Hall Ticket No | | | | | | | | | | | Question Paper Code: AEE007

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Regular / Supplementary) - May 2019

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

1. (a) Describe the constructional details of three phase squirrel cage induction motors with neat sketches. **[7M]**

   (b) The power input to the rotor of a 400 V, 50.Hz, 6-pole, three-phase induction motor is 20 kW. The slip is 3%. Calculate (i) the frequency of rotor current (ii) rotor speed (iii) rotor copper losses and (iv) rotor resistance per phase if rotor current is 60 A. **[7M]**

2. (a) Derive the equation of developed torque in three phase induction motor and state the effect of increase in rotor resistance on torque developed by motor. **[7M]**

   (b) A 400V, 3-Phase, 50 Hz, star connected induction motor has following per phase parameters R_1=0.15 Ω, X_1=0.45 Ω, R_2=0.12 Ω and X_2=0.45 Ω, X_m=28.5Ω. Fixed losses(core, friction and windage losses)=400 watts. Compute the stator current, rotor speed, power factor, output torque developed in N-M, output power developed,when the motor is operated at rated voltage and frequency at a slip of 4%. **[7M]**

UNIT – II

3. (a) List the speed control methods of three phase induction motor. Explain any two methods in detail. **[7M]**

   (b) A three phase, 400 V slip ring induction motor gave the following test readings;
   No load test : 400 V, 1250 W, 9 A,
   Blocked rotor test : 150 V, 4 kW, 38 A
   Draw the circle diagram. If the normal rating is 14.9 kW, Evaluate the full load value of current, power factor and slip from the circle diagram. **[7M]**

4. (a) Explain the working of induction generator. Explain the construction details and working of star-delta starter used in three phase induction motor. **[7M]**

   (b) A 6 pole, 50 Hz, three phase induction motor is running at 3% slip when delivering full load torque. It has standstill rotor resistance of 0.2 Ω and reactance of 0.4 Ω per phase. Calculate the speed of the motor if an additional resistance of 0.6 Ω per phase is inserted in the rotor circuit. The full load torque remains constant. **[7M]**

UNIT – III

5. (a) Explain the ASA method of finding the voltage regulation with relevant sketches. **[7M]**

   (b) Two 20 MVA, three phase alternators operate in parallel to supply a load of 35MVA at 0.8 power factor lagging. If the output of one machine is 25 MVA at 0.9 lagging, compute the output and power factor of the other machine. **[7M]**

6. (a) What is voltage regulation? Explain the synchronous impedance method for the determination of voltage regulation of an alternator. **[7M]**

   (b) Two alternators with identical speed/load characteristics are connected in parallel. Their induced emfs are $3000\angle 20^0$ V and $2900\angle 0^0$ V, synchronous impedances are (2 + j20) Ω/phase and (2.5 + j30) Ω/phase respectively. The load is connected with impedance of (10 + j4) Ω/phase. Find the load terminal voltage and circulating current under no load. **[7M]**

UNIT – IV

7. (a) Write short notes on synchronous condenser and construction of 'V' curves. **[7M]**

   (b) A 400 V, 50 Hz, 3 phase, 37.5 kW, star connected synchronous motor has a full load efficiency of 88%. The synchronous impedance of the motor is (0.2 + j 1.6) ohm per phase. If the excitation of the motor is adjusted to give a leading power factor of 0.9, calculate the excitation emf and the total mechanical power developed. **[7M]**

8. (a) Draw and explain power and excitation circles of synchronous motor. **[7M]**

   (b) A 75 kW, 400 V, 4 pole, three phase star connected synchronous motor has a resistance and synchronous reactance per phase of 0.04 Ω and 0.4 Ω respectively. Compute for full load 0.8 power factor lead the open circuit emf per phase and mechanical power developed. Assume an efficiency of 92.5% **[7M]**

UNIT – V

9. (a) Using double field revolving theory, explain why a single phase induction motor is not self staring. Also obtain the equivalent circuit of single phase induction motor. **[7M]**

   (b) The following data pertains to a 230 V, 50 Hz capacitor start single phase induction motor at stand still. Main winding excited alone=100V, 2A, 40 W.

   Auxiliary winding excited alone= 80 V, 1 A, 50 W.

   Determine the value of capacitance for determining the maximum torque. **[7M]**

10. (a) Explain the different types of starting methods of single phase induction motor and also draw the torque speed characteristics. **[7M]**

    (b) A single phase induction motor has stator windings in space quadrature and is supplied with a single phase voltage of 200V at 50Hz. The standstill impedance of the main winding is (5.2+10.1j) and the auxiliary winding is (19.7+14.2j). Find the value of capacitance to be inserted in the auxiliary winding for maximum starting torque. **[7M]**

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