EE-5002 ELECTRICAL MACHINE -II

Unit I

Polyphase Synchronous Machines : Constructional features. Polyphase Distributed AC Windings: Types, Distribution, coil span and winding factors. Excitation systems, emf equation and harmonic elimination. Generator Mode, Interaction between excitation flux and armature mmf, equivalent circuit model and phasor diagram for cylindrical rotor machine. Salient pole machines: two reaction theory, equivalent circuit model and phasor diagram. Power angle equations and characteristics. Voltage regulation and affect of AVR. Synchronising methods, Parallel operation and load sharing, operation on infinite busbar.

Unit II

Motoring mode, Transition from motoring to generating mode, Phasor diagram, steady state operating characteristic, V-curves, starting, synchronous condenser, hunting -damper winding effects, speed control including solid state control.

Unit III

Analysis under sudden short circuit. Transient parameters of synchronous machines, various transient and sub-transient reactance, time constant. Expression of transient and sub transient reactance in terms of self and mutual inductances of various windings, Analysis of 3-ph short circuit oscillogram and determination of transient parameters from oscillogram.
Testing of Synchronous Machines - Stability considerations. Brush less generators, Single phase generators.

Unit IV

Generalized theory of Electrical Machines: Basics for development of generalized approach for analysis of electrical machines, Kron's Primitive machine, Concept of rotational transformer, voltage and pseudo stationary coil, Expression for self and mutual inductances of various windings w.r.t. rotor position, Park's and Inverse Parks transformation.

Unit V

Special Electric motors: Switched reluctance motor, linear machines- power energy and levitation types, PM brushless DC motors.

Reference Books:

1. Fitzgerald, C.Kingslay, S.D. Umans, Electric machinery ,5th Ed., McGraw Hills, 1992
2. GMC pherson and R.D. Laramorl, An Introduction to Electric Machine & Transformer,2nd Ed.,John Wiley & Sons, 1990

Text Books:

1. P.S. Bimbhra, Generalised Theory of Electrical Machines.
2. E. Open claw Tayler, The performance & Design of AC Computer Meters, A.H.Wheeler & Co. (P) Ltd. Alalhabad, 1971
3. I.J, Nagrath & D.P. Kothari, Electrical Machines, TMH Electrical Machine-II

EXPERIMENTS

1. Determination of complete torque speed characteristics of a three phase induction machine in braking, motoring and generating regions and it's calibration
2. Study of effect of rotor resistance on the load characteristics of a wound - rotor induction motor.
3. (a) Determination of equivalent circuit parameters, prediction of performance. Verification from actual load test. (b) Separation of losses of Induction motors and estimation of efficiency.
4. Speed control of Induction motor - Conventional, electronic. Solid state speed control using (i) V constant, (ii) V/f constant, (iii) slip - energy injection
5. Determination of equivalent circuit parameters of a single phase Induction motor. Prediction torque -speed characteristics. Verification from load test
6 Study of torque step rate characteristic of a stepper motor. Determination of operating range.
7. Load characteristic of universal motor, operating on dc and ac supply. Comparison of performance.
8. Load characteristic of shaded pole-motor.
9. Characteristic of switched reluctance motor.
10. Circle diagram of 3 phase Induction Motor.
11. Performance of 3 Ph. Induction Motor with single phasing and comparison.