

22523

21222

3 Hours / 70 Marks

Seat No.

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15 minutes extra for each hour

- 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.

Marks

- 1. Attempt any FIVE of the following: 10**
- a) Define synchronous speed and slip speed.
 - b) State any four types of single phase Induction motor.
 - c) List any four applications of single phase Induction motor.
 - d) Define synchronous impedance and synchronous reactance.
 - e) State methods of starting of synchronous motor.
 - f) Draw schematic diagram of AC servo motor.
 - g) List any four applications of BLDC motor.
- 2. Attempt any THREE of the following: 12**
- a) Draw block diagram showing power stages of 3 ϕ Induction motor.
 - b) With neat sketch state the working principle of Star-Delta starter.
 - c) Draw the phasor diagram of loaded alternator when load is capacitive and also write the equation of no-load induced emf.
 - d) Explain the principle of operation of 3 phase synchronous motor.
- P.T.O.

3. Attempt any THREE of the following: 12

- a) The power input to a 500V, 50Hz, 6 pole, 3 ϕ induction motor running at 975 RPM is 40 kW. The stator losses are 1 kW and the friction and windage losses total 2 kW. Calculate:
- The slip
 - The rotor cu loss
 - Shaft power
 - The efficiency
- b) State why three phase induction motor never runs on synchronous speed.
- c) State the double field revolving theory of single phase Induction Motor.
- d) Define the following terms and write their mathematical expression.
- Pitch factor
 - Distribution factor related to the winding of alternator.

4. Attempt any THREE of the following: 12

- a) Describe with neat sketch, the principle of operation of single phase shaded pole Induction Motor.
- b) Compare resistant split phase motor with capacitor split phase motor on the basis of
- Output
 - Starting Torque
 - Power Factor
 - Applications
- c) Why synchronous motor is not self starting? Explain in detail.
- d) Draw a schematic diagram of a DC servo motor. Draw a speed torque characteristics of DC servo motor.
- e) Explain working principle of BLDC motor.

5. Attempt any TWO of the following:**12**

- a) A 3 phase Induction Motor has a starting torque of 100% and maximum torque of 200% of the full load torque. Determine –
- Slip at which maximum torque occurs.
 - Full load slip.
 - Rated current at starting in per unit of full load rotor current.
- b) A 6 pole, 50Hz, 3 ϕ Induction Motor running on full load develops a useful torque of 150 N-M at a rotor frequency of 1.5Hz. Calculate the shaft power output. If the mechanical torque lost in friction be 10 N-M, Determine–
- Rotor cu loss
 - The input to the motor and
 - The efficiency
- c) Describe the factors affecting the regulation of three phase alternator and draw the phaser diagram of loaded alternator when operating power factor is lagging and leading.

6. Attempt any TWO of the following:**12**

- a) i) Write the formula C for X_s ; $2s$ of an alternator.
ii) Explain the effect of armature reaction at various power factor of load on alternator. Draw suitable wave forms showing the effect.
- b) i) Find the no load line voltage of a star connected 3 phase, 6 pole alternator which runs at 1200 RPM, having flux per pole of 0.1 wb sinusoidally distributed. Its stator has 54 slots having double layer winding. Each coil has 8 turns and the coil is chorded by one slot.
ii) State any four advantages of rotating field over rotating armature of 3 phase alternator.
- c) Draw and explain V and inverted V curves of synchronous motor.
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