COURSE TITLE   : INDUCTION MACHINES
COURSE CODE   : 5031
COURSE CATEGORY   : A
PERIODS/WEEK   : 5
PERIODS/SEMESTER   : 65
CREDITS   : 4

TIME SCHEDULE

MODULE	TOPICS	PERIODS
1	Principle of Transformer	**16**
2	Testing of Transformer And Instrument Transformers	**16**
3	Principle and Construction of Three Phase Induction Motors	16
4	Testing and Speed Control of Induction Motors	**17**
Total		**65**

Course Outcome:

Sl.	Sub	**On completion of this course the student will be able:**
1	1	To comprehend the working principle of transformers.
	2	To understand the constructional details of transformer
	3	To understand the performance of the transformer
2	1	To comprehend the various methods of testing of transformer.
	2	To comprehend different types of three phase transformers
	3	To understand the operation and use of instrument transformer
3	1	To comprehend the working principle of induction motors.
	2	To comprehend the constructional details of different three phase induction motors.
	3	To understand the performance of the induction motors.
4	1	To comprehend the testing methods of three phase induction motors
	2	To understand the different types of starters used for starting three phase induction motors.
	3	To comprehend the speed control of induction motors.
	4	To understand the Electrical braking in induction motors

Specific Outcome:

MODULE I: Principle of Transformer

1.1.0   To explain the working principle of transformer
1.1.1   To illustrate the concept of ideal transformer

1.2.0   To describe the construction of a single phase transformer

1.3.0   To derive the emf equation of transformer
1.3.1   To define the voltage and current transformation ratio
1.3.2   To describe the effect of voltage and frequency variation in transformers
1.3.3   To illustrate the transformer on no load
1.3.4   To illustrate the transformer on load
1.3.5   To illustrate the effect of resistance and leakage reactance of transformer
1.3.6   To draw the phasor diagram of transformer on load
1.3.7   To determine the equivalent resistance and reactance of transformer referred to both Primary and secondary

MODULE II: Testing of Transformer and Instrument Transformers

2.1.0   To draw the equivalent circuit of transformer
2.1.1   To state the voltage regulation of transformer
2.1.2   To identify the losses in a transformer
2.1.3   To define the transformer efficiency
2.1.4   To describe pre determination of efficiency and regulation of a transformer
2.1.5   To determine the regulation and efficiency of a transformer by direct loading
2.1.6   To solve the simple problems to determine efficiency and regulation
2.1.7   To define all day efficiency

2.2.0   To explain the construction of three phase transformer
2.2.1   To identify and draw the three phase transformer connections
2.2.2   To describe the formation of three phase transformer by using two single phase transformers
2.2.3   To describe three phase to two phase and vice versa
2.2.4   To explain why tertiary winding is required
2.2.5   To describe magnetostriction effect and its implications
1.3.0   To illustrate parallel operation of transformers
1.3.1   To illustrate the auto transformer construction
1.3.2   To derive the equation of saving of copper in autotransformer
1.3.3   To describe the construction and working of instrument transformer

1.3.4   To give the rating of transformer

1.3.5   To explain the different cooling methods of transformer

MODULE III: Principle and Construction of Three Phase Induction Motors

3.1.0   To explain the principle of operation of three phase induction motor

1.2.0   To describe the construction of three phase induction motor

2.1.0   To define the slip of three phase induction motor

2.1.1   To solve the simple problems to find slip

2.1.2   To explain the rotor emf, rotor current and power factor

2.1.3   To draw the torque- slip and torque-speed curve

2.1.4   To explain the effect of change in supply voltage on starting torque

2.1.5   To explain the effect of change in supply voltage on torque and slip

2.1.6   To differentiate full load torque and maximum torque

2.1.7   To differentiate starting torque and maximum torque

2.1.8   To draw and explain the current- speed characteristics

2.1.9   To illustrate the different losses of three phase induction motor

2.1.10   To explain the efficiency of three phase induction motor

2.1.11   To draw power flow diagram

2.1.12   To explain power stages in three phase induction motor

2.1.13   To solve the problem to find torque and efficiency of three phase induction motor

2.1.14   To define rotor torque and synchronous watt

2.1.15   To explain the different factors for determination of torque

2.1.16   To draw and explain equivalent circuit of induction motor

2.1.17   To explain the phasor diagram of induction motor

MODULE IV: Testing and Speed Control of Induction Motors

4.1.0   To describe the   no-load and blocked rotor test of induction motor

4.1.1   To explain the different methods for measuring slip

4.1.2   To draw and explain circle diagram

4.1.3   To draw the performance curves of induction motor

4.1.4   To explain the factors governing the performance of induction motor

4.1.5   To describe high torque cage motors

4.1.6   To describe the equivalent circuit of double cage motor

4.1.7   To specify the ratings and types of enclosures of three phase induction motor

4.2.0   To describe the starting of squirrel cage induction motor

4.2.1   To describe the starting of slip ring induction motor

4.3.0   To illustrate the following speed control of induction motor

      I.   Kramer system of speed control

     II.   Leblanc system of speed control

    III.   Scherbius system of speed control

4.4.0   To   describe the electrical braking of poly phase induction motors

CONTENT DETAILS

MODULE I

Transformer –principle of operation-ideal transformer-practical transformer-construction of single phase transformer. Emf equation – problems. Transformation ratio. Transformer on no load- ideal and practical. Transformer on load. Resistance and leakage reactance- equivalent resistance and reactance as referred to both primary and secondary- problems. Vector diagram on load at various power factor.

MODULE II

Equivalent circuit of transformer. Regulation. Losses and efficiency- condition for maximum efficiency-problems. Testing of transformer- polarity test – O C & S C test. Pre-determination of efficiency and regulation. Parallel operation. Three phase transformer- construction. Transformer connections - banking of transformer- Cooling of transformer. Auto transformer. Instrument transformer.

MODULE III

Three phase induction motor-production of rotating magnetic field- construction – principle of operation –slip- problems. Torque equation - problems. Torque – slip characteristics. Starting torque-full load torque- maximum torque- problems. Losses and efficiency- power stages- problems. Equivalent circuit- vector diagram.

MODULE IV

Testing of 3 phase induction motors- direct load test- no load and blocked rotor test. Slip measurement. Circle diagram – predetermination of performance and maximum quantities. Double cage rotor - equivalent circuit of double cage motor. Starting of induction motors. Speed control of induction motor. Application of induction motor

TEXT BOOKS

1. BL Theraja. Electrical technology. Vol- II: S Chand & co.
2. J.B. Gupta. Theory & Performance of Electrical Machines: S. K. Kataria & Sons