

# TRANSFORMERS AND INDUCTION MACHINES (For EE Only)

Written by Administrator  
Friday, 06 November 2009 06:55 -

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**Sub Code**

:

**06EE46**

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**IA Marks**

:

**25**

**Hrs/ Week**

:

**04**

□

**Exam Hours**

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03

Total Hrs.

:

52

:

Exam Marks

:

100

**PART – A**

## UNIT 1:

**Basic Concepts:** Concept of coupled circuits. Dot convention. Writing network equilibrium equations in coupled circuits (problems on coupled circuits excluded). Principle of transformer action for voltage transformation. Constructional details of shell type and core type single-phase and three-phase transformers. Description of the following types of transformers — power transformer, distribution transformer, constant voltage transformer, constant current transformer, variable frequency transformers, auto-transformers. —

**6 Hours (20 Marks)**

## UNIT 2:

**Single-phase Transformers:** Concept of ideal transformer. Equation for E.M.F. induced in the two windings. Voltage transformation ratio. Ideal transformer on no-load and loaded condition with corresponding phasor diagrams. Concept of M.M.F. balance in the magnetic circuit of an ideal transformer. Current transformation ratio. Concept of referring impedance connected on one side of ideal transformer to the other side. Practical transformer – how it deviates from the ideal transformer. Development of exact equivalent circuit of a practical transformer – visualization of a practical transformer as an ideal transformer combined with imperfections of electric and magnetic circuits. Approximate equivalent circuit of a practical transformer. –

**6 Hours (20 Marks)**

## UNIT 3:

Phasor diagram of a practical transformer for both no-load and loaded conditions. Losses, power and all-day efficiency, regulation. Testing of transformers — O.C. test, S.C. test and predetermination of efficiency and regulation. Sumpner's test. Parallel operation — need, conditions to be satisfied for parallel operation. Load sharing. —

**6 Hours (20 Marks).**

## UNIT 4:

**Three-phase Transformers:** All types of three-phase transformer connections including open delta. Choice of connection. Bank of single-phase transformers for three-phase operation. Phase conversion using transformers. Scott connection for three-phase to two-phase conversion. Labeling of three-phase transformer terminals, phase shift between primary and secondary and vector groups. Conditions for proper operation of three-phase transformers in parallel. —

**7 Hours (20 Marks).**

**PART – B**

**UNIT 5:**

**(a) Three-winding Transformers:** Advantages and disadvantages of three-winding transformers. Equivalent circuit. — **2 Hours (5 Marks).**

**(b) Basic Concepts of Induction Machines:** Concept of rotating magnetic field. Operating principle, construction, classification and types — single-phase, three-phase, squirrel-cage, slip-ring, double-cage types.—

**5 Hours (15 Marks).**

**UNIT 6:**

**Three-phase Induction Motor:** Phasor diagram of induction motor on no-load and loaded conditions. Visualization of a three-phase induction motor as a generalized transformer with a rotating secondary and obtaining its equivalent circuit. Different kinds of power losses in an induction motor. Efficiency. Performance evaluation — output power, torque, efficiency, current and power factor. —

**7 Hours (20 Marks).**

## UNIT 7:

Torque-slip characteristics covering motoring, generating and braking regions of operation. Induction generator. No-load and blocked rotor tests. Circle diagram and therefrom performance evaluation of the motor. Cogging and crawling. Equivalent circuit and performance of double-cage and deep-bar motors. —

**6 Hours (20 Marks).**

**UNIT 8:**

**(a) Starting and Control of Three-phase Induction Motor:** Need for starter. DOL, Y-Delta and auto-transformer starting. Rotor resistance starting. Electronic starters (any one type). Speed control — voltage, frequency, and rotor resistance variations.—

**4 Hours (10 Marks).**

**(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. —  
**3 Hours (10 Marks).**

**Text Books**

1. **“Theory of Alternating Current Machines”**, Alexander Langsdorf, T.M.H.
2. **“Electric Machines”**, I. J. Nagrath and D. P. Kothari, 2nd Edition, T.M.H., ISBN 0-07-463285-X.

**References**

1. **“Performance and Design of A.C. Machines”**, M. G. Say, C.B.S. Publishers.
2. **“Electrical Machines”**, Ashfaq Hussain, Dhanpatrai and Co.

3. **“Electrical Machines and Transformers”**, Kosco, P.H.I.