

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV • EXAMINATION – WINTER 2013****Subject Code: 142401****Date: 19-12-2013****Subject Name: Electro Mechanical Energy Conversion - I****Time: 02:30 pm to 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 the zero power factor method for determining the voltage regulation of a three-phase alternator. **07**
 (b) Explain the working principle of single-phase repulsion motor with necessary diagram. **07**

- Q.2** (a) Explain the theory of production of rotating field in three-phase induction motor with three-phase supply. **07**
 (b) Explain the construction and working of permanent magnet stepper motor. List the advantages and disadvantages of permanent magnet stepper motor. **07**

OR

- (b) Define pitch factor and distribution factor. Derive the equation of the induced emf for three-phase alternator. **07**
Q.3 (a) Explain the characteristics of separately-excited dc generator. **07**
 (b) A shunt generator delivers 195 A at terminal voltage of 250 V. The armature resistance and shunt field resistances are 0.02Ω and 50Ω respectively. The iron and friction losses equal 950 W. Find (i) E.M.F. generated (ii) Cu losses (iii) output of the prime mover and (iv) mechanical and electrical efficiencies. **07**

OR

- Q.3** (a) Explain the external and internal characteristics of dc shunt generator. **07**
 (b) A 200 V dc shunt motor takes 4 A at no-load when running at 700 rpm. The field resistance is 100Ω . The resistance of armature at standstill gives a drop of 6 volts across armature terminals when 10 A were passed through it. Calculate (i) speed on load (ii) torque in N-m and (iii) efficiency. The normal input of the motor is 8 kW. **07**
Q.4 (a) Explain the iron losses of dc machine. **06**
 (b) Explain the flux control method and Ward-Leonard system of speed control of dc shunt motor. **08**

OR

- Q.4** (a) Explain the voltage build-up of dc shunt generator. State the conditions for the build-up of dc generator. **06**
 (b) Discuss the necessity of starter. Explain the three-point starter with neat diagram. **08**

- Q.5** (a) Write a technical note on “Auto Transformer”. **07**
 (b) Obtain the equivalent circuit of a 200/400 V, 50 Hz, 1-phase transformer from the following test data. **07**
 O.C. test : 200 V, 0.7 A, 70 W - on L.V. side
 S.C. test : 15 V, 10 A, 85 W - on H.V. side

OR

- Q.5** (a) Derive the equation for the torque of three-phase induction motor under running condition. Derive the condition for the maximum torque under running condition. **07**
 (b) A 150 kW, 300 V, 50 Hz, 6-pole star connected induction motor has a star connected slip-ring rotor with a transformation ratio of 3.6(stator/rotor). The rotor resistance is $0.1 \Omega/\text{phase}$ and its per phase leakage reactance is 3.61 mH. The stator impedance may be neglected. Find the starting current and starting torque on rated voltage with short-circuited slip rings. **07**
