



(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 121405

Roll No.

--	--	--	--	--	--	--	--	--	--

B. Tech.

(SEM. IV) THEORY EXAMINATION, 2014-15
ELECTRO-MECHANICAL ENERGY CONVERSION - I

Time : 3 Hours]

[Total Marks : 100

Note : Attempt all questions.

- 1 Attempt any two parts of the following : **10×2=20**
- (a) Derive an expression for electromagnetic torque in singly excited linear magnetic system.
 - (b) Write the energy balance equation for motor and generator. Why magnetic field is used as a coupling medium in electromechanical conversion device ?
 - (c) A doubly excited system has a stator inductance of 0.6 H, rotor self inductance=0.3 H and mutual inductance=0.4 H. The value of the rotor and the stator current under steady state are 10A and 8A. Calculate the total stored magnetic field energy.

2 Attempt any two parts of the following : **10×2=20**

- (a) What is reactance voltage ? How is it produced in a DC machine ? Also explain its effects on the performance of DC machine.
- (b) A 6-pole DC shunt generator supplies full-load current at a terminal voltage of 250 V. The armature and field resistances are 0.042Ω and 100Ω respectively. It runs at a speed of 1000 rpm and has 700 lap connected conductors. The voltage across armature resistance is 7.2 V. Find the following :
- (i) load current
 - (ii) emf generated
 - (iii) the flux/pole.

Neglect brush contact drop.

- (c) Compare and contrast between the external characteristics of all types of DC generators.

3 Attempt any two parts of the following : **10×2=20**

- (a) A 250 V, 30 kW, 1200 rpm, DC shunt motor has a full load efficiency of 88%. The armature resistance is 0.29Ω and total brush drop is 2V. The value of the field current is 2A. Determine :
- (i) Full load line current
 - (ii) Full load shaft torque and
 - (iii) Total resistance in the motor starter to limit the starting current to 1.5 times the full load current.
- (b) What is the drawback of a three-point starter ? How are these drawbacks eliminated in a four point starter ?

- (c) A 260 V, DC shunt motor draws no load current of 4A. The armature and field resistances are 0.5Ω and 250Ω respectively. Find the efficiency of the machine as a generator and that as a motor when the load current is 25 A.
- 4 Attempt any two parts of the following : **10×2=20**
- (a) Describe the back-to-back test for determining the regulation and efficiency of a pair of similar transformer. What are the limitations of this test ?
- (b) What is an auto transformer ? Discuss the advantages, disadvantages and applications of auto transformers. Compare the conductor savings of auto transformer with a two winding transformer.
- (c) In a scott connection, the loads on the two-phase side are 400 kW and 500 kW, both at 200 V and 08 p.f. lagging. The three phase line voltage is 2200 V. The 400 kW load is on the leading phase on the two-phase side. Neglecting transformer losses, calculate the value of line currents on the three-phase side.
- 5 Attempt any two parts of the following : **10×2=20**
- (a) Find the approximate equivalent circuit of a single-phase 100/1000V transformer having the following test results:
- OC Test : 100 V, 1.2 A, 150 W
SC Test : 35 V, 15 A, 750 W

- (b) Discuss relative advantages and disadvantages of employed three $1-\phi$ transformers for use in $3-\phi$ operation over employing a single unit $3-\phi$ transformer.
- (c) Write short notes on any two of the following :
- (i) All-day efficiency of a distribution transformer.
 - (ii) Armature reaction in DC machines.
 - (iii) Hopkinson's Test.
