

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE SEM-III Examination May 2012****Subject code: 131701****Subject Name: Electrical Machines****Date: 10/05/2012****Time: 02.30 pm – 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Explain working principle of transformer in detail and also derive E.M.F. equation of transformer. **07**
- (b)** A 50 kVA, 4400/220 V transformer has  $R_1 = 3.45 \Omega$ ,  $R_2 = 0.009 \Omega$ . The values of reactances are  $X_1 = 5.2 \Omega$  and  $X_2 = 0.015 \Omega$ . Calculate for the transformer (i) equivalent resistance as referred to primary (ii) equivalent resistance as referred to secondary (iii) equivalent reactance as referred to both primary and secondary (iv) equivalent impedance as referred to both primary and secondary (v) total Cu loss, first using individual resistances of the two windings and secondly, using equivalent resistances as referred to each side. Assume efficiency of the transformer equal to 100%. **07**
- Q.2 (a)** A 120 kVA, 6000/400 V, Y/Y, 3-phase, 50 Hz transformer has an iron loss of 1600 W. The maximum efficiency occurs at 3/4 full load. Find the efficiencies of the transformer at (i) full-load and 0.8 power factor (ii) half-load and unity power factor (iii) the maximum efficiency. **07**
- (b)** For a singly excited system derive the expression for magnetic field energy stored. **07**
- OR
- (b)** Explain the various losses taking place in a d.c. machine. **07**
- Q.3 (a)** Explain how rotating magnetic field is produced in 3-phase induction motor. **07**
- (b)** Explain crawling and cogging of an induction motor. **07**
- OR
- Q.3 (a)** Explain the general construction and working principle of a single-phase induction motor. **07**
- (b)** Explain the double revolving field theory for a single-phase induction motor. **07**
- Q.4 (a)** Explain the working principle of synchronous machine and derive the relation between electrical and mechanical angle. **07**
- (b)** Define and state the expressions for (i) Pitch factor (ii) Distribution factor. **07**
- OR
- Q.4 (a)** A synchronous generator is connected to an infinite bus. Discuss with the help of phasor diagrams the effect of changing excitation at constant mechanical input. **07**
- (b)** Why is it necessary to run alternators in parallel? Explain clearly the terms synchronizing current, synchronizing power and synchronizing torque of **07**

synchronous machine.

- Q.5 (a)** State the different types of d.c. generators and state the applications of each type. **07**
- (b)** With neat diagrams explain the phenomenon of armature reaction in a d.c. machine. **07**
- OR
- Q.5 (a)** Derive the expression for the electromagnetic torque developed in a d.c. motor. **07**
- (b)** Explain Swinburne's test for finding the efficiency of a d.c. machine. **07**

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