UTTAR PRADESH TECHNICAL UNIVERSITY
LUCKNOW

Syllabus

for

B.Tech. Electrical & Electronics Engg.

of

Second Year

(Effective from the Session: 2015-16)

STUDY AND EVALUATION SCHEME OF ELECTRICAL & ELECTRONICS ENGINEERING

Second Year

Semester- III & IV

								YEAR: 2nd SEMESTER-III			
Sl. No.	COURSE NO	SUBJECT	PERIOD			EVALUATION SCHEME			EXAM ESE	SUBJECT TOTAL	CREDIT
						SESSIONAL EVALUATION					
			L	T	P	CT	TA	TOTAL			
THEORY SUBJECTS											
1	NAS-301/-NOE 031-039	Mathematics III/Science Based Open Elective	3	1	0	30	20	50	100	150	4
2	NME-309	Thermal & Hydraulic Machines	3	1	0	30	20	50	100	150	4
3	NEE-301	Electro-Mechanical Energy Conversion–I	3	1	0	30	20	50	100	150	4
4	NEE-302	Electrical Measurement & Measuring Instruments	3	1	0	30	20	50	100	150	4
5	NEE-303	Basic System Analysis	2	1	0	15	10	25	50	75	3
6	NHU301/ NHU302	Industrial Psychology/ Industrial Sociology	2	0	0	15	10	25	50	75	2
7	AUC-001/ AUC-002	*Human Values & Professional Ethics/ Cyber Security*	2	0	0	15	10	25	50	75*	
PRACTICAL / DESIGN / DRAWING											
8	NME-359	Thermal & Hydraulic Machines Lab	0	0	3	10	10	20	30	50	1
9	NEE-351	Electromechanical Energy Conversion- I Lab	0	0	3	10	10	20	30	50	1
10	NEE-352	Electrical Measurement Lab	0	0	2	10	10	20	30	50	1
11	NEE-353	Numerical Technique Lab	0	0	2	10	10	20	30	50	1
12	NGP-301	General Proficiency Lab	-	-	-	-	-	50	-	50	
		Total	**17**	**5**	**7**					**1000**	**25**

*Human values & Professional Ethics /Cyber Security will be offered as a compulsory audit course for which passing marks are 30% in End Semester Examination and 40% in aggregate.

STUDY AND EVALUATION SCHEME

B-Tech. Electrical Engg./Electrical & Electronics Engineering

YEAR: 2nd SEMESTER-IV

Sl. No.	COURSE NO	SUBJECT	PERIOD			EVALUATION SCHEME				SUBJECT TOTAL	CREDIT
						SESSIONAL EVALUATION			EXAM ESE		
			L	T	P	CT	TA	TOTAL			
THEORY SUBJECTS											
1	NOE 041-049/ NAS-401	Science Based Open Elective/ Mathematics III	3	1	0	30	20	50	100	150	4
2	NEC-409	Analog & Digital Electronics	3	1	0	30	20	50	100	150	4
3	NEE-401	Electro-Mechanical Energy Conversion–II	3	1	0	30	20	50	100	150	4
4	NEE-402	Network Analysis and Synthesis	3	1	0	30	20	50	100	150	4
5	NEE-403	Instrumentation & Process Control	2	1	0	15	10	25	50	75	3
6	NHU401/ NHU402	Industrial Psychology /Industrial Sociology	2	0	0	15	10	25	50	75	2
7	AUC-002/ AUC-001	*Cyber Security/ Human Values & Professional Ethics*	2	0	0	15	10	25	50	75*	-
PRACTICAL / DESIGN / DRAWING											
8	NEC-459	Electronics Lab	0	0	3	10	10	20	30	50	1
9	NEE-451	Electro-Mechanical Energy Conversion – II Laboratory	0	0	3	10	10	20	30	50	1
10	NEE-452	Network Lab	0	0	2	10	10	20	30	50	1
11	NEE-453	Electrical Instrumentation Lab	0	0	2	10	10	20	30	50	1
12	NGP-401	General Proficiency	-	-	-			50	-	50	
		Total	**16**	**5**	**10**					**1000**	**25**

The details of Science Based Electives are to be provided by The Boards of Studies of Science Subjects; these are common to all branches.

*Human values & Professional Ethics /Cyber Security will be offered as a compulsory audit course for which passing marks are 30% in End Semester Examination and 40% in aggregate.

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.

NME-309: THERMAL AND HYDRAULIC MACHINES

L T P 3 1 0

1. Preamble: To provide basic concepts and applications of thermodynamics and fluid mechanics. It enriches the knowledge regarding working and controlling of thermo mechanical machineries.

2. Course Objectives

a) To develop the basic knowledge and skills of the students in the areas of thermodynamics and fluid mechanics.
b) To develop the skills of the students in the areas of several applications of thermal and fluid machineries.
c) To develop the basic concepts of students in the area of governing and controlling of thermal and hydraulic machineries.

3. Course Outcomes

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

a) Understand the fundamental concepts of thermodynamics and vapor power cycles.
b) Do analysis of steam and Gas Turbines.
c) Understand and analyze basic IC engine cycles.
d) Understand the basic concepts and working of Hydraulic turbines.
e) Understand the basic concepts and working of Centrifugal and Reciprocating Pumps.

4. Pre-Requisite

Knowledge of basic principles of physics related to energy conversion.

5. Links to other Courses

This subject links with power plant engineering.

6. Course Content –

Unit 1:

Thermodynamic equilibrium, cyclic process, enthalpy, Zero, first and second laws of thermodynamics, Carnot cycle, concept of entropy, properties of steam, processes involving steam in closed and open systems, Enthalpy. Vapour Pressure Cycles: Rankine cycle, reheat cycle, Regenerative cycle.

Unit 2:

Steam Turbine: Theoretical approach only of Classification, impulse and reaction turbines their velocity diagrams and related calculations, work done and efficiencies, re-heat factor, staging, bleeding and governing of turbines. Gas Turbine: Theoretical approach only of Classification, Brayton cycle, working principle of gas turbine, gas turbine cycle with intercooling, reheat and regeneration, stage and polytrophic efficiencies.

Unit 3:

Otto, Diesel .and Dual cycles, introduction to 2-stroke and 4-stroke SI and CI engines.

Unit 4:

Impact of Jet: Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat and curve). Hydraulic Turbines: Classification, heads and efficiencies, construction, working, work done and efficiency of impulse turbines.

Unit 5:

Centrifugal Pump: Classification, construction, working. Reciprocating Pump: Classification, construction, working.

Text Books:

1. Onkar Singh "Applied Thermodynamics" New Age International, 2006.
2. Steam & Gas Turbine by R.Yadav, CPH Allahabad
3. R.K.Rajput" A Text Book of Hydraulic Machines" S. Chand & Co.,2008.

References:

1. P.L.Ballany "Thermal Engineering " Khanna Publishers, 2003
2. R.K.Bansal "A Text Book of Fluid Mechanics and Hydraulic Machines" Laxmi Publications, 2006.
3. Gas Turbine, by V. Ganeshan, Tata McGraw Hill Publishers.

NEE – 301: ELECTRO-MECHANICAL ENERGY CONVERSION –I

L T P 3 1 0

1. Preamble: To provide sound knowledge in the basic concepts of singly and doubly excited magnetic systems and Electrical Machines. It enriches the knowledge regarding methods of speed control and testing of DC machines. It provides adequate knowledge regarding the construction and basic principle operation and testing of single and three phase transformers and autotransformers.

2. Course Objectives

a) To develop the basic knowledge and skills of the students in the areas of electrical machines and drives.
b) To develop the skills of the students in the areas of several domestic applications of transformer.
c) To serve as a pre-requisite for post graduate courses for Advance Electrical Machines and Electrical Drives.

3. Course Outcomes

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

a) Apply knowledge of mathematics to learn energy conversion of singly excited and doubly excited magnetic systems.
b) Apply knowledge of mathematics and electrical engineering to study basic concepts of dc machines.
c) Understand and solve problems related to testing of D.C machines and applications of D.C motors and generators.
d) Understand, formulate and solve problems related to testing of single phase transformer, efficiency and voltage regulation.
e) Understand open delta, Scott's connection and harmonics in three phase transformers.

4. Pre-Requisite

Knowledge on transformer and electrical machines

5. Links to other Courses

The subject electro-mechanical energy conversion links with Electrical Machines Drives and Power Electronics.

6. Course Content:

Unit – I

Principles of Electro-mechanical Energy Conversion- Introduction, Flow of Energy in Electromechanical Devices, Energy in magnetic systems (defining energy & Co-energy), Singly excited systems; Determination of mechanical force, Mechanical energy, Torque equation,

Doubly excited Systems; Energy stored in magnetic field, Electromagnetic torque , Generatedemf in machines; Torque in machines with cylindrical air gap.

Unit – II

D.C. Machines- Construction of DC Machines, Armature winding, Emf and torque equations, Armature reaction, Commutation, Interpoles and compensating windings, Performance characteristicsofD.C.generators.

Unit –III

D.C. Machines (Contd.)- Performance characteristics of D.C. motors, Starting of D.C. motors; 3 point and 4 point starters, Speed control of D.C. motors; Field control, Armature control and Voltage control (Ward Lenonard method); Efficiency and Testing of D.C. machines (Hopkinson's&Swinburn'sTest).

Unit – IV

Single Phase Transformer- Phasor diagram, Efficiency and voltage regulation, All day efficiency.

Testing of Transformers- O.C. and S.C. tests, Sumpner's test, Polarity test.

Auto Transformer- Single phase and three phase auto transformers, Volt-amp relation, Efficiency, Merits & demerits and applications.

Unit – V

Three Phase Transformers - Construction, Three phase transformer, Phasor groups and their connections, Open delta connection, Three phase to 2 phase, 6 phase or 12 phase connections and their applications, Parallel operation of single phase and three phase transformers and load sharing, Excitation phenomenon and harmonics in transformers, Three winding transformers.

Text Books:

1. I.J. Nagrath&D.P.Kothari," Electrical Machines", 3rd Edition Tata McGraw Hill
2. A.E. Fitzgerald, C.KingsleyJr and Umans,"Electric Machinery" 6th Edition McGraw Hill, International Student Edition.
3. PS Bhimbra, "Electrical Machinery",7th Edition Khanna Publishers
4. Husain Ashfaq ," Electrical Machines", 2nd Edition DhanpatRai& Sons.
5. B.R. Gupta &VandanaSinghal, "Fundamentals of Electrical Machines, 3rd Edition New Age International.

Reference Books:

1. Irving L.Kosow, "Electric Machine and Transformers", 2nd Edition Prentice Hall of India.
2. Bhag S. Guru and Huseyin R. Hizirogulu, "Electric Machinery and Transformers" 3rd Edition OxfordUniversity Press, 2001.

NEE-302: ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS

L T P 3 1 0

1. Preamble: To enable the students gain knowledge about different types of measuring techniques for measurement of circuit components and electrical quantities using electrical and electronic instruments.

2. Course Objectives

a) To develop the basic knowledge and skills of the students in the areas of measurement techniques.
b) To develop the skills of the students in the areas of several domestic applications of measuring instruments.

3. Course Outcomes

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

a) Understand operation and construction of the measuring systems and their properties.
b) Understand the operation, construction and applications of CT & PT, speed, frequency and power factor meter.
c) Understand the measurement of resistance, inductance & capacitance.
d) Understand operation and construction the magnetic systems and AC potentiometer.
e) Understand the digital measurement of electrical quantities and CRO.

4. Pre-Requisite

Basic Electrical Engineering

5. Links to other Courses

Project

Course Contents

Unit -I

(1) Philosophy Of Measurement: Methods of Measurement, Measurement System**,** Classification of instrument system, Characteristics of instruments & measurement system**,** Errors in measurement &its analysis, Standards

(2)Analog Measurement of Electrical Quantities : Electrodynamic ,Thermocouple, Electrostatic & Rectifier type Ammeters & Voltmeters , Electrodynamic Wattmeter, Three Phase Wattmeter, Power in three phase system , errors & remedies in wattmeter and energy meter.

Unit - II

Instrument Transformers: CT and PT; their errors, Applications of CT and PT in the extension of instrument range, Introduction to measurement of speed, frequency and power factor**.**

Unit - III

Measurement of Parameters: Different methods of measuring low, medium and high

resistances**,** measurement of inductance & capacitance with the help of AC Bridges, Q Meter.

Unit - IV

(1)AC Potentiometer: Polar type & Co-ordinate type AC potentiometers, application of ACPotentiometers in electrical measurement.

(2)Magnetic Measurement: Ballistic Galvanometer,**f**lux meter**,** determination of hysteresis loop, measurement of iron losses**.**

UNIT - V

(1)Digital Measurement of Electrical Quantities- Concept of digital measurement, Block diagram, Study of digital voltmeter, Frequency meter, Spectrum analyzer, Electronic multimeter**.**

(2)Cathode Ray Oscilloscope- Basic CRO circuit (block diagram), Cathode Ray Tube (CRT) & its components, Applications of CRO in measurement, LissajousPattern, Dual trace & dual beam oscilloscopes**.**

Text Book:

1. E.W. Golding & F.C. Widdis, "Electrical Measurement &Measuring Instrument", A.W. Wheeler& Co. Pvt. Ltd. India.
2. A.K. Sawhney,"Electrical & Electronic Measurement & Instrument", DhanpatRai& Sons , India .

Reference Books:

3. Forest K. Harries,"ElectricalMeasurement",Willey Eastern Pvt. Ltd. India .
4. M.B. Stout ,"Basic Electrical Measurement" Prentice hall of India, India.
5. W.D.Cooper," Electronic Instrument & Measurement Technique " Prentice Hall International.
6. RajendraPrashad ,"Electrical Measurement &Measuring Instrument" Khanna Publisher.
7. J.B. Gupta, "Electrical Measurements and Measuring Instruments", S.K. Kataria& Sons.

NEE-303- BASIC SYSTEM ANALYSIS

L T P 3 1 0

1. Preamble: This course provides an introduction to the basic signals, systems and their classifications. This course gives the basic idea of various transformation techniques and their application for system analysis.

2. Course Objectives: To enrich the students to acquire knowledge about the basics of signals and systems, transformation techniques and their application in system analysis.

3. Course Outcomes: Student will be able to:

a) Understand different standard signals and their mathematical expression which are useful to formulate and design a system to meet realistic constraint for the study of the systems response. Study the mechanical systems modeling that communicate effectively complex engineering problems and the analogy of mechanical system with electrical system.
b) Analyze the responses of LTI system to Fourier series and Fourier transform and its impact on global and economic context and understand methodologies to evaluate their effect on the systems.
c) The ability to understand and analyze the properties of continuous time signals and system using Laplace transforms by keeping different engineering issues in mind.
d) Have a thorough understanding of the fundamental concepts and techniques used in state variables concept for modern control system engineering problem and its impact on different application
e) Ability to identify basic requirements of Z-transforms and its application effectively used in complex engineering problems.

4. Pre-requisites: Engineering Mathematics –I and Engineering Mathematics-II

5. Link to other courses: Digital Image Processing

Course Contents

UNIT- I

Introduction to continuous time signals and systemsBasic continuous time signals, unit step, unit ramp, unit impulse and periodic signals with their mathematical representation and characteristics. Introduction to various types of systems.

Analogous System: Linear mechanical elements, force-voltage and force-current analogy, modeling of mechanical and electro-mechanical systems

UNIT-II

Fourier Transform Analysis: Exponential form and Trigonometric form of Fourier series, Fourier symmetry, Fourier Transform: properties. Applications to network analysis.

UNIT-III

Laplace Transform Analysis: Review of Laplace Transform, Initial and Final Value Theorems, Inverse Laplace Transform, Convolution Theorem, Superposition Integral , Application of Laplace Transform to analysis of networks, waveform synthesis and Laplace Transform of complex waveforms.

UNIT-IV

State – Variable analysis : Introduction, State Space representation of linear systems, Transfer Function and state Variables , State Transition Matrix, Solution of state equations for homogeneous and non-homogeneous systems , Applications of State-Variable technique to the analysis of linear systems

UNIT-V

Z-Transform Analysis : Concept of Z-Transform, Z-Transform of common functions, Inverse ZTransform, Initial and Final Value theorems , Applications to solution of difference equations, Pulse Transfer Function.

Text Books:

1. David K.Cheng; "Analysis of Linear System", Narosa Publishing Co.
2. ME Van-Valkenberg; " Network Analysis", Prentice Hall of India
3. C.L.Wadhwa, "Network Analysis and Synthesis", New Age International Publishers,2007.
4. SamarajitGhosh, "Network Theory: Analysis and Synthesis" Prentice Hall of India, 2008

Reference Books:

5. ChoudharyD.Roy, "Network & Systems", Wiley Eastern Ltd.
6. Donald E.Scott, "Introduction to circuit Analysis" Mc. Graw Hill
7. B.P. Lathi, "Linear Systems & Signals" Oxford University Press, 2008.
8. I.J. Nagrath, S.N. Saran, R. Ranjan and S.Kumar, "Singnals and Systems, "Tata Mc. GrawHill, 2001. 9. Taan S. Elali&Mohd. A. Karim, "Continuous Signals and Systems with MATLAB" 2nd Edition, CRC Press.

NME-359: THERMAL & HYDRAULIC MACHINELAB

L T P 0 0 3

Note : Minimum 10 experiments out of following:

1. Study and working of Two stroke petrol Engine
2. Study and working of Four stroke petrol Engine
3. Study and working of two stroke Diesel Engine
4. Study and working of four stroke Diesel Engine.
5. Study of compounding of steam turbine
6. Study of Impulse & Reaction turbine
7. Impact of Jet experiment.
8. Turbine experiment on Pelton wheel.
9. Turbine experiment on Francis turbine.
10. Turbine experiment on Kaplan turbine.
11. Experiment on Reciprocating pump.
12. Experiment on centrifugal pump.

NEE-351: ELECTROMECHANICAL ENERGY CONVERSION- I LAB

L T P 0 0 3

Note: Minimum eight experiments are to be performed from the following list:

1. To obtain magnetization characteristics of a d.c. shunt generator.
2. To obtain load characteristics of a d.c. shunt generator and compound generator
(a)Cumulatively compounded
(b) Differentially compounded.
3. To obtain efficiency of a dc shunt machine using Swinburne's test.
4. To perform Hopkinson's test and determine losses and efficiency of DC machine.
5 To obtain speed-torque characteristics of a dc shunt motor.
6 To obtain speed control of dc shunt motor using
(a) armature resistance control
(b) field control
7. To obtain speed control of dc separately excited motor using Conventional Ward-Leonard/Static Ward –Leonard method.
8. To study polarity and ratio test of single phase and 3-phase transformers.
9. To obtain equivalent circuit, efficiency and voltage regulation of a single phase transformer using C.C. and S.C. tests.
10. To obtain efficiency and voltage regulation of a single phase transformer by Sumpner's test.
11. To obtain 3-phase to 2-phase conversion by Scott connection.
12. To determine excitation phenomenon (B.H. loop) of single phase transformer using C.R.O.

NEE-352: ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS LAB

L T P 003

Note: Minimum of nine experiments from the following:

1. Calibration of ac voltmeter and ac ammeter.
2. Measurement of form factor of a rectified sine wave and determine source of error if r.m.s.value is measured by a multi-meter.
3. Measurement of phase difference and frequency of a sinusoidal ac voltage using C.R.O.
4. Measurement of power and power factor of a single phase inductive load and to study.effect of capacitance connected across the load on the power factor.
5. Measurement of low resistance by Kelvin's double bridge.
6. Measurement of voltage, current and resistance using dc potentiometer.
7. Measurement of inductance by Maxwell's bridge.
8. Measurement of inductance by Hay's bridge.
9. Measurement of inductance by Anderson's bridge.
10. Measurement of capacitance by Owen's bridge.
11. Measurement of capacitance by De Sautybridge.
12. Measurement of capacitance by Schering bridge.
13. Study of Frequency and differential time counter.

***College may add any two experiments in the above list.**

NEE-353: NUMERICAL TECHNIQUE LAB

L T P 002

Note: Minimum eight experiments out of the following list:

MATLAB Based Experiments

1. Solution of linear equations for under damped and over damped cases.
2. Determination of eigen values and eigenvectors of a square matrix.
3. Determination of roots of a polynomial.
4. Determination of polynomial using method of least square curve fitting.
5. Determination of polynomial fit, analyzing residuals, exponential fit and error bounds from the given data.
6. Solution of differential equations using 4^{th} order Runge-Kutta method.
7. Solution of differential equation using revised Euler method.
8. Solution of difference equations.
9. Determination of time response of an R-L-C circuit.

***College may add any three experiments in the above list.**

Text/Reference Books:

1. AlmosGilat, "MATLAB: An Introduction with Applications" Wiley India Ltd., 2004.

2. R.P. Singh, "Getting Started with MATLAB" Oxford University Press.

NEE-401: ELECTRO-MECHANICAL ENERGY CONVERSION – II

L T P 3 1 0

1. Preamble: To provide sound knowledge in the basic concepts of singly and doubly excited magnetic systems and Electrical Machines. It enriches the knowledge regarding methods of speed control and testing of DC machines. It provides adequate knowledge regarding the construction and basic principle operation and testing of single and three phase transformers and autotransformers.

2. Course Objectives

a) To develop the basic knowledge and skills of the students in the areas of electrical machines and drives.
b) To develop the skills of the students in the areas of several domestic applications of transformer.
c) To serve as a pre-requisite for post graduate courses for Advance Electrical Machinesand Electrical Drives.

3. Course Outcomes

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

a) Apply knowledge of mathematics to learn energy conversion of singly excited and doubly excited magnetic systems.
b) Apply knowledge of mathematics and electrical engineering to study basic concepts of dc machines.
c) Understand and solve problems related to testing of D.C machines and applications of D.C motors and generators.
d) Understand, formulate and solve problems related to testing of single phase transformer, efficiency and voltage regulation.
e) Understand open delta, Scott's connection and harmonics in three phase transformers.

4. Pre-Requisite

Knowledge on transformer and electrical machines

5. Links to other Courses

The subject electro-mechanical energy conversion links with Electrical Machines Drives and Power Electronics.

6. Course Content:

UNIT - I

Synchronous Machine I - Constructional features, Armature winding, EMF Equation, Windingcoefficients, Equivalent circuit and phasor diagram, Armature reaction, O. C. & S. C. tests,Voltage regulation using Synchronous Impedance method, MMF method, Potier's Triangle method, Parallel operation of synchronous generators, Operation on infinite bus, Synchronizing power and torque co-efficient.

UNIT – II

Synchronous Machine II - Two reaction theory, Power flow equations of cylindrical and salientpole machines, Operating characteristics.

Synchronous Motor - Starting methods, Effect of varying field current at different loads, V-Curves, Hunting & damping, Synchronous condenser.

UNIT - III

Three phase Induction Machine – I

Constructional features, Rotating magnetic field, Principle of operation, Phasor diagram, Equivalent circuit, Torque and power equations, Torque- slip characteristics, No load & blocked rotor tests, Efficiency, Induction generator & its applications.

UNIT - IV

Three phase Induction Machine- II

Starting, Deep bar and double cage rotors, Cogging & Crawling, Speed control (with and without emf injection in rotor circuit).

UNIT – V

Single phase Induction Motor - Double revolving field theory, Equivalent circuit, No load andblocked rotor tests, Starting methods, Repulsion motor.

AC Commutator Motors - Universal motor, Single phase a.c. series compensated motor, Stepper motors.

Text Books

1. D.P.Kothari& I. J. Nagrath, "Electric Machines", Tata McGraw Hill, 2010.
2. AshfaqHussain "Electric Machines" DhanpatRai& Company, 2014
3. Fitzerald, A. E., Kingsley and S.D.Umans "Electric Machinery", MC Graw-Hill, 6th ed. 2003.

Reference Books

1. P.S. Bimbhra, "Electrical Machinery", Khanna Publisher, 7th ed. 2011.
2. P.S. Bimbhra, "Generalized Theory of Electrical Machines", Khanna Publishers, 5thed. 2002
3. M.G. Say, "Alternating Current Machines", Pitman & Sons

NEE- 402: NETWORK ANALYSIS AND SYNTHESIS

L T P 3 1 0

1. **Preamble:** This course Network Analysis and synthesis, provides an introduction to the basic concepts of circuits and networks and their influence in other circuits, this course gives the basic idea of solving AC and DC circuits and study of circuit transients.

2. **Course Objectives:** To enrich the students to acquire knowledge about the basics of circuit analysis, network theorems, concepts of AC circuits, transient analysis, two port network and synthesis of the electric circuit.

3. **Course Outcomes:** On successful completion of this course students will be able to:
   a) Understand about the network elements, types of networks, network topology & analysis complex circuits using Mesh current & Nodal voltage method.
   b) Gain knowledge about the solution methods of AC and DC circuits.
   c) Get an insight into solution of RLC circuits,
   d) Understand the concept of two port network.
   e) Understand the synthesis of the electric circuit

4. **Pre-Requisite:**

   Basic Electrical and Electronics Engineering

5. **Links to Other Courses:**

   Fundamental to all courses of Electrical and Electronics Engineering

6. **Course Content**

Unit – I

Graph Theory- Graph of a network, Definitions, Tree, Co tree, Link, basic loop and basic cutset, Incidence matrix, Cut set matrix, Tie set matrix, Duality, Loop and Nodal methods of Analyses.

Unit – II:

Network Theorems (Applications to AC Networks)-Superposition theorem, Thevenin'stheorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem. Millman's theorem, Compensation theorem, Tellegen's theorem.

Unit – III

Transient Circuit Analysis- Natural response and forced response, Transient response andsteady state response for arbitrary inputs (DC and AC), Evaluation of time response both through classical and Laplace methods.

Unit – IV

Network Functions- Concept of complex frequency, Transform impedances network functionsof one port and two port networks, Concept of poles and zeros, Properties of driving point and transfer functions.

Two Port Networks- Characterization of LTI two port networks; Z, Y,ABCD, A'B'C'D', g and h parameters, Reciprocity and symmetry, Inter-relationships between the parameters, Inter-connections of two port networks, Ladder and Lattice networks: T & Π representation.

Unit – V

(a) Network Synthesis- Positive real function; definition and properties, Properties of LC, RCand RL driving point functions, Synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms.

(b) Filters- Image parameters and characteristics impedance, Passive and active filterfundamentals, Low pass filters, High pass (constant K type) filters, Introduction to active filters.

Text Books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall of India
2. Alexander, Sadiku, "Fundamentals of Electric Circuits", McGraw Hill
3. D. Roy Choudhary, "Networks and Systems", Wiley Eastern Ltd.
4. C. L. Wadhwa, "Network Analysis and Synthesis", New Age International Publishers
5. A. Chakrabarti, "Circuit Theory", DhanpatRai& Co.

Reference Books:

1. Hayt, Kimmerly, Durbin, "Engineering Circuit Analysis", McGraw Hill
2. Donald E. Scott, "An Introduction to Circuit analysis: A System Approach", McGraw Hill
3. M. E. Van Valkenburg, "An Introduction to Modern Network Synthesis", Wiley Eastern Ltd.
4. T. S. K. V. Iyer, "Circuit Theory", Tata McGraw Hill
5. Joseph A. Edminister, " Theory & Problems of Electric Circuits", McGraw Hill

NEE – 403: ELECTRICAL INSTRUMENTATION AND PROCESS CONTROL

L T P 2 1 0

1. Preamble: Instrumentation can be described as "the art and science of measurement and control". It is the technology of measurement that services not only physical, chemical and biological sciences; but also all branches of engineering and medicine. This course provides the knowledge of various types of transducers used in industries, various methods used for transmission of data measured in industries, process control and various types of display devices & recorders.

2. Course Objectives

a) To enrich the students to acquire knowledge about various types of transducers, their construction and functioning.
b) To provide the students' knowledge of various types of data/ information transmission methods and different types of display devices & recorders.

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

a) Understand electrical transducers, their classification, characteristics and working methodology and also factors affecting the choice of transducers.
b) Gain knowledge about construction and working of Capacitive, Piezoelectric, Hall effect and Opto - electronic transducers and their industrial applications.
c) Know about measurement of non-electric quantities like motion, force, pressure, temperature, flow and liquid level used in various industries.
d) Learn about general telemetry system, land line and radio frequency telemetering system, transmission channels and data acquisition systems used for transmission of data/ information.
e) Understand principle of process control, its elements & characteristics and electronic, pneumatic & digital controllers, pipeline control and PLC.
f) Learn about display devices& recorders such as storage oscilloscope, spectrum analyzer, strip chart and X-Y recorders, magnetic tape and digital tape recorders and recent developments as computer added measurements, fibre optic transducers, micro sensors and smart sensors.

4. Pre-Requisites:

- Knowledge of physics & chemistry.
- Knowledge of Basic Electrical and Electronics Engineering

5. Links to Other Courses:

- Electrical measurements and measuring instruments.
- Biomedical instrumentation.
- Analog and digital communication.

6. Course Content :

Unit-I

Transducer – I

Definition, Advantages of electrical transducers, Classification, Characteristics, Factors affecting the choice of transducers, Potentiometers, Strain guages, Resistance thermometer, Thermistors, Thermocouples, LVDT, RVDT

Unit-II

Transducer – II

Capacitive, Piezoelectric, Hall effect and Opto electronic transducers. Measurement of motion, force, pressure, temperature, flow and liquid level.

Unit-III

Telemetry

General telemetry system, Land line & radio frequency telemetering systems, Transmission channels and media, Data receiver & transmitter.

Acquisition System

Analog data acquisition system, Digital data acquisition system, Modern digital data acquisition system.

Unit-IV

Display Devices and Recorders

Display devices, Storage oscilloscope, Spectrum analyzer, Strip chart & X-Y recorders, Magnetic tape & digital tape recorders.

Process Control

Principle, Elements of process control system, Process characteristics, Electronic, pneumatic & digital controllers.

Text Books:

1. A. K. Sawhney, "Advanced Measurements & Instrumentation", Dhanpat Rai & Sons
2. B.C. Nakra & K.Chaudhry, "Instrumentation, Measurement and Analysis", Tata McGraw Hill 2nd Edition.
3. Curtis Johns, "Process Control Instrumentation Technology", Prentice Hall

Reference Books:

1. E. O. Decblin, "Measurement System – Application & design", McGraw Hill.
2. W. D. Cooper and A.P. Beltried, "Electronics Instrumentation and Measurement Techniques" Prentice Hall International.
3. Rajendra Prasad, "Electronic Measurement and Instrumentation Khanna Publisher.
4. M.M.S. Anand, "Electronic Instruments and Instrumentation Technology" PHI Learning.

NEC – 409: ANALOG & DIGITAL ELECTRONICS

L T P 2 1 0

1. Preamble: Analog electronics is aimed to provide the basics of analog circuit operation and the characteristics for various circuits along with the basic designing parameters for various circuits. Digital electronics provides an introduction to the basic concepts of Digital logic gates and to acquire knowledge of analysis of Digital Logic Circuits using various implementations and designing techniques and provides students to realize about synchronous and asynchronous circuits.

2. Course Objectives:

a) To study various special purpose diode.
b) Student should be able to understand the Feedback and its application in amplifiers and oscillators.
c) To study the implementation of combinational and sequential logic circuits.
d) To understand the applications of Op-Amp and IC555 Timer.

3. Course Outcomes:

a) The students will be exposed to special purpose diodes and switching application of a transistor.
b) This course is intended to introduce the basic principles of amplifiers with feed-back system
c) To study sinusoidal and square wave oscillators.
d) To learn advanced levels in digital electronics including various logic circuits, synthesis of logic circuits and their simplification and counters.
e) To attain the basic knowledge of 555 IC, Schmitt Trigger, Op-Amp and its application.

4. Pre-requisite:

- Knowledge of Engineering Physics.
- Knowledge on truth table of logic gates.
- Knowledge on digital system terms and specifications.

5. Links to other courses:

- Microprocessor and its applications.
- Analog & Integrated electronics
- VLSI design

6. Course Content

UNIT-I:

Special Diodes-

LED,Varactor diode, Photo diode, Schottky diode, Tunnel diode; their characteristics and applications.Transistors as a switch.

UNIT-II

Frequency Response:

Amplifier transfer function, low and high frequency response of common emitter and common sourceamplifiers.

Feedback:

General feedback structure; properties of negative feedback; series-series, series-shunt, shunt-series andshunt-shunt feedback amplifiers.

UNIT-III:

Basic principle of sinusoidal oscillator, R-C Phase Shift and Wein Bridge oscillators, tuned oscillators-Collpits and Hartley; Crystal oscillator

DIGITAL ELECTRONICS:

UNIT-IV

Combinational Logic Circuits: Multiplexers/ Demultiplexers, Encoders/Decoders.

Sequential Logic Circuits: latches, flip-flops- S-R, T, D, J-K.

Shift Registers: Basic principle, serial and parallel data transfer, shift left/right registers, universal shiftregister.

Counters: Mode N Counters, ripple counters, synchronous counters, ring/Johnson counters.

UNIT-V

OP-AMP applications - Astable, Monostable and Bistable multivibrators, Schmitt trigger, IC-555 Timer, A/D and D/A converters.

Voltage Regulators: Series, shunt and switching regulators, op-amp based configurations.

Memories: Introduction to ROM, RAM; Sequential Memory, Memory organization.

Text Books:

1. A.S. Sedra and K.C. Smith “Microelectronics Circuits” Oxford University Press (India)
2. Malvino& Leach, “Digital Principles and applications” Tata Mc. Graw Hill
3. R.A. Gayakwad “Op amps and Linear Integrated Circuits” Prentice Hall of India.
4. Balbir Kumar and ShailB.Jain, “Electronic Devices and Circuits” Prentice Hall of India,2007

Reference Books:

1. Taub& Schilling “Digital Electronics”- Tata McGraw Hill
2. Anil K. Maini, “Digital Electronics: Principles and Integrated circuits” Wiley India Ltd, 2008.
3. Millman, J. and Grabel A, “Microelectronics” McGraw Hill
4. Anand Kumar, “Switching Theory and Logic Design” Prentice Hall of India, 2008.
5. Aloke. K. Dutta, “Semiconductor Devices and circuits”, Oxford University Press, 2008.

NEE- 451: ELECTRO-MECHANICAL ENERGY CONVERSION – II LABORATORY

L T P 0 0 3

Note: Minimum eight experiments are to be performed from the following list, out of which there should be at least two software based experiments.

1. To perform no load and blocked rotor tests on a three phase squirrel cage induction motor and determine equivalent circuit.
2. To perform load test on a three phase induction motor and draw:
(i) Torque -speed characteristics
(ii) Power factor-line current characteristics
3. To perform no load and blocked rotor tests on a single phase induction motor and determine equivalent circuit.
4. To study speed control of three phase induction motor by varying supply voltage and by keeping V/f ratio constant.
5. To perform open circuit and short circuit tests on a three phase alternator and determine voltage regulation at full load and at unity, 0.8 lagging and leading power factors by (i) EMF method (ii) MMF method.
6. To determine V-curves and inverted V-curves of a three phase synchronous motor.
7. To determine Xd and Xq of a three phase salient pole synchronous machine using the slip test and to draw the power-angle curve.
8. To study synchronization of an alternator with the infinite bus by using:
(i) dark lamp method (ii) two bright and one dark lamp method.

Software based experiments (Develop Computer Program in 'C' language or use MATLAB or Equivalent software)

9. To determine speed-torque characteristics of three phase slip ring induction motor and study the effect of including resistance, or capacitance in the rotor circuit.
10.To determine speed-torque characteristics of single phase induction motor and study the effect of voltage variation.
11. To determine speed-torque characteristics of a three phase induction motor by (i) keeping v/f ratio constant (ii) increasing frequency at the rated voltage.
12. To draw O.C. and S.C. characteristics of a three phase alternator from the experimental data and determine voltage regulation at full load, and unity, 0.8 lagging and leading power factors.
13. To determine steady state performance of a three phase induction motor using equivalent circuit.

NEE-452: NETWORK LABORATORY

L T P 0 0 2

Note: Minimum eight experiments are to be performed from the following list.

1. Verification of principle of superposition with ac sources.
2. Verification of Thevenin, Norton and Maximum power transfer theorems in ac circuits.
3. Verification of Tellegin's theorem for two networks of the same topology.
4. Determination of transient response of current in RL and RC circuits with step voltage input.
5. Determination of transient response of current in RLC circuit with step voltage input for underdamp, critically damp and overdamp cases.
6. Determination of frequency response of current in RLC circuit with sinusoidal ac input.
7. Determination of z and h parameters (dc only) for a network and computation of Y and ABCD Parameters.
8. Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values.
9. Determination of image impedance and characteristic impedance of T and Π networks, using O.C. and S.C. tests.
10. Verification of parameter properties in inter-connected two port networks : series, parallel and cascade also study loading effect in cascade.
11. Determination of frequency response of a Twin – T notch filter.
12. To determine attenuation characteristics of a low pass / high pass active filters.

College may add any three S/W based experiments in the above list.

NEE – 453: ELECTRICAL INSTRUMENTATION LAB

L T P 0 0 2

Note: Minimum eight experiments are to be performed from the following list.

1. Measurement of displacement using LVDT.
2. Measurement of displacement using strain gauge based displacement transducer.
3. Measurement of displacement using magnetic pickup.
4. Measurement of load using strain gauge based load cell.
5. Measurement of water level using strain gauge based water level transducer
6. Measurement of flow rate by anemometer
7. Measurement of temperature by RTD.
8. Measurement of temperature by thermocouple
9. Study of P,PI and PID controllers
10. Study of storage oscilloscope and determination of transient response of RLC circuit.
11. Determination of characteristics of a solid state sensor/fibre-optic sensor
12. Design and test a signal conditioning circuit for any transducer

College may add any three S/W based experiments in the above list.

NEC-459: ELECTRONICS LAB

L T P 0 0 2

ANALOG ELECTRONICS:

Note: Select at least any four out of the following:

1. To Plot V-I characteristics of junction diode and zener diode.
2. To draw wave shape of the electrical signal at input and output points of the half wave, full wave and bridge rectifiers.
3. To Plot input / output characteristics for common base transistor.
4. To Plot input /output characteristics of FET and determine FET parameters at a given operating point.
5. To determine voltage gain, current gain, input impedance and output impedance of common emitter amplifier.
6. To determine voltage gain, current gain, input impedance and output impedance and frequency response of R-C coupled common emitter amplifier.
7. To design R-C Phase shift / Wein Bridge oscillator and verify experimentally the frequency of oscillation.
8. To study transistor as a switch and determine load voltage and load current when the transistor is ON.

ANALOG IC & DIGITAL ELECTRONICS:

Note: Select at least any four out of the following:

9. To study application of Operational Amplifier as summer integrator and voltage comparator.
10. To study operation of Op-Amp based astable and monostablemultivibrators.
11. To study operation IC 555 based astable and monostablemultibrators.
12. To study operation of (a) multiplexer using IC 74150 (b) demultiplexer using IC 74138.
13. To study operation of Adder / Subtractor using 4 bit / 8 bit IC 7483.
14. To study operation of (a) J K Master – slave flip – flop using IC 7476 (b) Modulo N counter using programmable counter IC74190.
15. To verify experimentally output of A/D and D/A converters.
16. To study regulation of unregulated power supply using IC 7805/7812 voltage regulator and measure the load and line regulations