Printed Pages : 4   EEE401

(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. $10 \times 2 = 20$

   (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.

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SECTION – B

2.   Answer any **three** parts : $3 \times 10 = 30$

   (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 : $5 \times 10 = 50$

3.   Attempt any **two** parts : $2 \times 5 = 10$

   (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

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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

    (i) the maximum value of flux in the core

    (ii) the core loss and

    (iii) the magnetizing component of no-load current

4. Attempt any **one** part. $1 \times 10 = 10$

(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. $1 \times 10 = 10$

(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 0.2 Ω 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.

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