

17511

21819

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.

Marks

1. a) **Attempt any THREE of the following:** **12**
 - (i) Explain how in a 3 phase induction motor to a rotating magnetic field is developed.
 - (ii) List any four advantages and two disadvantages of 3 phase induction motor.
 - (iii) Define and explain distribution factor of a winding with neat sketch.
 - (iv) With the help of diagram explain how star-delta starter used for reducing starting current of 3 phase induction motor.

- b) **Attempt any ONE of the following:** **6**
 - (i) Draw a neat sketch of a D.O.L starter and state functions of OLC and NOC.
 - (ii) State and explain the main constructional features and principle of operation of universal motor.

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

- a) Derive the condition for maximum torque developed in a 3 phase induction motor.
- b) Describe the torque speed characteristics of A.C series motor.
- c) What are the special features of servo motor? State their types.
- d) List the advantages of having stationary armature and rotating field for 3 phase alternator.
- e) If frequency of the supply voltage to the stator is 50 Hz, while the frequency of the induced emf in the rotor is observed to be 90 cycles per min. Calculate the slip and speed of the motor. Stator is wound for 6 poles.
- f) A 3 phase, 50 Hz, 4 pole, star connected alternator has 72 slots with 4 conductors per slot. The coil span is 2 slots less than pole pitch. If machine gives 6600 V between lines on O.C determine the useful flux per pole.

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

- a) Explain double field revolving theory for 1 phase induction motor
- b) Derive the expression for torque under running condition of 3 phase induction motor.
- c) Describe the Z method to find regulation of the alternator.
- d) A 4 pole, 50 Hz, 7.46 kW induction motor has a starting torque of 160% of full load torque and maximum torque of 200% of full load torque. Determine:
 - (i) Full load speed
 - (ii) Speed at maximum torque
- e) Draw a phasor diagram of an alternator at unity and lagging power factor.

4. a) **Attempt any THREE of the following:** **12**
- (i) The useful torque of a 3 phase, 50 Hz, 8 pole induction motor is 190 N.M the rotor frequency is 1.5 Hz. Calculate the rotor Cu.loss if mechanical losses are 700 watts.
 - (ii) Explain speed control by changing frequency of 3 phase induction motor. State disadvantage of this method.
 - (iii) Describe the effect of armature reaction on the performance of alternator.
 - (iv) Why it is necessary to run alternators in parallel? State condition for parallel operation.
- b) **Attempt any ONE of the following:** **6**
- (i) State the difference between single layer and double layer armature winding related to alternator. State two merits of both.
 - (ii) A 750 KVA, 2300 V, delta connected alternator has had open and short circuit tests performed and the following data were obtained.
S.C test: Field current = 31.5 Amp line current rated
O.C test: Field current = 31.50 Amp line voltage = 1050 V
The dc resistance across the terminals was measured at 0.38 Ω . Calculate the voltage regulation at 0.8 p.f lag.
5. **Attempt any FOUR of the following:** **16**
- a) Describe the slip measurement by comparing rotor frequency and stator frequency.
 - b) Explain the effect of change of steam supply to one alternator when they are running in parallel.
 - c) State the procedure of any one method of sychonisation alternator to a busbar.
 - d) What is an induction generator? State its principle of operation.
 - e) State the principle of operation of linear induction motor. List its two applications.

- f) A phase wound 3 phase induction motor has an induced emf of 135 volts between slip rings of rotor at standstill with rated voltage applied to stator. The rotor winding has a resistance per phase of 0.25Ω and standstill leakage reactance per phase of 1.6Ω . Calculate:
- Rotor current/phase when running short circuited with 5% slip.
 - The slip and rotor current per phase when the rotor is developing max torque.

6. Attempt any FOUR of the following:

16

- Compare resistance split phase and capacitor start 1 phase induction motor (any four points).
 - Describe the working of shaded pole induction motor.
 - Derive the emf equation of an alternator
 - Describe the construction of stepper motor (variable reluctance type)
 - Explain the working of capacitor start capacitor run induction motor with the help of circuit diagram.
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