4EE209PC/4EP209PC- Electrical Machine – I

Course Outcomes:

After Completion of this course, students will be able to:

1. **Explain** the Construction, working operation, of DC Machines.
2. **Illustrate** the different Characteristics, types, their Application and Parallel Operation of DC Generator.
3. **Demonstrate** the various types of DC motor, characteristics, starting method, testing method, speed control method and braking operation on DC motors.
4. **Explain** the Construction, working, types of Single-Phase Transformer and testing of Single-phase transformer.
5. **Explain** the Construction, working, different connections, applications and testing of three phase transformers.

Syllabus

Unit I: D.C. Machines:

Construction, Principle of Operation, EMF Equation, Torque Equation. Armature winding – Lap, wave, single layer, double layer. Armature Reaction and commutation, method of improving commutation.

Unit II: D.C. Generators:

Types- Separately & Self Excited generator, Characteristics- OCC, internal &External, Applications of D. C. Generators, Parallel Operation of Series, Shunt & Compound D.C. Generators, testing of DC Generators.

Unit III: D.C. Motors:

Types- Series, Shunt & Compound Motor, Characteristics of DC Motor, Applications of D.C. motors. Starting, Electric Braking, Speed Control of DC Motors. testing of DC Motors, Losses, efficiency.

Unit IV: Single phase Transformer:

Working Operation, EMF Equation, and separation of core losses, Equivalent Circuit,Phasor diagram, Parallel Operation. Open Circuit, Short Circuit &Sumpner's test on single phase transformer.

Single phase Autotransformer: - construction, working, merits, demerits and its application.

Unit V: Three Phase Transformer:

Construction, Working, Types, connections, vector groups, open delta Connection, Open Circuit test, Short Circuit test, load test, magnetic balance test.

Unit VI:

On load &Off load tap changers, Scott Connection, Power transformer and Distribution transformer. Three-winding transformer, Magnetisinginrush current phenomenon.

Books Recommended:

Text Books:

1) Nagrath& Kothari: Electrical Machines, (Tata McGraw-Hill Book Comp. Delhi.)
2) J. B Gupta: Theory Electrical machines, (Katria Publication)

Reference Books:

1) C. Dawes: Electrical Engineering Vol. I : Direct current (IV Edition), McGraw Hill Book Company
2) P. S. Bimbhra: Electrical Machinary, Khanna Publisher
3) Clayton and Hancok: Performance and design of d.c. machines

4EE210PC/4EP210PC - Control System

Course Outcomes:

After completing this course, student will be able to:

1. Demonstrate the fundamental concepts of automatic Control and mathematical modeling of the Systems.
2. Analyze the transfer functions, Signal flow graphs and feedback system for stability and noise reduction.
3. Examine the functionality and applications of various control system components like motors and encoders.
4. Analyze time response characteristics of first and second order system with error analysis.
5. Apply stability criteria using Routh-Hurwitz and frequency response methods.
6. Assess system stability through Bode plots, Nyquist plots and gain/phase margin analysis.

Syllabus:

Unit I: Introduction to Automatic Control

Open loop and closed loop system, servo-mechanisms, mathematical modeling of physical systems, transfer functions, block diagrams and signal flow graphs, Effect of feedback on sensitivity to parameter variation and reduction of the noise.

Unit II: Control System Components

Electrical / Electro-mechanical components such as A.C./D.C. servomotors, stepper motors, Synchors, potentiometers, Tacho-generators, encoders, their functional analysis and operating characteristics and their application.

Unit III: Time Response Analysis

Time response of first and second order systems to standard inputs. Time response specifications, types of system, error analysis, error coefficients, steady state errors, dynamic error series. Approximate methods for higher order system, proportional, derivative and integral control.

Unit IV: Stability

Stability of control systems, characteristics equation, impulse response, Routh-Hurwitz stability criterion, relative stability. Root Locus: construction of root locus, determination of roots from root locus conditions on variable parameter for stability, effect of addition of poles and zeros.

Unit V: Frequency Response Analysis

Frequency response of linear system, specification, Logarithmic frequency response (Bode) plots from transfer function for various systems. Polar plots for various systems, Nyquist criterion, Nyquist plots and stability analysis.

Unit VI: State Variable Analysis

Space model representation of LTI systems using physical system, Relationship between state variable model and transfer function, Solution of state equations.

Books Recommended:

Text Book:

1. Nagrath I.J., Gopal M.: Control System Engineering, Wiley Eastern.

Reference Books:

1. Control Engineering, D.Ganesh Rao, k. Chennavenkatesh, 2010, PEARSON
2. Modern Control System, Richard Dorf, Robert Bishop, 11th edition 2008 PEARSON
3. Ogata K: Modern Control Systems, Prentice Hall of India.
4. Control Systems by K.R.Varmah TMH edition 2010
5. Control System Engineering, R Ananda Natarajan, P Ramesh Babu, SCITECH Publications, Chennai, 2nd edition,2010
6. Automatic Control Systems – Basic Analysis &DesignbyW.A.Wolovich Oxford University Press, 1st edition 2010
7. Linear Control Systems, AshfaqHussain, HaroonAshfaq, DhanpatRai& co.

4EE211PC/4EP211PC - ElectromagneticFields

Courseoutcomes:

Attheendofthecoursethestudentwillbeableto:

1. Demonstratethebasicmathematicalconceptsrelatedtoelectromagneticvectorfields.
2. Applytheprinciplesofelectrostaticstothesolutionsofproblemsrelatingtoelectricfielda
3. Applytheprinciplesofmagnetostaticstothesolutionsofproblemsrelatingtomagneticfie ld.
4. ApplyMaxwell'sequationindifferentforms(differentialandintegral)todiverseengi neering problems.

Syllabus:

Unit I:

ReviewofVectorAnalysis:Cartesian,cylindricalandsphericalco-ordinatesystems,vectoralgebraandvector calculus. Line integral and multiple integrals. Gauss theorem.

UnitII:

Electrostatics:Coulomb'slaw,electricfield,Gaussfluxtheoremintegralanddifferentialform.Ele ctrostatics potential, Poison and Laplace equations.

UnitIII:

Electrostatics fields in dielectrics: electric dipole, polarization. P and D vectors, boundary conditions. Capacitance and electrical energy.

UnitIV:

Magneticfields:Biot-Savartlaw,Ampere'slawintegralanddifferentialform.Continuityequation,time of relaxation.electric current, J vector.

UnitV:

Magnetic fields in materials: magnetic dipoleboundaryconditionsbetween magneticmaterials, inductance, Electromagnetic Energy.

UnitVI:

Maxwell equations and wave equations: Displacement current, time varying fields and Maxwell's equations, plane uniform magnetic waves. Depth of penetration Poynting vector

TextBook:

1. **“**EngineeringElectromagnetics”,byHaytW.H.TataMc-GrawHillpublication

ReferenceBooks:

1. ElectromagneticfieldsbyTVSArunMurthySChand&Co
2. PrinciplesandapplicationsofElectromagneticfieldsbyPlansycollin,Mc-GrawHillBooks Co.
3. FoundationsofelectromagnetictheorybyJohnReitz,Addison WesleyPubCo.
4. BasicelectromagneticfieldbyHerbertNeelf,HarberInternationaleducation
5. Introductiontoelectromagnetic,DerucyandJohnson,Mc-GrawHillBooksCo.

4EE212PC/4EP212PC – Electrical Machine-I Lab

Conduct minimum eight experiments based on the syllabus of Electrical Machine – I subject (4EP209PC)

4EE213PC/4EP213PC – Control System Lab

Conduct minimum eight experiments based on the syllabus of Control System subject (4EP210PC)

4EE214MD/4EP214MD - Electrical Measurements

Course Outcomes:

A student completing this course, should be able to:

1. Classify the various measuring instruments like PMMC, MI, Electrodynamic type.
2. Explain the measurement of power and energy by wattmeter and energy meter.
3. Analyze various methods for measurement of resistance, inductance, and capacitance using AC/DC bridges.

Syllabus

Unit-I: Analog Instruments - Classification of measuring instrument, Different torques in measuring instrument, Construction, theory of operation, torque equation, errors, merits and demerits of analog Ammeter, Voltmeter (PMMC, MI instruments) and Electrodynamic type meter.

Unit II: Wattmeter and Energy Meter-Construction, theory of operation, torque equation, errors, merits and demerits of each type.

Analysis of three phase balanced load: - Blondell's theorem, Measurement of active and reactive power in single phase and three phase circuits.

Unit III: Measurement of circuit parameters- Different methods of measurement of inductance, capacitance and low, medium, high value of resistance,

Instrument transformers- C.T. and P.T., Importance, theory and construction and applications.

Text Book:

1. A.K. Sawhney, 'Electrical & Electronic Measurements & Instrumentation', DhanpatRai& Co (P) Ltd

Reference Books:

1. E.W.Golding & F.C.Widdis, 'Electrical Measurements & Measuring Instruments', A.H.Wheeler & Co.
2. Electrical Measurements and Measuring Instruments. By, R. K. Rajput. Publisher, S. Chand,

4EE215VS/4EP215VS – Electrical Software Lab

Develop minimum eight computer programme / Simulation models for various tasks in electrical engineering domain using any open source/professional software.

4EE216OE1/4EP216OE1: Electrical Drives

Course Outcomes:

After completing this course, Students will be able to:

1. Explain the basic of electrical drives and Power Electronics devices
2. Demonstrate various modern speed control techniques of DC drives
3. Demonstrate various modern speed control techniques of AC drives

Syllabus:

Unit I:

Fundamentals of electric drives: Definition, block diagram, types of electrical drives, duty cycle, selection criterion for electrical drives. Theory, principle and characteristics of Power Transistor, SCR, Power MOSFET and IGBT.

Unit II:

DC Motor & Drive: Types, construction, principle of working, characteristics. Speed control: Armature voltage and field current control methods.

Unit III:

AC Motor & Drive: Three phase Induction Motors:Types,construction, principle of working, torque-speed characteristics. Power Electronics based Speed Control of three phase induction motor i) Stator side control of three phase squirrel cage Induction Motor ii) Rotor side control of three phase slip ring Induction Motor

Text Books:

1. S.K.Pillai: A First Course on Electrical Drives by New Age International Publishing Co. Ltd
2. VedamSubrahmanyam: Electric Drives: Concepts & Applications by Tata McGraw Hill Publishing Co Ltd.

Reference Books:

1. I.J.Nagrath& D.P.Kothari: Electric Machines by Tata McGraw Hill Publishing Co Ltd.
2. V.K.Mehta: Principles of Electronics by S.Chand and Co Ltd,New Delhi
3. M.D.Singh & K.B.Khanchandani: Power Electronics by Tata McGraw Hill Publishing Co Ltd
4. Austin Hughes and Bill Drury: Electric Motor and Drives: Fundamentals, Types and Applications by Newness, Oxford.
5. Gopal. K. Dubey: Fundamentals of Electrical Drives by CRC Press
6. R. Krishnan: Electric Motor Drives: Modelling, Analysis & Control by Prentice Hall of India Pvt Ltd.

4EE216OE2/4EP216OE2: ELECTRICAL MACHINES

Course Outcomes:

After Successful completion of this course, Students will be able to:

1. Demonstrate their knowledge of construction, working, types, characteristics, starters, and speed control method of DC motor.
2. Describe the construction, working operation, performance characteristics, starters, speed control &application of three phase Induction Motor.
3. Explain the construction, working operation & performance characteristics of single-phase Induction Motor and special motors like universal motor, BLDC Motor.

Syllabus

Unit I:DC Motor:

Construction, Principle of Operation, Torque Equation, Types- Series, Shunt & Compound Motor, Characteristics of DC Motor, Starters for DC Motor, Speed Control of DC Motor. Applications of D.C. motors.

Unit II: Three phase Induction Motor:

Construction, Working, Torque equation, Torque Slip Characteristics, Starters for IM, Methods of speed control, single phasing phenomenon. Applications.

Unit III: Single phase Induction Motor:

Double revolving field theory, Constructional features, working, Split-phase starting methods Torque Speed Characteristics and applications of single-phase Induction motors.

Special Motors: Construction, working principle, and applications of Universal motor, & Brushless DC (BLDC) Motor.

Text Books:

1. I.J. Nagrath& D. P. Kothari: Electric Machines by Tata McGraw Hill Publishing Co Ltd. 2. J. B. Gupta: Theory of Electrical Machines, published by S. K. Kataria& Sons, Delhi.

Reference Books:

1. P. S. Bimbhra: Electrical Machinery, published by Khanna Publisher Delhi
2. C. Dawes: Electrical Engineering Vol. I: Direct current (IV Edition), (McGraw Hill Book Company)
3. A. S. Langdorf, “Theory of Alternating Current Machinery” Tata McGraw Hill Publication New Delhi.

4EE217EM/4EP217EM - Engineering Economics

Course Outcomes –

After successful completion of the course, students will be able to -

1. Apply the concepts economics to assess demand and, including elasticity and laws of returns.
2. Demonstrate the understanding of cost and revenue structures, market types and inflationary trends, and banking principles.
3. Make use of the principles of time value of money, economic equivalence, and depreciation to evaluate engineering projects through various methods.

Syllabus:

Unit I:

Engineering Economics- Nature, Scope, Basic problems of an economy, Micro Economics and Macro Economics.

Demand- Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Elasticity of demand & its measurement,

Supply-Meaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, Determination of market equilibrium.

Production-Production function, Laws of returns: Law of variable proportion, Law of returns to scale.

Unit II:

Cost and revenue concepts, Basic understanding of different market structures, Determination of equilibrium price under perfect competition, Break Even Analysis-linear approach.

Banking -Commercial bank, Functions of commercial bank, Central bank, Functions of Central Bank.

Inflation-Meaning of inflation, types, causes, measures to control inflation.

National Income-Definition, Concepts of national income, Method of measuring national income.

Unit III:

Time value of money- Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.

Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects.

Depreciation- Depreciation of capital assert, Causes of depreciation, Methods of calculating depreciation (Straight line method, Declining balance method).

Text Books:

1. Elementary Economic Theory by Dewett and Varma J.D., S.Chand and Co
2. Engineering Economics by R.PaneerSeelvan, PHI

Reference Books:

1. Principles of Economics, DevigaVengedasalam; KarunagaranMadhavan, Oxford University Press.
2. Principles of Micro Economics by Ahuja,H.L., S.Chand and Co
3. Macro Economics by S.P.Gupta, TMH
4. Engineering Economics by Riggs, Bedworth and Randhwa, McGraw Hill Education India
5. Engineering Economy by William G.Sullivan, Elin M.Wicks, C. PatricKoelling, Pearson