GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

AC MACHINES

Course Code: GR15A2041 L:3 T:1 P:0 C:4
II Year II Semester

Prerequisites: In-depth knowledge of Physics oriented towards dynamics, heat, electricity, magnetism and calculus, analytical co-ordinate geometry and trigonometry, D.C Machines

Course Objectives
- To provide students with a strong back ground in Induction Motor, speed control techniques and its characteristics.
- To train the students to have the solid foundation in technical concepts required to engineering problems.
- To prepare the students to excel in post graduate programs or to succeed in industry.
- To provide a foundation in the theory and applications of above electrical machines.

Course Outcomes
- An ability to find role of electrical machinery pertaining to Synchronous machines, Single phase motors in simple & complex applications.
- Express importance of extensive research in electrical machines.
- In-depth knowledge of applying the concepts on real time applications.
- Articulate rotating magnetic generation
- Ability to calculate machine variables in direct and quadrature axis form
- Ability to express working of single and three phase AC Machines

Unit-I
Poly-phase Induction Motors: Poly-phase induction motors-construction details of cage and wound rotor machines-Production of a rotating magnetic field - Principle of operation - Rotor E.M.F and rotor frequency - Rotor reactance, rotor current and P.F at standstill and during operation.

Unit-II
Characteristics of Induction Motors: Rotor power input, rotor copper loss and mechanical power developed and their inter relation-Torque equation-Deduction from torque equation - Expressions for maximum torque and starting torque - Torque slip characteristic - Equivalent circuit - Phasor diagram - crawling and cogging. No-load Test and Blocked rotor test –Predetermination of performance-Methods of starting and starting current and Torque calculations

Speed Control Methods: Speed control-change of voltage, change of frequency, V/f ; Injection of an E.M.F into rotor circuit (qualitative treatment only)-Induction generator-Principle of operation.

Unit-III

Construction, Principle of operation, Characteristics & Regulation of Synchronous Generator : Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – Distribution, pitch and winding factors – E.M.F Equation.

Harmonics in generated E.M.F.: Suppression of harmonics – Armature reaction - Leakage reactance – Synchronous reactance and impedance – Experimental determination - Phasor diagram – Load characteristics

Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – Salient pole alternators – Two reaction analysis – Experimental determination of Xd and Xq (Slip test) Phasor diagrams – Regulation of salient pole alternators.

Unit-IV

Parallel Operation of Synchronous Generator: Synchronizing alternators with infinite bus bars – Synchronizing power torque – Parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – Determination of sub-transient, transient and steady state reactance's.

Synchronous Motors – Principle of Operation: Theory of operation – Phasor diagram – Variation of current and power factor with excitation – Synchronous condenser – Mathematical analysis for power developed, Hunting and its suppression – Methods of starting – Synchronous induction motor.

Unit-V

Single Phase Motors & Special Motors: Single phase Motors: Single phase induction motor – Constructional features- Double revolving field theory – Split-phase motors – Shaded pole motor.

Teaching Methodologies

1. EM-II ppts
2. Assignments uploaded in website

Text Books

1. Electric Machines –by I. J. Nagrath & D. P. Kothari, Tata Mc Graw Hill, 7th Edition.2009
2. Performance and Design of AC Machines-M. G. Say. BPB Publishers

Reference Books

1. Electro mechanics-II (transformers and induction motors) S. Kamakashaiah Hitech publishers.
2. Electric machinery - A.E. Fitzgerald, C. Kingsley and S. Umans, McGraw Hill Companies, 5th edition
3. Electrical machines-P.S Bhimbra, Khanna Publishers.
4. Theory of Alternating Current Machinery- by Langsdorf, Tata McGraw-Hill Companies, 2nd edition.
5. Electrical Machines – M.V Deshpande, Wheeler Publishing
6. Electrical Machines – J.B. Gupta, S.K. Khataria& Son's Publications