**ELECTRICAL MACHINE DESIGN**
**EE-401-E**

| L | T | P | Total | |
|---|---|---|---|---|
| 3 | 1 | - | 4 | Theory: 100 Marks<br>Sessional: 50 Marks<br>Duration: 3 Hrs |

**UNIT I**

**GENERAL**: General features & limitations of electrical machine design, types of enclosures, heat dissipation, temperature rise, heating & cooling cycles, rating of machines, cooling media used & effect of size and ventilation.

**DC MACHINES** :Output equation, choice of specific loadings, choice of poles and speed, Design of conductors, windings, slots field poles, field coils, commutator and machine design.

**UNIT II**

**TRANSFORMERS**: Standard specifications, output equations, design of core, coil, tank and Cooling tubes, calculation of circuit parameters, magnetizing current, losses and efficiency, Temperature rise and regulations from design data.

**SYNCHRONOUS MACHINES**: Specifications, ratings and dimensions, specific loadings, main dimensions, low speed machines, turbo generators, armature conductors, cooling.

**UNIT III**

**INDUCTION MOTORS:**

Three Phase Induction Motor: Standard specifications, output equations, specific loadings, main dimensions, conductor size and turns, no. of slots, slot design, stator core, rotor design, performance calculations.

**Single Phase Induction Motor**: output equations, specific loadings, main dimensions, design of main and auxiliary winding, capacitor design, equivalent circuit parameters, torque, efficiency.

**UNIT IV**

**Computer Aided Design**: Computerization of design procedures, development of computer programs & performance predictions, optimization techniques & their application to design problems.

**NOTE**: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all , selecting at least one question from each unit.

**TEXT BOOKS**

1. M.G.Say, Performance and design of ac machines, CBS Publishers.
2. S.K. Sen., Principles of electrical machine design with computer programs, Oxford and IBH publishing co. 1987.
3. A.E.Clayton, Hencock: Performance and design of dc machines, CBS Publishers.

**REFERENCES**

1. J.H. Kuhlmann, Design of electrical operators, John Willey, 1957.
2. CG Veinott, Theory and design of small induction machines, MGH, 1959.
3. A Shanmugasundarem, Electrical machine design databook

**HIGH VOLTAGE ENGINEERING**
**EE-403-E**

| L | T | P | Total | Theory: 100 Marks |
|---|---|---|---|---|
| 4 | 1 | - | 5 | Sessional: 50 Marks |
| | | | | Duration: 3 Hrs |

**UNIT** -l:

**Conduction & Breakdown in Gases, Liquid & Solid Dielectrics:**

Gases - Ionization process, town sends current growth equation. $1^{5t}$ & $2^{nd}$ ionization coefficients. Town sends criterion for breakdown. Streamer theory of breakdown. Paschen's law of gases. Gases used in practice.

Liquid Dielectrics - Conduction & breakdown in pure & commercial liquids, suspended particle theory, stressed oil volume theory, liquid dielectrics used in practice.

Solid Dielectrics - Intrinsic, electromechanical, & thermal breakdown, compos it dielectric, solid dielectrics used in practice.

**UNIT** – 2

Application of insulating materials in power transformers, rotating machines, circuit breakers, cables & power capacitors.

Generation of high D.C., A.C. impulse voltage & impulse currents. Tripping & control of impulse generators.

Measurement of high D.C., A.C. (Power frequency & high frequency) voltages, various types of potential dividers, generating voltmeter, peak reading A.C. voltmeter, Digital peak voltmeter, electrostatic voltmeter, Sphere gap method, factors influencing the spark voltage of sphere gaps.

**UNIT** - 3

High Voltage Testing of Electrical Apparatus:

Testing of insulators, bushings, circuit breakers power capacitors & power transformers. Over voltage Phenomenon & Insulation Co-ordination:

Theory of physics of lightning flashes & strokes. Insulation co-ordination, volt time and circuit time characteristics.

Boys camera, standard voltage & current shapes produced in Lab., Horn gap single diverters, ground wires, surge absorbers.

**UNIT** – 4

EHV Transmission & Corona Loss:

Need for E.H.V. transmission, use of bundled conductors, corona characteristics of smooth bundled conductors with different configurations, corona loss, factors, affecting the corona. Shunt & Series compensation of E.H.V. lines. Tuned power lines. & H.V.D.C. Transmission:

Advantages, disadvantages & economics of H.V.D.C. transmission system. Types of D.C. links, converter station equipment, their characteristics.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

**Suggested Books :**


1. Kamaraju & Naidu, "HV Engg."
2. RS Jha, "HV Engg."
3. Bagmudre "EHV AC Transmission Engg."
4. Kuffel & Abdullah, "HV Engg."
5. Kimbark, "HVDC Transmission".

**DISCRETE DATA NON LINEAR CONTROL SYSTEM**
**EE-405-E**

| L | T | P | Total | Theory: 100 Marks |
|---|---|---|---|---|
| 3 | 1 | - | 4 | Sessional: 50 Marks |
| | | | | Duration: 3 Hrs |

**UNIT -1 Sampling & Reconstruction:**
Time invariant vs. time variant systems. Introduction to discrete time system, Computer controlled system: Mathematical treatment of sampling process, Sampling theorem. Reconstruction from sampled signal, Transfer function of discrete data system: transfer function of discrete data system with cascade elements, transfer function of Z.O.H, Transfer function of closed loop discrete data system.

**UNIT -2 Discrete Z- Transform: Z- Transform of discrete time functions**:-
One-sided Z-Transform, Two sided Z- Transform, Properties of Z- Transform, Inverse Z- Transform by partial fraction method, power series method, Residue method. Pulse transfer function.
Stability Analysis:
BIBO stability, Zero- Input stability. Concept of stability in Z- plane, Z and S domain relationship. Bilinear transformation.
Stability test of discrete data system: Jury's stability criterion, modified Routh's criterion, Schur Cohn criterion.

**UNIT -3 Non-linear systems:**
Linear & non-linear systems classification & comparison, special features of non-linear systems, properties of non linear system. Linear verses Non-linear control system, different types of non-linearities Limit cycle, jump resonance, sub harmonics.

**UNIT -4**
**Non-linear control** Describing functions , determination of describing function and stability analysis,. Lyapunov stability analysis, stability definitions. Popov's stability criterion, Phase Plane Method.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all , selecting at least one question from each unit.

**Books Recommended:**

I. Control system by Ogata PHI Education.
2. Digital control system by M. Gopal TMH education ...
3. Non Linear Control by Slotin & Li
4 Modem Automatic control system by B.C. Kuo.

## NON-CONVENTIONAL SOURCES OF ENERGY & MANAGEMENT

**EE-407-E**

| L | T | P | Total | |
|---|---|---|---|---|
| 3 | 1 | - | 4 | Theory: 100 Marks<br>Sessional: 50 Marks<br>Duration: 3 Hrs |

**UNIT I: Introduction**: Limitations of Conventional Energy sources, uses & growth of alternate energy sources, Basic schemes & application of direct energy conversion.

Energy Management: Principles of energy conservation, Energy Audit, energy conservation approach/technologies, co-generation, waste heat utilization, power factor improvement, regeneration methods, energy storage, efficient energy management, techniques, energy management system in India.

**UNIT II : MHO Generators**: Basic principle, gaseous conduction & Hall effect, generator & motor effect, different types of MHO generators, practical MHO generators, applications & economic aspects.
Thermo-Electric Generators: Thermoelectric effects, Thermoelectric converters, figure of merit, properties of thermoelectric materials, brief description of construction of thermoelectric generators, applications & economic aspects.

**UNIT III: Photo Voltaic Effect & Solar Energy**:- Photo Voltaic effect, different types of photoelectric cells, cell fabrication, characteristics of photo voltaic cells, conversion efficiency, solar batteries, solar radiation analysis, solar energy in India, solar collector, solar furnaces & applications.

**UNIT IV: Miscellaneous Sources**: Fuel cells, principle of action, general description of fuel cells, conversion efficiency, operational characteristics & applications. Low level hydro plants, definition of low head hydropower, Choice of site, choice of turbines. Wind power, history of wind power, wind machines, theory of wind power, characteristics of suitable wind power sites, Bio mass energy, conversion processes. Different bio mass energy resources, electric equipment, precautions, and applications.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

**References:**


1. Energy Resources; Demand & Conservation with special reference to India by KashbariTMH
2. An Introduction to Direct Energy Conservation by R.A. Coormbe.
3. Direct Energy Conversion by Kettani, M.
4. Energy Hand book by Robert L. Loftness.
5. Energy Technology Hand Book by Considine.
6. Non-Conventional sources of Energy by G.D. Rai.
7. Energy Technology, Non-Conventional, Renewable & conventional by S. Rao, Parulekar.
8. Energy storage for Power system, A Ter-Gazarian (peter Peragimus Ltd.)

**FUZZY LOGIC & NEUTRAL NETWORKS**
**EE-409-E**

| L | T | P | Total |
|---|---|---|---|
| | Theory: 100 Marks | | |
| 3 | 1 | - | 4 |
| | Sessional: 50 Marks | | |

Duration: 3 Hrs

**UNIT I :**
Introduction to Fuzzy sets, Crisp sets, Basic concepts of Fuzzy sets, L-fuzzy sets, level 2-fuzzy sets, type 2-fuzzy sets. Fuzzy sets Vs. Crisp sets. Fuzzy Arithmetic, Algebraic operations, set-theoretic operations, fuzzy relation on sets & fuzzy set compositions of Fuzzy relations, properties of the minimum-maximum composition.

**UNIT II :**
Introduction to Fuzzy control, Fuzzy logic controller components, Construction of Fuzzy sets (Direct methods, Indirect method), Introduction to Expert system, Case study on fuzzy logic controller, Application of Fuzzy control.

**UNIT III:**
Introduction to Neural Networks, Artificial Neuron model, Neural Network controller, Multilayer Network, Back propagation Algorithm (Forward, Backward), learning control Architecture (Indirect learning, General, Forward Inverse), Simplex matrix operation.

**UNIT IV:**
Application of Neural Network: The traveling salesman problem, Time series prediction.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

**References:**


1. James A. Anderson" Introduction to Neural Networks", Prentice Hall India.
2. H.J. Zimmermann" Fuzzy set theory & its Applications ", Allied Publishers Ltd.
3. Nil Junbong " Fuzzy Neural Control Principles & Algorithm", PHI.
4. N.K. Bose" Neural Network Fundamental with Graphics ", TAT A McGraw Hill.
5. Klir George J. " Fuzzy sets and Fuzzy Logic Theory and Applications", PHI.
6. J.M Zurada , " Introduction to Artificial Neural Network" , Jaico Publishers

**INSTALLATION, TESTING, COMMISSIONING AND MAINTENANCE OF ELECTRICAL EQUIPMENTS**
**EE-411-E**

L T D Total

Theory: 100 Marks
Sessional : 50 Marks
Duration : 3 Hrs

UNIT 1
Installation, testing, commissioning and maintenance of: Generators, & Power transformers. UNIT 2

UNIT-2
Installation, testing, commissioning and maintenance of:
AC and DC motors

UNIT 3
Installation, testing, commissioning and maintenance of:
Ckt breakers, Isolators, PT, CT, Bus bars.

UNIT 4
Installation, testing, commissioning and maintenance of:
Transmission lines, Cables, Capacitors, Synchronous condensers. Neutral grounding, Power factor improvement

**NOTE:** The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

**Reference books**


1. Testing, commissioning operation and maintenance of electrical equipment By S.ROA, KHANNA PUB.
2. Testing, commissioning operation and maintenance of electrical equipment By T ARLOK SINGH

**RELIABILITY**
**EE-413-E**

| L | T | P | Total | |
|---|---|---|---|---|
| 3 | 1 | - | 4 | Theory: 100 Marks<br>Sessional: 50 Marks<br>Duration: 3 Hrs |

**UNIT 1:**

INTRODUCTION: Definition of reliability, failure data analysis, mean failure ratio, MTTF, MTBF, graphical plot, MTTF in terms of failure density, generalization, reliability in terms of failure density (integral form), reliability in other situation.

HAZARD MODELS: Introduction, constant hazard linearly increasing hazard, Weibull model, on density function and distribution function, and reliability analysis, important distribution and its choice, expected value, standard deviation and variance, theorem concerning expectation and variance.

**UNIT 2:**

SYSTEM RELIABILITY: Introduction, series system with identical component, reliability bounds-classical approach Bayesian approach application of specification hazard models, an rout-of-an structure methods for solving complex system, systems not reducible to mixed configuration, mean time to failure system, logic diagrams, Markov model and graph. RELIBILITY IMPROVEMENT AND FAULT TREE ANALYSIS: Introduction, improvement by component, redundancy, element redundancy, unit redundancy, optimization, stand by redundancy, reliability-cost trade off, fault tree construction, calculation of reliability from fault tree.

**UNIT 3:**

MAINTAINABILITY, A V AILABITY AND REPAIRABLE SYSTEM: Introduction, maintainability, availability, system down time, reliability and maintainability trade off, instantaneous repair rate MTTR, reliability and availability function.

BAYESIAN APPROXIMATION AND RELIABITY ESTIMATION: Introduction, Lindley's expansion, reliability estimation, normal, Weibull, inverse gaussian and Rayleigh.

**UNIT 4:**

RELIABILITY ALLOCATION AND APPLICATION: Reliability allocation for a series system, approximation of reliability in a computer system and nuclear power plant, failure models and effects analysis (FMEA)

**NOTE:**

The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all , selecting at least one question from each unit. Each question will be of equal marks.

**Suggested Books:**


1. S.K.Sinha, Reliability and life testing, (WEL New Delhi).
2. L.A.Srinath, Reliability engineering, (EWP New Delhi).
3. Bal Guru Swami, Quality control and Reliability, (Khanna publisher New Delhi).

**VHDL AND DIGITAL DESIGN**
**EE-415-E**

| L | T | P | Total | |
|---|---|---|---|---|
| 4 | 1 | - | 5 | Theory: 100 Marks<br>Sessional: 50 Marks<br>Duration: 3 Hrs |

**UNIT I:**
INTRODUCTION: History. Why use VHDL? Hardware design construction, design levels, HDLs Hardware simulation and synthesis. Using VHDL for design synthesis, terminology. PROGRAMMABLE LOGIC DEVICES :Why use programmable logic? What is a programmable logic device ? Block diagram, macrocell structures and characteristics of PLDs and CPLDs. Architecture and features of FPGAs. Future direction of programmable logic.

**UNIT II:**
BEHA VIORAL MODELING: Entity declaration, architecture body, process statement, variable assignment, signal assignment. Wait, If, Case, Null, Loop, Exit, Next and Assertion statements. Inertial and transport delays, Simulation deltas, Signal drivers.
DATA FLOW AND STRUCTURAL MODELLING: Concurrent signal assignment, sequential signal assignment, Multiple drivers, conditional signal assignment, selected signal assignment, block statements, concurrent assertion statement, component declaration, component instantiation.

**UNIT III:**
GENERICS AND CONFIGURA TIONS : Generiecs, Why configurations ? default configurations, component configurations. Generiecs in configuration. Generic value specification in architecture, block configurations, architecture configurations. SUBPROGRAMS AND PACKAGES :Subprograms - functions, procedures, declarations. Package declarations, package body, use clause, predefinal package standard. Design libraries, design file.

**UNIT IV:**
ADVANCED TOPICS: Generate Statements, Aliases, Qualified expressions, Type conversions, Guarded signals, User defined attributes, Predefined attributes., VHDL synthesis.

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

**Suggested Books:**


I. D. Perry, VHDL, 3rd Ed.- TMH.
2. J Bhasker, A.VHDL- Primer, PHI.
3. Skahil, VHDL for Programmable logic- 2nd Ed - Wiley.

**B.TECH Vlth SEMESTER**
**VHDL LAB (EE-417E)**

P-3

| | |
|---|---|
| Exam | 25 |
| Sessional : | 50 |
| Time | 3Hrs |

**LIST OF EXPERIMENTS:**

1. Write a VHDL Program to implement a 3 :8 decoder.
2. Write a VHDL Program to implement a 8: 1 multiplexer using behavioral modeling.
3. Write a VHDL Program to implement a 1 :8 demultiplexer using behavioral modeling.
4. Write a VHDL Program to implement 4 bit addition/subtraction.
5. Write a VHDL Program to implement 4 bit comparator.
6. Write a VHDL Program to generate Mod- 10 up counter.
7. Write a VHDL Program to generate the 1010 sequence detector. The overlapping patterns are allowed.
8. Write a program to perform serial to parallel transfer of 4 bit binary number.
9. Write a program to perform parallel to serial transfer of 4 bit binary number.
10. Write a program to design a 2 bit ALU containing 4 arithmetic & 4 logic operations.

**NOTE:** At least 10 experiments are to be performed with at least 7 from above list, remaining 3 may either be performed from the above list or designed & set by concerned institution as per the scope

**TRANSDUCER & THEIR APPLICATION**
**EE-419-E**

| L | T | P | Total | |
|---|---|---|---|---|
| 4 | 1 | - | 5 | Theory: 100 Marks<br>Sessional: 50 Marks<br>Duration: 3 Hrs |

**UNIT - I**

Definition of transducer. Advantages of an electrical signal as out-put. Basic requirements of transducers, Primary and Secondary Transducer, Analog or digital types of transducers. Resistive, inductive, capacitive, piezoelectric, photoelectric and Hall effect transducers.

**UNIT-II**

Measurement of Displacement - Potentiometric resistance type transducers, inductive type transducers, differential transformer (L.V.D.T), capacitive transducers, Hall effect devices, strain gage transducers. Measurement of Velocity - variable reluctance pick up, electromagnetic tachometers, photoelectric tachometer, toothed rotor tachometer generator.

Measurement of Flow: Venturi meter, orifice meter, nozzle meter, Pitot-static tube, rotameter, turbine flow meter, ultrasonic flow meter, electromagnetic flow meter, hot wire anemometer.

**UNIT - III**

Measurement of Pressure - Manometers, Force summing devices and electrical transducers Measurement of Force - Strain-gage load cells, pneumatic load cell, L VDT type force transducer.

Measurement of Torque - Torque meter, torsion meter, absorption dynamometers, inductive torque transducer, digital methods

**UNIT - IV**

Measurement of Temperature - Metallic resistance thermometers, semi conductor resistance sensors (Thermistors), thermo-electric sensors, pyrometers.

Measurement of Liquid Level: Resistive Method, Inductive method, capacitive method Sound Measurement: Microphone, Types of Microphones.

Measurement of Humidity: Resistive, capacitive, aluminium oxide & crystal hygrometers.

**NOTE:**

The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

**Suggested Books:**


1. B.C. Nakra, K.K. Chaudhry, "Instrumentation Measurement and Analysis," . Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Thomas G. Beckwith etc. all, "Mechanical Measurements (International Student Edition), Addison-Wesley Longman, Inc. England.
3. A.K. Sawhney, " A Course in Electrical and Electronic Measurements and Instrumentation," Dhanpat Rai & Sons, Delhi-6.

**TRANSDUCER APPLICATION LAB**
**EE-421-E**

| L | T | P | Total |
|---|---|---|---|
| | | 3 | - |

Practical : 25 Marks
Sessional: 50 Marks
Duration: 3 Hrs

**LIST OF EXPERIMENT**

1. To Measure Temperature using RTD.
2. To Measure Displacement using L.V.D.T.
3. To Measure Load using Load Cell.
4. Pressure Measurement using Cantilever.
5. Light Measurement using LDR & Photo Cell.
6. To Measure Angular Displacement using Capacitive Transducer.
7. To Measure the Variation in Water Level using Capacitive Transducer.
8. To Measure Speed of DC Motor using Reluctance Method.
9. To Measure Strain using Strain Gauge.
10. To Measure Speed using Photo Interrupter Method.

**NOTE:** At least 10 experiments are to be performed with at least 8 from above list, remaining 2 may either be performed from the above list or designed & set by concerned institution as per the scope

**POWER SYSTEM LAB**
**EE-423-E**

| L | T | P | Total |
|---|---|---|---|
| - | - | 2 | - |

Practical: 25 Marks
Sessional: 50 Marks
Duration: 3 Hrs

1. To find out the dielectric strength of transformer oil.
2. To find zero sequence component of three phase line.
3. To draw the characteristics of thermal overload relay.
4. To study an IDMT over current relay to obtain and plot it's characteristic curves i.e. the graph between current and time.
5. To measure the ABCD parameters of a given transmission line.
6. To plot the power angle characteristics of given transmission lines.
7. To find the string efficiency of a string insulator with/without guard rings.
8. To study the characteristics of transmission line for t-network & pie- network.
9. To study and testing of a current transformer.
10. To study various types of distance relay

NOTE: At least 10 experiments are to be performed with at least 8 from above list, remaining 2 may either be performed from the above list or designed & set by concerned instit~tion as per the scope

**CIRCUIT SIMULATION LAB**
**EE-425-E**

| L | T | P | Total | |
|---|---|---|---|---|
| - | - | 2 | - | Practical: 25 Marks<br>Sessional: 25 Marks<br>Duration: 3 Hrs |

1. Design of Low pass filter with a Cut of frequency of 10KHz and gain = 2
2. Design a Band Pass filter with lower cut of frequency = 1 KHz and upper cut of frequency of = 2KHz and gain = 2.
3. Design a high pass filter with cut of frequency = 10KHZ and gain = 2
4. Design a positive and negative clipper using op amp 741
5. Design a positive and negative c1amper using op amp 741.
6. Design a practical integrator with a frequency of 2 KHz
7. Design a practical differentiator with a frequency of 4 KHz.
8. Design a square wave generator with frequency of 2 KHz.
9. Design a Wein bridge oscillator with frequency of 1 MHz.
10. Design a phase shift oscillator with frequency of 1 Khz.
11. To study RLC series resonance.
12. To study RLC parallel resonance.

NOTE: At least 10 experiments are to be performed with at least 8 from above list, remaining 2 may either be performed from the above list or designed & set by concerned institution as per the scope