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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year II Semester Examinations, May - 2019

ELECTRICAL MACHINES – II

(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a)	What is rotating magnetic field of a three phase induction motor.	[2]
b)	Define slip of an induction motor. Write the equation for the same.	[3]
c)	What is cogging of an induction motor?	[2]
d)	List three different speed control methods of a three phase induction motor.	[3]
e)	List any two advantages of rotating magnetic field in Synchronous Generators.	[2]
f)	List any three differences between smooth Cylindrical and Salient pole types of Alternator.	[3]
g)	Why a 3-phase synchronous motor always runs at synchronous speed?	[2]
h)	List any three conditions to be satisfied for parallel operation of alternators.	[3]
i)	Classify different types of single phase induction motors.	[2]
j)	Explain Double revolving field theory of Single phase Induction motor.	[3]

PART – B

(50 Marks)

2.a)	Define i) Synchronous speed, ii) Actual speed of an induction motor.	
b)	A three phase, 400V, 100hp, 50Hz, 4-pole induction machine delivers rated output power at a slip of 5%. Determine the i) synchronous speed ii) motor speed (actual speed) iii) frequency of the rotor induced voltage.	
c)	12 pole, 3 phase alternator driven at a speed of 500rpm supplies power to an 8pole, 3phase induction motor. If the slip of the motor at full load is 0.03, calculate the full load speed of the motor.	[10]

OR

3.a)	The active power input to a 415V, 50Hz, 6 pole 3-phase Induction motor running at 970rpm is 41kW. The input power factor is 0.9. Calculate line current and slip.	
b)	With the help of neat diagram explain the constructional features of wound rotor type of induction motor. Write any one advantage and dis- advantage of wound rotor type of induction motor.	[5+5]

4. The following test results are obtained from a three phase, 100 hp, 460 V, eight pole, star-connected squirrel-cage induction machine.
No-load Test: 460 V, 60 Hz, 40 A, 4.2 kW
Blocked rotor test: 100 V, 60 Hz, 140 A, 8.0 kW.
Average dc resistance between two stator terminals is 0.152 Ω.
(a) Determine the parameters of the equivalent circuit and (b) the motor is connected to a three phase, 460 V, 60 Hz supply and runs at 873 rpm. Determine the input current, input power, air gap power, rotor copper loss, mechanical power developed, output power, and efficiency of the motor. [10]

OR

5.a) The following data refers to a 12 pole , 420 V, 50 Hz, 3-phase mesh connected induction motor:
R_1=2.95Ω, X_1=6.82Ω, R_2^1=2.08Ω, X_2^1=4.11Ω per phase. On no load, the line value of magnetizing current is 6.7 A and the total core loss is 269 W, Determine the p.f., input current, equivalent rotor current and torque developed by the motor at a slip of 3% using exact equivalent circuit.

b) Why starters are necessary for starting an induction motor? What are the various types of starters used for Induction motor starting? [5+5]

6.a) Explain the direct axis synchronous reactance and quadrature axis synchronous reactance of salient pole alternator. On which factors these values depend.

b) A 3 phase 8 pole star connected alternator has the armature coils short chorded by one slot. The coil span is 165^0 electrical. The alternator is driven at the speed of 750rpm.if there are 12 conductors per slot and flux per pole is 50 mWb. Calculate the value of induced emf across the terminals. [5+5]

OR

7. The following test results are obtained on a 6600V alternator:

Open circuit voltage	3100	5000	6600	7500	8300
Field current(amps)	16	25	37.5	50	70

A field current of 20A is found necessary to circulate full load current on short circuit of the armature. Using ampere-turn method, find the full load regulation at 0.8 pf lagging. [10]

8. A three phase, 250 hp, 2300 V, 60 Hz, Y connected non-salient rotor synchronous motor has a synchronous reactance of 11 Ω per phase. When it draws 165.8 kW, the power angle is 15 electrical degrees. Neglect ohmic losses. Determine (a) The excitation voltage per phase EF (b) The supply line current Ia and (c) The supply power factor. [10]

OR

9. Two identical 2000 KVA alternators operate in parallel. The governor of first machine is such that the frequency drops uniformly from 50 Hz on no load to 48 Hz on full load. The corresponding speed drop in second machine is 50 to 47.5 Hz.
a) how will the two machines share a load of 3000kw? b) what is the maximum load a unity power factor that can be delivered without overloading either machine? [10]

10.a) Develop equivalent circuit of a single phase induction motor in terms of its circuit parameters.

b) Find the input current, power factor and efficiency of a ½ h.p., 110V, 50Hz, single phase induction motor based on double revolving field theory with the following data at a slip of 5%.
Stator impedance = 2+j3Ω
Equivalent rotor impedance = 2+j3Ω
Magnetizing impedance = 50Ω
Friction and windage loss = 25 W. [5+5]

OR

11.a) Explain with neat sketches the construction and working principle of a Shaded-pole induction motor.

b) A single-phase, 120 V, 60 Hz, four-pole, split-phase induction motor has the following standstill impedances.
Main winding: $Z_m = 5 + j6.25$
Auxiliary winding: $Z_a = 8 + j6$
(i) Determine the value of capacitance to be added in series with the auxiliary winding to obtain maximum starting torque.
(ii) Compare the starting torques and starting current with and without the added capacitance in the auxiliary winding circuit when operated from a 120V, 60 Hz supply. [5+5]

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