B.TECH.

THEORY EXAMINATION (SEM–IV) 2016-17

ELECTRO-MECHANICAL ENERGY CONVERSION I

Time : 3 Hours *Max. Marks : 100*

Note : Be precise in your answer. In case of numerical problem assume data wherever not provided.

SECTION – A

1. Attempt the following: **10 x 2 = 20**

(a) Distinguish between singly excited and doubly excited systems.

(b) Define co- energy.

(c) How the direction of rotation of the dc shunt motor can be changed?

(d) Based on the principle of conservation of energy. Write an energy balance equation of the motor.

(e) Give the two application of dc shunt motor.

(f) Why transformer is not working on dc supply?

(g) Why a DC series motor cannot be started on no load?

(h) How to minimized hysteresis and eddy current losses in transformer?

(i) Define the term Voltage Regulation of transformer.

(j) A 4-pole, wave wound armature has 720 conductors and is rotated at 1000 rev/min. if useful flux is 20 mWb, calculate the generated voltage.

SECTION – B

2. Attempt any five of the following questions: **5 x 10 = 50**

(a) Show that the torque in a doubly excited magnetic system is equal to the rate of increase of the field energy with respect to displacement at constant currents.

(b) (i) Derive an expression for the emf generated in the armature winding of a dc generator.

(ii) A 200V D.C. series motor takes 40A when running at 700 rpm. Calculate the speed at which the motor will run and the current taken from the supply. If the field is shunted by a resistance equal to field resistance and the load torque is increased by 50%. Armature resistance = 0.15Ω. Field resistance = 0.1Ω. It may be assumed that flux per pole is proportional to field.

(c) Two identical dc shunt m/c when tested by Hopkinson's method gave following data: line voltage 230V, line current excluding both the field currents 30 A, motor armature current 230 V, field currents 5A and 4 A. if the armature resistance of each m/c is 0.025 ohm, calculate efficiency of both the machines.

(d) Explain the working principle of dc motor. Explain the significance of back E.M.F. Derive equation for armature torque of a dc motor.

(e) 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:

1.	Full load	0.8 p.f.	8 hours
2.	Half load	u.p.f.	10 hours
3.	No load		Remaining hours

(f) Briefly explain the sumpner's test and polarity test.

(g) Discuss the necessity of parallel operation of transformers. Also state the conditions for satisfactory operation of three phase transformer in parallel.

(h) Draw the connection diagram of open-delta system and show that

$$\frac{S\ open\ \Delta}{S\ closed\ \Delta} = \frac{1}{\sqrt{3}}$$

SECTION – C

Attempt any two of the following questions: **2 x 15 = 30**

3. (i) Why Starter is necessary in DC Motor? List the types of starter and Explain Three Point Starter with neat diagram.

   (ii) A 230/230 V, 3kVA transformer gave the following result:
   O.C. test: 230V, 2A, 100W
   S.C. test: 15V, 13A, 120W
   Determine the regulation and efficiency at full load 0.80 p. f. lagging.

4. (i) What is armature reaction? Discuss its effects on d.c. machines. Also explain how the effect of armature reaction is minimized?

   (ii) Compare the armature control and field control method of speed control of dc motor.

5. (i) Explain the working principle and constructional detail of three winding transformer. Also mention the importance of third winding.

   (ii) Explain auto-transformer in detail. List the applications of auto-transformer