B.TECH
(SEM IV) THEORY EXAMINATION 2017-18
ELECTRO-MECHANICAL ENERGY CONVERSION-I

Time: 3 Hours   Total Marks: 100

Note: 1.   Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1.   **Attempt all questions in brief.**   **2 x10 = 20**
   a)   Write energy balance equation and explain it.
   b)   Explain doubly excited system.
   c)   Derive the EMF equation of dc machine.
   d)   Explain the role of interpoles in dc machine.
   e)   Why starters are used in dc motors?
   f)   Draw the speed torque characteristics of d.c. shunt, series and compound motors.
   g)   Why the rating of a transformer is in KVA?
   h)   Why open circuit and short circuit test are performed on transformer?
   i)   What are the limitations of V-V connections?
   j)   Give some advantages of three phase transformer over single phase transformer.

SECTION B

2.   **Attempt any three of the following:**   **10 x 3 = 30**
   a)   Derive the expression for energy stored in the magnetic field and show that the same is equal to the area between ϕ-F curve and the flux axis.
   b)   A 4 pole dc shunt generator used to charge a battery of 100 V having negligible resistance. If armature of 1500 conductors, each of 2 mΩ resistance. The charging currents are found to be 10A and 20A for generator speed of 1050 and 1140 rpm respectively. Find the field circuit resistance and flux per pole of the generator. Neglect armature reaction effects.
   c)   Explain rehostatic method for speed control of dc shunt motor and Ward Leonard system for the speed control of dc series motor with the help of proper diagram.
   d)   Explain Sumpner's test with the help of connection diagram and give its limitations
   e)   Explain with the help of phasor diagram how 2 phase supply can be obtained from 3 phase supply using Scott connection.

SECTION C

3.   **Attempt any one part of the following:**   **10 x 1 = 10**
   (a)   Explain electromechanical energy conversion with the help of block diagram and Prove that for a linear electromagnetic system, the energy and co-energy are numerically equal.

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

4.   **Attempt any one part of the following:**   **10 x 1 = 10**
   (a)   Explain the term Armature Reaction in detail. Discuss its effects on the operation of d.c. machines. What methods are used to minimize it?

   (b)   Explain process of commutation in dc machines and describe the methods to improve it.

5. **Attempt any one part of the following:** 10 x 1 = 10
   (a) Explain different test performs on dc machine in detail.
   (b) Draw and explain the four point starter for DC motors. Why it is preferred over three point starter?

6. **Attempt any one part of the following:** 10 x 1 = 10
   (a) Derive the condition of maximum voltage regulation of single-phase transformer.
   (b) The maximum efficiency of a single phase 200 KVA, 2000/500 V transformer occurs at 80% of full load and is equal to the 96 % at 0.8 p.f. Determine the efficiency and regulation on full load at 0.8 p.f. lagging if the impedance of the transformer is 9%.

7. **Attempt any one part of the following:** 10 x 1 = 10
   (a) A three phase step down transformer with per phase turns ratio 70: 1.5 connected in delta/star and is supplying a load of 400 kW, 0.8 lagging p.f. at 440 volt. Sketch the connection diagram and show in it different line voltages.
   (b) Explain various types of 4 phase transformer connections and discuss their vector groups.