

III Year – I SEMESTER**T P C**
3+1 0 3**ELECTRICAL MACHINES – III****Preamble:**

This course essentially covers ac machines. It covers topics related to principle of operation, constructional features and starting of single phase induction motors and three phase synchronous motors. In addition, it also covers voltage regulation and parallel operation of synchronous generators.

Learning Objectives:

- To study the application of “Double revolving field” theory for single – phase induction motor and appreciate the function and application of a.c series motor.
- To discuss e.m.f generation principle of synchronous generator and armature reaction effect.
- To study the effect of load at different power factors, methods of predetermination of regulation for non– salient and salient pole generators.
- To study the parallel operation and the concepts of transfer of real and reactive powers.
- To understand the operation and performance of synchronous motor.
- To study the power circle diagrams and methods of starting of synchronous motor.

UNIT – I:**Single Phase Motors**

Single phase induction motors – Constructional features and the problem of starting–Double revolving field theory–AC Series motor–Compensation.

UNIT-II:**Synchronous generator construction and operation**

Constructional features of non–salient and salient pole type – Armature windings –Distributed and concentrated windings – Distribution– Pitch and winding factors –E.M.F equation–Improvements of waveform and armature reaction– Numerical problems.

UNIT – III:**Voltage regulation of synchronous generator**

Voltage regulation by synchronous impedance method– MMF method and Potier triangle method–Phasor diagrams– Two reaction analysis of salient pole machines and phasor diagram– Numerical problems.

UNIT –IV:**Parallel operation of synchronous generators**

Parallel operation with infinite bus and other alternators – Synchronizing power – Load sharing –Transfer of real and reactive power– Numerical problems.

UNIT–V:**Synchronous motor – operation**

Synchronous Motor principle and theory of operation– Phasor diagram – Starting torque–Variation of current and power factor with excitation – Synchronous condenser – Mathematical analysis for power developed– Numerical problems.

UNIT – VI:**Synchronous motor performance and starting**

Excitation and power circles – Hunting and its suppression – Methods of starting – Synchronous induction motor.

Learning outcomes:

At the end of the course the student should be able to

- Analyze the performance of single phase induction and ac series motors.
- Explain the structure of synchronous machines and design the windings.
- Develop solutions for regulation of both non salient pole and salient pole synchronous generators.
- Explain the role of synchronous generators operation when connected to an infinite bus or when operating in parallel.
- Analyze the performance of synchronous motor for development of torque and power factor correction.
- Explain hunting phenomenon and methods of starting of synchronous motor.

Text Books:

1. Electrical Machines – by P.S. Bhimbra, Khanna Publishers.
2. The Performance and Design of AC Machines – by M.G.Say, ELBS and Ptiman & Sons.

Reference Books:

1. Electric Machinery – by A.E. Fitzgerald, C. Kingsley and S.Umans- by Mc Graw–Hill Companies, 5th edition, 1990.
2. Theory of Alternating Current Machinery by Langsdorf, Tata Mc Graw–Hill, 2nd edition.
3. Analysis of Electric Machinery and Drive systems – by Paul C. Krause, Oleg Wasynczuk and Scott D.Sudhoff, wiley publications, 2nd edition Publishers.