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

PAPER ID : 121401 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. IV) THEORY EXAMINATION 2013-14

ELECTRO-MECHANICAL ENERGY CONVERSION-I

Time : 3 Hours *Total Marks : 100*

Note :– Attempt **all** sections.

SECTION–A

1. Attempt **all** parts : **(2×10=20)**

   (a) Does transformer draw any current when secondary is open ? If yes, then why ?

   (b) How are Hysterisis and Eddy Current losses minimized ?

   (c) What is back emf in dc motor ?

   (d) Why are breathers used in transformers ?

   (e) What are the effects of armature reaction ?

   (f) Define energy and co-energy. What is the significance of co-energy ?

   (g) What is the need of starter in dc motor.

   (h) Explain singly excited system.

   (i) Give the classification of insulating material with their temperature ranges.

   (j) Draw the phasor diagram of an ideal transformer when loaded.

SECTION-B

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

(a) (i) Derive the emf equation of a dc generator.

(ii) The terminal voltage of an 8 pole dc shunt generator with 780 wave connected armature conductors and running at 500 rpm at terminal voltage 240 V. The armature resistance is 0.24 Ω and field resistance is 240 Ω. Find the armature current, the induced emf and flux per pole of load resistance is 12 Ω.

(b) Explain Ward Leonard method to control the speed of dc motor. The no load current and speed of a 4 pole, 250 V d.c. shunt motor are 6 A and 500 rpm respectively. It has a shunt field current of 1 A. If its full load current be 80 A, find its full load speed. The value of armature resistance is 0.012 Ω. Neglect the brush drop. Armature reaction weakens the flux by 25 %.

(c) With the help of circuit diagram, explain Hapkinson test on dc motor. Derive the expressions for efficiency of the dc machine as motor and generator. Write its advantages over Swinburne's test.

(d) (i) Draw the phasor diagram of a single phase step up transformer feeding a lagging p.f load.

(ii) With the help of circuit diagram, explain short circuit test. Why is the core loss assumed neglisible in this test ?

(e) The full load voltage drops in a single phase transformer are 2 % and 4 % respectively due to resistance and reactance. The full -load ohmic loss is equal to the iron loss. Calculate :

(i) The efficiency on full load at unity p.f.

(ii) The full-load pf at which voltage drop is maximum

(iii) The load p.f at which the voltage drop is zero.

SECTION-C

Note :– Attempt **all** questions. **(10×5=50)**

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

(a) With the help of a neat sketch, explain the flow of energy in electro-mechanical devices.

(b) Derive the condition for maximum efficiency of transformer. Also obtain expression for the fraction of load at which the maximum efficiency occurs.

(c) A 240 V d.c shunt motor has an armature resistance of 0.4 Ω.The full load speed and corresponding current are 600 rpm and 25 A respectively. A resistance of 2 Ω is connected in series with armature. Determine :

(i) Speed at full load.

(ii) Stalling torque.

4. Attempt any **one** part : **(10×1=10)**

(a) What is armature reaction ? Discuss its effects on the operation of dc machines. Also explain how the effect of armature reaction is minimized.

(b) A compensated dc machine has 20000 At/Pole the ratio of pole arc to pole pitch is 0.8. The interpolar air gap length and the flux density are 1.2 cm and 0.3 T respectively. For rated I = 1000 A, calculate the compensating winding At/Pole and no. of turns on each interpole.

5. Attempt any **one** part : **(10×1=10)**

(a) The Hopkinson test on two identical shunt machines gave the following result:

Input voltage = 500 V, Input current = 15 A, Output current of generator = 120 A, Field current of generator = 4 A, Field current of motor = 3 A, Armature resistance of each machine = 0.06 Ω. Determine the efficiency of motor and generator.

(b) Derive an expression for electromagnetic torque in an ac machine with cylindrical air gap. State the assumption made

6. Attempt any **one** part : **(10×1=10)**

(a) Briefly explain the (i) Sumpner's Test, (ii) Polarity test.

(b) Draw and explain the three point starter for d.c motors. Which of its short comings is overcome in four part starter and how ?

7. Attempt any **two** parts : **(5×2=10)**

(a) Classify and explain various losses in dc machine.

(b) Draw the connection diagram for open delta system and show that $\frac{S_{open\Delta}}{S_{closed\Delta}} = \frac{1}{\sqrt{3}}$

(c) Two single phase transformers share a load of 400 KVA at 0.8 pf lagging. Their equivalent impedances referred to secondary windings are $(1+j2.5)\Omega$ and $(1.5+j3)\Omega$ respectively. Calculate the load shared by each transformer.