**24225**

**3 Hours / 70 Marks**　　Seat No. ☐☐☐☐☐☐☐☐

***Instructions :***　(1)　All Questions are *compulsory.*

　　　　　　　　(2)　Illustrate your answers with neat sketches wherever necessary.

　　　　　　　　(3)　Figures to the right indicate full marks.

　　　　　　　　(4)　Assume suitable data, if necessary.

　　　　　　　　(5)　Use of Non-programmable Electronic Pocket Calculator is permissible.

**Marks**

1.　**Attempt any FIVE of the following :**　　　　　　　　　　　　　　　**10**

　　(a)　Draw Torque-Armature current characteristics of DC shunt motor and label it.

　　(b)　State any two braking methods of 3-$\phi$ induction motor.

　　(c)　Give any two applications of synchronous motor.

　　(d)　Name any two methods of synchronization of alternators.

　　(e)　Give any two applications of DC servo motor.

　　(f)　State the advantages of BLDC motor (any two).

　　(g)　State the temperature limit for class A and class B insulators.

2.　**Attempt any THREE of the following :**　　　　　　　　　　　　　　**12**

　　(a)　Draw and explain the following characteristics of DC series motor :

　　　　(i)　Torque vs. Armature current

　　　　(ii)　Speed vs. Torque

(b) Explain the working principle of 3-φ induction motor with neat sketch.

(c) State the necessity and conditions of parallel operation of 3-φ alternator.

(d) Explain the working principle of AC servo motor.

3. **Attempt any THREE of the following :** 12

(a) Draw the torque speed characteristics of 3-φ induction motor and explain.

(b) Derive the emf equation of single phase alternator.

(c) Explain the working principle of synchronous motor with neat sketch.

(d) A 10 kVA, 500/200 V, 50 Hz, 1 phase transformer gave the following test results :

O.C. Test : 500 V, 2 A, 400 W

S.C. Test : 5 V, 24 A, 300 W

Calculate the efficiency of this transformer at full load 0.8 p.f. lagging.

(e) Compare core type transformer with shell type transformer (any four points).

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

(a) Explain with circuit diagram the procedure to control the speed of DC series motor by variation of armature voltage.

(b) Explain with neat sketch the operation to control the speed of 3-φ induction motor by stator voltage method.

(c) Explain the constructional details of 3-φ alternator with neat sketch.

(d) Describe with circuit diagram the procedure to conduct S.C. test of single phase transformer.

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

   (a) Suggest the suitable starter for the following motors with justification :

   (i) 100 HP, 415 V, 50 Hz, 3-phase, slip ring induction motor

   (ii) 15 HP, 415 V, 50 Hz, 3-phase, squirrel cage induction motor

   (iii) 2.2 kW, 415 V, 50 Hz, 3-phase, squirrel cage induction motor.

   (b) A 3 phase star connected alternator is rated at 1500 kVA, 13.5 kV. The armature resistance and synchronous reactance are 1.2 $\Omega$ and 20 $\Omega$ respectively per phase. Calculate percentage voltage regulation for a load of 1000 kW at 0.8 p.f. leading.

   (c) Explain the working of permanent magnet stepper motor with neat sketch.

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

   (a) Briefly explain any six troubles that can occur in 3 phase slip ring induction motor. Also suggest their remedies.

   (b) Define voltage regulation of alternator. State and explain the factors on which voltage regulation depends.

   (c) Explain the working principle of switched reluctance motor with neat sketch.

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