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3 Hours / 100 Marks   Seat No.

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) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) **Attempt any __THREE__ of the following:**   **12**

(i) Explain the construction of three phase Induction Motor with neat diagram.

(ii) Explain with neat sketches the production of rotating magnetic field in three phase Induction Motor.

(iii) Draw a neat labelled sketch of Star Delta Starter. Can we use star delta starter for starting a DC servo motor.

(iv) Give any four advantages of rotating magnetic field alternator.

b) **Attempt any <u>ONE</u> of the following:**   **6**

    (i)   Explain the method of speed control of Slip Ring Induction Motor with a neat circuit diagram.

    (ii)   A 500V, 3 phase, 50 Hz Induction motor developes an output of 15 kW at 950 rpm. If input power factor is 0.86 lagging. Mechanical losses are 730 W and stator losses 1500 W. Find

       1)   The slip

       2)   The rotor copper loss

       3)   Motor Input

       4)   The line current

2.   **Attempt any <u>FOUR</u> of the following:**   **16**

a) Explain the working principle of three phase Induction Motor.

b) Derive the condition for maximum starting torque of three phase I.M.

c) Derive the expression for distribution factor.

d) Calculate the pitch factor for three phase winding of alternator having 72 stator slots and 6 poles. The coil span is 1 to 10 slot.

e) Explain with neat diagram working of universal motor.

f) Explain construction and working of permanent magnet stepper motor.

Marks

3. **Attempt any <u>FOUR</u> of the following:** **16**

a) Draw and explain the torque speed characteristic of three phase Induction Motor.

b) The power input to 500 V, 50 Hz, 6 pole, 3 phase Induction Motor running at 975 rpm is 40 KW. The stator losses are 1 KW and the friction and windage losses are 2 KW. Calculate:

    (i) Slip

    (ii) Rotor copper loss

    (iii) Shaft power

    (iv) Efficiency

c) Derive EMF Equation of Alternator

d) State the essential steps to conduct the open circuit test and short circuit test on alternator. Which precaution has to be taken while conducting the short circuit test on alternator.

e) Write any two applications of each of the following single phase Induction Motor.

    (i) Capacitor Start Induction Run Motor.

    (ii) Resistance Start Induction Run Motor.

    (iii) Capacitor start Capacitor Run Motor.

    (iv) Shaded pole I.M.

Marks

4. a) **Attempt any THREE of the following:** **12**

(i) A 746 KW, 3 phase, 50 Hz, 6 pole Induction Motor has a rotor impedance of $(0.02 + j0.15)$ Ω at standstill. Full load torque is obtained at 360 rpm. Calculate :

1) The ratio of maximum to full load torque

2) The speed at maximum torque

3) Rotor resistance to be added to get maximum starting torque.

(ii) Suggest the three phase Induction motor for the following applications with reason

1) Fans and blowers

2) Lift

3) Lathe machines

4) Centrifugal pumps

(iii) A 4 pole three phase star connected alternator armature has 12 slots with 24 conductors per slot and the flux per pole is 0.1 Wb sinusoidaly distributed. Calculate the line emf generated at 50 Hz. Assume full pitch coils.

(iv) Explain lump method of synchronising alternator to bus bar.

b) **Attempt any ONE of the following:** **6**

(i) A 100 KVA, 3000V, 50 Hz, 3 phase star connected alternator has effective armature resistance of 6.2 ohm.
The field current of 40 A produces short circuit current of 200 A and an open circuit emf of 1040 V. Calculate the full load voltage regulation at 0.8 p.f. lagging and 0.8 p.f. leading. Draw phasor diagrams.

(ii) What is armature reaction? Describe armature reaction with flux distribution waveform of three phase alternator when the nature of load on the alternator is resistive, purely inductive.

Marks

5. **Attempt any FOUR of the following:** 16

   a) Explain why Induction Motor can never run with the synchronous speed.

   b) Explain the effect of resistance of rotor winding on starting torque of three phase Induction Motor.

   c) Explain why synchronising of alternator is necessary? Also state condition for synchronization of alternators.

   d) Explain the concept of load sharing.

   e) Describe the working of A.C. Servo Motor.

   f) What is Induction Generator? State the principal of operation and any two applications of I.G.

6. **Attempt any FOUR of the following:** 16

   a) Explain why single phase Induction motor is not self starting.

   b) Explain the principle of operation of linear Induction Motor.

   c) Compare the salient pole type and smooth cylindrical type rotor used in three phase alternator. (Any four points)

   d) Explain working of shaded pole induction motor with suitable sketch.

   e) Explain working of capacitor start capacitor run single phase Induction Motor.

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