

3/4 B.Tech. FIRST SEMESTER

EE5T1

ELECTRICAL MACHINES-III

Credits : 4

Lecture : 4 periods/week
Tutorial : 1 period /week

Internal assessment: 30 marks
Semester end examination: 70 marks

Objective:

This subject is an extension of previous machines courses. It deals with the detailed analysis of Synchronous generators and motors which are the prime source of electrical power generation and its utilities. Also concerns about the different types of single phase motors which are having significant applications in house hold appliances and control systems.

Learning Outcomes :

1. Upon completing this course student understands the constructional details of synchronous machines, their load characteristics, able to solve the problems on regulation, parallel operation of alternation.
2. Upon completing the course students should be able understand the working principle methods of application of synchronous motor
3. Upon completing the course student should be able to understand principle operation of AC series motor, universal motor reluctance motor, stepper motor, BLDC motor.

UNIT I Construction and Principle of operation

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.

UNIT II Synchronous Generator Characteristics

Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics.

UNIT III Regulation of Synchronous Generator

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 X_d and X_q (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 reactances, Capability charts.

UNIT V 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 .

UNIT V Power Circles and Methods of starting of Synchronous Motors

Excitation and power circles – hunting and its suppression – Methods of starting – synchronous induction motor.

UNIT VII Introduction to Commutator Machines

Principle and performance of AC series motor- Universal Motor- Principle of permanent magnet and reluctance motors.

UNIT VIII Introduction to Special machines

Stepper Motor- principle, operation of variable Reluctance stepper Motor, permanent Magnet Stepper Motor and their applications.

Servomotor-Types-constuctional features-principle of operation – characteristics.

Induction generator- operation of Induction Generator – self excited and externally excited generators and its Applications.

Learning resources

Text Books:

1. Electrical Machines by PS Bhimbra Khanna publishers
2. Electrical Machines – by I.J.Nagrath & D.P.Kothari, Tata Mc Graw-Hill Publishers, 7th Edition 2005.
3. Electrical Machinery by A.E. Fitzgerald, C. Kingsley and S. Umans Mc Graw Hill Companies 5th edition 1990.

Reference Books:

1. The Performance and Design of A.C.Machines – by M.G.Say, ELBS and Ptiman & Sons.
2. Theory of Alternating Current Machinery by Langsdorf, Tata Mc Graw-Hill, 2nd edition.
3. Electromechanics-III (Synchronous and single phase machines), S.Kamakashiah, Right Publishers