

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

PAPER ID : 0207

Roll No.

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

B. Tech.

(SEMESTER-IV) THEORY EXAMINATION, 2011-12

ELECTRO-MECHANICAL ENERGY CONVERSION - I

Time : 3 Hours]

[Total Marks : 100

Note : Attempt questions from all sections. Assume missing data, if any.

SECTION – A

1. Attempt all the parts.

10 × 2 = 20

- (a) What are electro-mechanical energy conversion devices ? Also mention the two most important phenomena which makes the electromechanical energy conversion possible.
- (b) Write the energy balance equation for motor action and draw power flow diagram.
- (c) Explain the functions of interpoles in d.c. machines.
- (d) Draw the external characteristics of d.c. compound generators.
- (e) What are various possible causes for a d.c. shunt generator not building up voltage ?
- (f) Discuss the necessity of starter for d.c. motors.
- (g) Why a d.c. series motor should never run unloaded ?
- (h) State various power losses in transformers.
- (i) Describe polarity test of transformer. Also mention its importance.
- (j) Write advantages of 3-phase transformer.

SECTION - B

2. Answer any **three** parts : **3 × 10 = 30**

- (a) (i) Define and explain field energy and coenergy of a magnetically excited, system.
- (ii) Prove that for a linear electromagnetic system, the energy and coenergy are numerically equal.
- (b) Explain methods of speed control of d.c. shunt motors.
- (c) Draw and explain phasor diagram of a single phase transformer supplying full load at
- (i) Lagging power factor and
- (ii) Unity power factor
- (d) An 8-pole d.c. generator has 500 armature conductor and a useful flux per pole of 0.065 Wb. What will be the emf generated if it is lap wound and runs at 1000 rpm. ?
- What must be the speed at which it is driven to produce the same emf if the dc. Generator is wave connected ?
- (e) The primary and secondary voltage of an autotransformer are 500 V and 400 V respectively. Calculate and show with the aid of a diagram, the current distribution in the windings when the secondary current is 100 A.
- Also calculate the saving in conductor material in using autotransformer in place of two winding transformer of same rating.

SECTION - C

Note : Answer **all** questions : **5 × 10 = 50**

3. Attempt any **two** parts : **2 × 5 = 10**

- (a) A 200 kVA, 1000/250 V, 50 Hz, single phase transformer gave the following results :
- Open circuit test : 250 V, 18 A, 1300 W
- Short circuit test : 80 V, 200 A, 2400 W

Calculate the all day efficiency if transformer is loaded as follows during a day :

at full load 0.8 p.f. lagging for 8 Hours

at half load unity p.f. for 10 Hours

at no load for remaining hours.

- (b) Derive condition for maximum efficiency of transformer. Also obtain expression for fraction of load at which maximum efficiency occurs.
- (c) The no-load current of a single phase transformer is 5 A at 0.25 p.f. when supplied at 235 V, 50 Hz. The number of turns on primary winding is 200. Calculate
- the maximum value of flux in the core
 - the core loss and
 - the magnetizing component of no-load current

4. Attempt any one part.

1 × 10 = 10

- (a) Explain process of commutation in dc machines and describe the methods to improve it.
- (b) What is armature reaction ? Discuss its effects on the operation of d.c. machines. Also explain how the effect of armature reaction is minimized ?

5. Attempt any one part.

1 × 10 = 10

- (a) Linear relation between flux in the air-gap of a clapper type relay and current in the operating coil is given as

Current (i) 0 10 A

Flux (ϕ) 0 5mWb

The coil has 100 turns. Calculate energy stored in the magnetic field at a coil current of 10 A and the inductance of the coil.

- (b) Derive an expression for electromagnetic torque in an ac machine with cylindrical airgap. State the assumptions made.

6. Attempt any **one** part.

$1 \times 10 = 10$

- (a) With the help of circuit connection and phasor diagram, explain the Scott connection feeding a 2-Phase balanced load at 0.70 p.f. lagging.
- (b) Discuss the necessity of parallel operation of transformers. Also state the conditions for satisfactory operation of three phase transformer in parallel.

7. Attempt any **two** parts.

$2 \times 5 = 10$

- (a) A 500 V d.c. shunt motor takes 4 A on no-load. The armature circuit resistance is 0.2Ω and field current is 1 A. Calculate the output and efficiency when the input current is 20 A.
- (b) Classify and explain various losses in d.c. machines.
- (c) Derive back emf and torque equations of d.c. machines.