

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

**PAPER ID : 0207**

Roll No.

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B.Tech.

(SEMESTER-IV) THEORY EXAMINATION, 2012-13  
**ELECTRO-MECHANICAL ENERGY CONVERSION-I**

Time : 3 Hours ]

[ Total Marks : 100

**SECTION - A**

1. Attempt all question parts : **10 × 2 = 20**
- (a) Define energy and co-energy.
  - (b) How magnetic hysteresis can be overcome ?
  - (c) Draw the internal and external characteristics of DC shunt generator.
  - (d) Define reactance voltage during commutation.
  - (e) What is the need of starter in starting the motors ?
  - (f) Compare armature voltage control and flux control of DC shunt motor.
  - (g) Why the transformer ratings in kVA ?
  - (h) Differentiate core type and shell type transformer.
  - (i) What are necessary conditions for parallel operation of transformer ?
  - (j) List out the advantages of a bank of three single phase transformers over a single three phase transformer.

**SECTION - B**

2. Attempt any **three** question parts : **3 × 10 = 30**
- (a) (i) Derive an expression for reluctance torque in a rotating electrical machine.
  - (ii) Show that for a linear system, energy and co-energy are numerically equal.

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- (b) Describe the effects of armature reaction on the operation of DC machines. Also explain the remedies employed for decreasing the effects of armature reaction.
- (c) How to determine the efficiency of shunt machines using Hopkinson's test ? Explain in detail.
- (d) With the help of neat constructional diagram, explain the construction and working principle of an autotransformer.
- (e) Explain with the help of diagrams, the phenomenon of harmonics in case of single phase transformers.

**SECTION - C**

Attempt all questions :

**5 × 10 = 50**

3. Attempt any two parts :

**2 × 5 = 10**

- (a) Describe an idealized machine and explain its importance in analyzing an actual machine.
- (b) State and briefly explain the various phenomenon useful for the electromechanical energy conversion in rotating machines.
- (c) Drive the emf equation for D.C. generator.

4. Attempt any one part :

**1 × 10 = 10**

- (a) Illustrate the commutation action in a DC machines.
- (b) (i) Explain the principle and operation of D.C. motors.  
(ii) A 250 V shunt motor on no-load runs at 1000 rpm and takes 5 A. The total armature and shunt field resistance are respectively 0.2 ohm and 250 ohms. Calculate the speed when loaded and taking a current of 50 A, if armature reaction weakens the field by 3%.

5. Attempt any one part :

**1 × 10 = 10**

- (a) Explain with the help of neat diagram the Ward Leonard method used for speed control of dc motor. What are its advantages and disadvantages ?

- (b) The armature and field resistance of a 250V D.C. shunt motor are 0.5 ohm and 250 ohm respectively. When driving a load of constant torque at 600 r.p.m., the armature current is 20 A. If it is desired to raise the speed from 600 to 800 r.p.m., what resistance should be inserted in the shunt field circuit ?

6. Attempt any **one** part :

$1 \times 10 = 10$

- (a) A transformer has its maximum efficiency of 0.98 at 20 kVA at unity power factor. During the day it is loaded as follows :

12 hours ; 2 kW at power factor 0.6

6 hours ; 10 kW at power factor 0.8

6 hours ; 20 kW at power factor 0.9

Find the all-day efficiency of the transformer.

- (b) Explain the procedure of O.C and S.C test for a transformer and also calculate the efficiency.

7. Attempt any **two** parts :

$2 \times 5 = 10$

- (a) With the help of neat diagram, explain Scott connection in transformer.
- (b) Explain the difference phasor groups of transformers and draw connections for delta-zigzag and star-zigzag connections.
- (c) What are the conditions required to be satisfied for the parallel operation of a single phase and three phase transformers ? Derive the expression for the circulating current flowing through the secondary windings of transformers connected in parallel.

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