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(51)

National Institute of Technology, Hamirpur (HP)

Name of the Examination: B.Tech

Branch	:	Electrical Engineering	**Semester**	:	5^{th}
Course Name	:	Electrical Machines-II	**Course Code**	:	EE-312

Time: 2 Hours   Maximum Marks: 50

Note: All questions are compulsory.
Assume data where ever Necessary.

1. The rotor resistance and standstill reactance of a 3-phase induction motor are 0.015Ω and 0.09Ω per phase. At normal voltage, the full-load slip is 3%. Estimate the percentage reduction in stator voltage to develop full-load torque at one-half of full-load speed. What is then the power factor? (5)

2. The normal full-load slip and shaft torque of a 500 hp, 50 Hz, 3-phase induction motor are 1.9% and 2400 Nm respectively. The rotor winding has a resistance of 0.25 Ω and a standstill reactance of 1.5 Ω per phase. Estimate the slip and power output for the same full load current when external resistance of 2 Ω per phase are inserted in the rotor circuit. Neglect no-load current. (5)

3. Explain the procedure of drawing the circle diagram of an induction motor. What information can be drawn from the circle diagram? (5)

4. A 400V, 50Hz, induction motor, when started directly from the mains takes 4 times the full-load current and the torque produced is twice the full-load torque. Determine:
   i. The motor current, the line current and the starting torque when started by means of an autotransformer of ratio 2.5:1.
   ii. The voltage to be applied and the motor current if the full-load torque is to be obtained at starting. (5)

5. A 4-pole, 230V, 50Hz, single phase induction motor has the following constants in ohms referred to stator.

R_1	X_1	R_2	X_2	X_m
2.3	3.2	4.2	3.2	74

Core loss=98 Watts. If this motor is running with a slip of 0.05 at rated voltage and frequency, then compute the stator current, pf, power output, efficiency with auxiliary winding open. (5)

6. Explain excitation and power circles of a cylindrical pole synchronous motor. Hence show that the minimum and maximum current for any power occurs at U.P.F. (5)

7. Draw the phasor diagram of a salient pole synchronous generator supplying full load lagging current and hence find the expression for the per phase real power output as a function of load angle. (5)

8. A 3-phase star-connected synchronous generator supplies a load current of 9A at 0.9 power factor lagging at 440V. Find the load angle and the components of armature current I_d and I_q if X_d=9Ω and X_q=5Ω. Neglect armature resistance. Calculate voltage regulation of the alternator. (5)

9. A 3-phase, 17.32 KVA, 400 V, star-connected alternator is delivering rated load at 400 V and at p.f. 0.8 lag. Its synchronous impedance is (0.2+j2) Ω per phase. Find the load angle at which it is operating. Now, with the magnitude of e excitation voltage held constant, the nature of rated load p.f. is altered to pf 0.8leading. determine the value of new terminal voltage. (5)

10. State the conditions necessary for paralleling the alternators and descried the alternator synchronizing procedure. (5)