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# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Regular) - May, 2018

Regulation: IARE – R16

AC MACHINES

Time: 3 Hours

(EEE)

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

## UNIT – I

- Explain the constructional details and working principle of three phase induction motor with neat sketch? [7M]
  - A three phase, 50Hz, 8 pole, induction motor has full load slip of 2%. The rotor resistance and stand still rotor reactance per phase are 0.001ohm and 0.005 ohm respectively. Find the ratio of the maximum to the full load torque and speed at which the maximum torque occurs. [7M]
- Draw and explain the torque slip characteristics of the three phase induction motor with different modes of operation? [7M]
  - A three phase star connected 400V, 50Hz four pole induction motor has the following per phase parameters in ohms, refer to the stator.  $R_1=0.15$ ,  $X_1=0.45$   $R_{21}=0.12$ ,  $X_{21}=0.45$   $X_m=28.5$  compute the stator current and power factor when the motor is operated at rated voltage and frequency with  $s=0.04$ . [7M]

## UNIT – II

- What are the different starting methods for induction motor and Explain the auto transformer starting method for three phase induction motor? [7M]
  - A six pole, 50Hz three phase induction motor running at 960rpm on full load 4% slip develops a torque of 149.3N-m at its pulley rim. The friction and Windage losses are 200W and stator Cu and iron losses equal 1,620W. Calculate the i) Output power ii) the rotor Cu losses iii) the efficiency at full load. [7M]

- A 415-V, 29.84KW, 50Hz, delta connected motor gave the following test data.

Construct the circle diagram and determine a) The line current and power factor for rated output b) The Maximum torque. Assume Stator and Rotor Cu loss at stand still.

No-Load : 415V, 21A, 1,250W Short circuit : 100V, 45A, 2,730W

[14M]

## UNIT – III

- Describe the difference in construction of rotors of alternators used in hydroelectric plants and steam plants. Draw neat sketch of two types of rotors. [7M]

- (b) A 3, 6 pole synchronous generator has a resultant air gap flux of 0.06wb per pole. The flux is distributed sinusoidally over the pole. The stator has 2 slots per pole per phase and 4 conductors per slot are accommodated. The coil span is  $150^\circ$  electrical. Calculate the phase and line induced voltages when the machine runs at 375 rpm.

[7M]

6. (a) What do you mean by synchronizing of alternator? Describe any one method of synchronizing.  
(b) With the aid of circuit diagram for inductive impedance between two voltages sources and is associated phasor diagram derive an expression for power developed.

[7M]

#### UNIT – IV

7. (a) Explain different methods of starting synchronous motor. [7M]  
(b) A 2000V, 3, Y connected synchronous motor has an effective resistance and synchronous reactance of  $0.2\Omega$  and  $2.2\Omega$  per phase respectively. The input is 800KW at nominal voltage and the induced line emf is 2500V. Calculate the line current and pf. [7M]
8. (a) Explain the effect of excitation on armature control and power factor for synchronous motor? [7M]  
(b) A 6600V Star connected three phase synchronous motor works at constant voltage and constant excitation. Its synchronous reactance is 20 ohm per phase and armature resistance negligible. When the input power is 1000KW, the power factor is 0.8 leading. Find the power angle and power factor when the input is increased to 1500kW. [7M]

#### UNIT – V

9. (a) Explain the principle of operation of the Single phase Induction motor by the double field revolving theory? [7M]  
(b) Explain the operation of Capacitor start-Run Induction Motor? [7M]
10. (a) Draw and Explain the equivalent circuit of a single phase induction motor without core losses? [7M]  
(b) Find the mechanical power output of 185-W, 4 pole, 110-V, 50Hz single phase induction motor, whose constants are given below at a slip of 0.05.  $R_1=1.86$  ohm,  $X_1=2.56$  ohm,  $R_2=3.56$  ohm,  $X_2^1=0.45$  ohm,  $X_2=2.56$  ohm,  $X_\phi=53.5$  ohm, Friction and Windage losses=13.5W. [7M]

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