and methodologies of engineering science to the solution of industrial problems.

2. Course Educational Objectives: Every engineer has to manage the things during his working. This subject helps student to understand material, production, demand forecasting, personnel, stock market and marketing management.

3. Course Outcome:

Students will be able to understand:

1. Able to perform the Management Functions compare selected Theories of Management perform the functions in the Marketing Mix; and assess ethical issues in Business situations.
2. Able to apply management skills and concepts to specific situations; plan and implement a project,analyze and develop a human relations strategy.
3. Able to communicate effectively, and apply the basic concepts of an Industrial Economy and adapt technical expertise to a given process or product.
4. Able to apply knowledge learnt, gain new skills and be aware of current technologies.
5. Able to understand industrial problems and suggest possible solutions.

4. Course Content:

UNIT-I

Introduction: Concept, Development, application and scope of Industrial Management .
Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership.

UNIT-II

Management Function: Principle of Management – Time and motion study, work simplification – process charts and flow diagrams, Production Planning.

Unit-III

Inventory Control: Inventory, Cost, Deterministic Models, Introduction to supply chain management.

Unit-IV

Quality Control: Process control, SQC, Control charts, Single, Double and Sequential Sampling, Introduction to TQM.

Text Book: T.N. Chabra, `Industrial Management, Dhanpat Rai Publication, 2010.

NEE – 013/NEN-013: NEURAL NETWORKS AND FUZZY SYSTEM

L T P 3 1 0

1. Preamble: This course gives an introduction to some new fields in computational intelligence with its principal components of fuzzy logic, ANN and it is hoped that it would be quite useful to study the fundamental concepts on these topics for the pursuit of allied research.

2. Course Educational Objectives:

Students undergoing this course are expected to:

1. To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems
2. To provide the mathematical background for carrying out the optimization associated with neural network learning
3. To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience

3. Course Outcomes:
Students undergoing this course are able to:

1. Design of various neural networks.
2. Discuss the concepts of Fuzzy set theory.
3. Ideas of fuzzy logic.
4. Use of heuristics based on human experience.
5. Generalize to form appropriate rules for inference systems.

4. Pre-requisites: NIL

5. Link to other courses:

Design of various neural networks. Discuss the concepts of Fuzzy set theory Ideas of fuzzy logic Use of heuristics based on human experience Generalize to form appropriate rules for inference systems.

UNIT-I

Neural Networks-1(Introduction & Architecture)
Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks.Various learning techniques; perception and convergence rule,
Auto-associative and hetro-associative memory

UNIT-II

Neural Networks-II (Back propogation networks)
Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications.

UNIT-III

Fuzzy Logic-I (Introduction)
Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

UNIT-IV

Fuzzy Logic –II (Fuzzy Membership, Rules)
Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications.

UNIT-V

Fuzzy Neural Networks:
L-R Type fuzzy numbers, fuzzy neutron, fuzzy back propogation (BP), architecture, learning in fuzzy BP, inference by fuzzy BP, applications.

Text Books:

1. Kumar Satish, "Neural Networks" Tata Mc Graw Hill
2. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India.

Reference Books:

1. Siman Haykin, "Neural Netowrks" Prentice Hall of India
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.

NEN-021: VLSI DESIGN

L T P 2 1 0

1. Preamble: This course is able to provide the basic of microelectronics and MOS Technologies, fabrication process of devices, implementation of logic circuits using MOS Technologies, design for testability and design verification.

2. Course educational objectives:

The subject aims to provide the student with:

1. The subject aims to provide the student with:
2. Study of microelectronics and MOS Technologies
3. CMOS fabrication Process and sticks/ Layout Design Diagram.
4. Implementation of combinational and sequential logic circuits using different MOS technologies.
5. Semiconductor memories, Design for Testability.

3. Course outcomes:

The Students will able to:

1. Review of Microelectronics and Introduction to MOS Technologies, Basic Electrical Properties of MOS, CMOS and Bi CMOS.
2. Understand fabrication process and will be able to draw sticks diagram and layout design using design rules.
3. Implement different combinational and sequential logic circuits using NMOS inverter and CMOS inverter.
4. An ability to understand the different physical design of CMOS Technology and to design the layout and schematic and analysis digital logic gates.
5. Design a chip with ASIC design flow and floor planning and testing of ICs.
6. Understand the importance of testing and types of fault models.
7. Design of programmable logic devices and implementation on FPGA.

4. Pre-requisites:

1. Digital Electronics
2. Analog Electronics

UNIT-I

Introduction to integrated circuit technology. CMOS fabrication, the p-well process, n-well process, twin tub process. Bi-CMOS technology. Basic electrical properties of MOS circuits, Ids-Vds relationship, MOS transistor threshed voltage Vt, Transconductance and output conductance, MOS transistor figure of merit.

UNIT-II

The n-MOS inverter, pull-up to pull-down ratio, CMOS inverter and its characteristics, latch –up in CMOS circuits, stick diagrams, n-MOS design style, CMOS design style, lambda based design rules , Body effect, sheet resistance, capacitances of layers, Gate delays, Delay estimation, logical efforts, Scaling modelsand scaling factors, limitation of scaling, , Limits of miniaturization.

UNIT-III

n-MOS, CMOS NAND Gates, n-MOS, CMOS NOR gates. Combinational circuit design, sequential circuit design, design considerations, problems associated with VLSI Design, Design Methodology and Tools, Standard Cell Based Design, Design Flows, Automated Layout Generation, Placement, Floor planning, Routing, Parasitic Extraction, Timing Analyses.

UNIT-IV

Full Custom Design, Semi Custom Design, Programmable Logic structures, Field Programmable Gate arrays (FPGA) , Configurable Logic Block (CLB), Application-Specific Integrated Circuits (ASICs).

UNIT-V

Design for Testability, Faults types and Models, Controllability and Observability, AD HOC Design Techniques, Scan-Based Techniques, Built-In self Test (BIST),Techniques, Current Monitoring IDDQ Test. Packaging, Package Parasitic, Heat dissipation, Design Economics, Parametric yield.

Text Books:

1. Basic VLSI Design by Douglas A. Pucknell & Kamran Eshraghian, Prentice-Hall of India.
2. CMOS VLSI Design, A Circuits and Systems Perspective by Neil H.E. Weste, David Harris, AyanBanerjee, Pearson Education.
3. CMOS Digital Integrated Circuits Analysis and Design by Sung-Mo Kang, Yusuf Leblebici. Tata Mc-Graw-Hill.

NEC– 651: IC LAB

L T P 0 0 3

OBJECTIVE: To design and implement the circuits to gain knowledge on performance of the circuit and its application. These circuits should also be simulated on Pspice.

1. Log and antilog amplifiers.
2. Voltage comparator and zero crossing detectors.
3. Second order filters using operational amplifier for:
    a. Low pass filter of cutoff frequency 1 KHz.
    b. High pass filter of frequency 12 KHz.
    c. Band pass filter with unit gain of pass band from 1 KHz to 12 KHz.
4. Wien bridge oscillator using operational amplifier.
5. Determine capture range; lock in range and free running frequency of PLL.
6. Voltage regulator using operational amplifier to produce output of 12V with maximum load current of 50 mA.
7. A/D and D/A convertor.
8. Voltage to current and current to voltage convertors.
9. Function generator using operational amplifier (sine, triangular & square wave)
10. Astable and monostable multivibrator using IC 555.

NEN-652: ELECTRICAL & ELECTRONICS CAD LAB

L T P 0 0 3

1. Design of Single phase transformer.
2. Design of Single phase Induction Motor.
3. Design of DC motor.
4. Design of DC generator.
5. Design of Single phase alternator.
6. Design of Synchronous Motor.
7. Design of lag, lead and lag-lead compensator.
8. Design of PI & PD Controller.
9. Design of PID controller.
10. Design of Analog Filter
11. Design of Self-tuned filter.
12. Design of voltage controller Oscillator
13. Design of DC-DC converter.

Text Books:

1. A.K. Sawhney, “A Course in Electrical Machine Design” Dhanpat Rai & Sons.
2. M.G. Say, “The Performance and Design of AC Machines” Pitman & Sons.