



17511

21415

3 Hours/100 Marks

Seat No.

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- Instructions:** (1) **All** questions are **compulsory**.
(2) Answer **each** next main question on a **new page**.
(3) Illustrate your answers with **neat** sketches **wherever** necessary.
(4) Figures to the **right** indicate **full** marks.
(5) Assume **suitable data**, if necessary.
(6) **Use of Non-programmable Electronic Pocket Calculator is permissible**.
(7) **Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.**
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MARKS

1. A) Attempt **any three** :

12

- Compare squirrel cage induction motor and slip ring induction motor on any four points.
- Explain the working principle of 3 phase induction motor.
- Explain with diagram how star delta starters are used for reducing the starting current of 3 phase induction motors.
- Derive the relationship between N_s and f of alternator.

B) Attempt **any one** :

6

- Explain speed control method of 3 phase induction motor by the following methods :
 - Frequency control
 - Stator voltage control
 - Rotor resistance control.
- Explain working principle of AC series motor. Draw speed-torque characteristics of AC series motor.

P.T.O.



2. Attempt **any four** :

16

- a) Explain the effect of resistance of rotor winding on starting torque of 3 phase IM.
- b) Explain effect of voltage on torque speed characteristics of 3 phase IM.
- c) Explain why armature winding of an alternator is short pitched and distributed.
- d) Compare salient pole and cylindrical rotor alternator (any four points).
- e) Explain construction and working of permanent magnet stepper motor.
- f) Explain construction and working of AC servomotor.

3. Attempt **any four** :

16

- a) Derive the condition for T_{max} of a 3 phase induction motor.
- b) A 3 phase, 6 pole induction motor is connected to a 50 Hz supply. Calculate synchronous speed, rotor speed at 4% slip, frequency of rotor induced voltage at 4% slip, frequency of stator voltage at 10% slip.
- c) Calculate the value of pitch factor for a 3 phase winding of a 4 pole alternator having 36 slots and the coil is spread from 1st slot upto 7th slot.
- d) Define each of following terms of alternator :
 - i) Leakage reactance
 - ii) Synchronous impedance
 - iii) Distribution factor
 - iv) Pitch factor.



e) Write **any two** applications of **each** of the following :

- i) Shaded pole IM
- ii) Capacitor start induction run
- iii) Resistance start induction run
- iv) Capacitor start capacitor run.

4. A) Attempt **any three** :

12

- a) A 37 kW (output), 4 pole, 50 Hz 3ϕ , induction motor has a friction and windage loss of 20 Nm. The stator losses equal the rotor copper loss. Calculate input power to the stator winding when the 3 phase induction motor is delivering full load output at 1440 rpm.
- b) Explain how each of the following can reduce starting current of 3 phase IM :
 - i) By inserting resistance in rotor winding
 - ii) By connecting autotransformer in stator winding.
- c) A 3 phase star connected alternator is rated at 1500 kVA, 13.5 kV. The armature resistance and synchronous reactance are 1.4Ω and 25Ω respectively per phase. Calculate percentage voltage regulation for a load 1200 kW at 0.8 leading pf.
- d) State essential conditions for operation of alternators in parallel.

B) Attempt **any one** :

6

- a) Explain armature reaction in alternators for unity pf, zero pf leading, zero pf lagging load. Draw suitable waveforms showing the effect of armature flux.
- b) Derive the emf equation of an alternator.

**MARKS**

5. Attempt **any four** : **16**
- a) Draw a block diagram showing power stages of a 3 phase induction motor.
 - b) Derive the ratio of full load torque and maximum torque of a 3 phase induction motor.
 - c) State any four advantages of operating alternators in parallel.
 - d) Explain 'lamp method' of synchronising alternator to the bus bar.
 - e) Explain with diagram working of Linear Induction Motor.
 - f) Explain working principle of induction generator.
6. Attempt **any four** : **16**
- a) Explain why single phase induction motors are not self starting.
 - b) Explain with diagram the working of a universal motor.
 - c) Explain the method of finding regulation of alternator by ampere turn method.
 - d) Explain working of capacitor start and capacitor run single phase induction motor.
 - e) Explain working of shaded pole induction motor with suitable sketches.
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