

2/4 B.Tech. SECOND SEMESTER

EE4T4

ELECTRICAL MACHINES – II

Credits: 4

Lecture: 4 periods/week

Internal assessment: 30 marks

Tutorial: 1 period /week

Semester end examination: 70 marks-

Objective:

As an extension of Electrical machines- I course, this subject facilitates to study of the performance of Transformers and Induction motors which play major role in power transmission, industrial drives and agricultural pump sets.

Learning outcomes :

1. Upon completing the course, students should be able to understand construction, working principle, operating characteristics of single phase and 3 phase transformers. Able to solve the problems about regulation, efficiency, sharing of load in parallel operation.
2. Upon completing the course, students should be able to understand the construction, working principle, speed torque characteristics, able to solve the problems with different types of motors for efficiency, torque, speed control methods and their industrial applications.
3. Upon completing the course, student should be able to understand double field theory, construction of single phase motor and their characteristics and industrial applications.

UNIT-I: Basic concepts: Principle of operation of transformer, constructional details of shell type and core type single-phase and three-phase transformers. EMF equation, operation of practical power transformer under no load and on load (with phasor diagrams).concept of ideal transformers and commercial transformers.

UNIT-II: Single Phase Transformers: Equivalent circuit, losses, efficiency, condition for maximum efficiency, all day efficiency. Open circuit and short circuit tests, calculation of parameters of Equivalent circuit. Regulation, predetermination of efficiency and regulation. Polarity test, Sumpner's test.

UNIT-III: Parallel operation of Single Phase Transformers: Need, conditions to be satisfied for Parallel operation. Load sharing in case of similar and dissimilar transformers. Auto- transformers (single and three phase)-construction, principle of operation, copper efficiency, Merits and De-merits and their applications.

UNIT-IV: Three Phase Transformers: Introduction, choice between single unit three-phase transformer and bank of single-phase transformers. Transformers connection for three-phase operation-star/star, delta/delta, zigzag/star and vee/vee,

choice of connection, Phase shift between primary and secondary and vector groups. Scott connection for three-phase to two-phase conversion and its applications. Conditions for parallel operation of three –phase transformers, load sharing, ON load and OFF load tap changers.

UNIT-V: Basic concepts of three phase Induction machines: Concept of rotating magnetic field. Principle of operation, construction of stator-stator windings, squirrel-cage & slip-ring rotors. Slip, torque-slip characteristic covering-motoring, generating and braking regions of operation. Maximum torque.

UNIT-VI: Three-phase Induction Motor: Phasor diagram of Induction Motor on no-load and on load. Equivalent circuit, losses, efficiency, No-load and blocked rotor tests. Circle diagram and performance evaluation of motor. Cogging and crawling.

UNIT-VII: High torque rotors: Double cage and deep bar rotors. Equivalent circuit and performance evaluation of double cage induction motor.

Starting methods of Induction Motors: Need for starter. Direct on line (DOL), Star-delta and autotransformer starting. Rotor resistance starting, modern methods – introduction to soft starters, principle of Induction generator.

UNIT-VIII:

(a) **Speed Control of Three-phase Induction Motors:** Speed control-voltage, frequency, and rotor resistance, pole changing and cascading of motors, introduction to solid state controllers.

(b) **Single Phase Induction Motor:** Double revolving field theory and principle of operation. Types of Single- Phase Induction Motors: split- phase capacitor start, shaded pole motors and their applications.

TEXT BOOKS:

1. Electrical Machines – P.S.Bhimbra, Khanna publishers
2. Electrical Machines – J.B.Guptha kataria publications
3. Electrical Machines (AC)-Asfaq Hussaian

REFERENCE BOOKS:

1. Performance and design of A.C machines by MG Say, BPB publishers.
2. Theory of Alternating Current Machinery by Langsdorf, Tata Mc Graw-Hill, 2nd edition.
3. Electrical Machines by I.J.Nagrath & D.P.Kothari, Tata Mc Graw - Hill publishers.

