

ENERGY CONVERSION-I

(Code : EET-401)

Full Marks : 80

Time : 3 hours

Answer any five questions including Q.Nos.1 & 2

Figures in the right-hand margin indicate marks

1. Answer *all* the questions in brief : 2 × 10
- (a) What is the function of pole shoe in a dc machine ?
  - (b) Why transformer rating is done in kVA ?
  - (c) State the working principle of DC motor.
  - (d) Define All Day Efficiency of transformer.
  - (e) State two uses of Auto-transformer.
  - (f) What type of speed control is obtained by flux control method and armature voltage control method.
  - (g) State the condition for maximum efficiency in a transformer.
  - (h) Difference between core-type and shell-type transformer.
  - (i) State the name of vector groups for  $180^\circ$  phase displacement in three-phase transformers. <http://www.sctevtonline.com>
  - (j) Define commutator pitch.
2. Answer the following : 5 × 6
- (a) Derive the condition for maximum power developed in a dc motor.
  - (b) Derive the condition for maximum efficiency in a dc generator.
  - (c) An 8-pole dc shunt generator with 778 wave connected armature conductors and running at 500 rpm supplies a load of  $12.5\Omega$  resistance at terminal voltage of 250V. The armature resistance is  $0.24\Omega$  and field resistance is  $250\Omega$ . Find the armature current induced emf and flux per pole.
  - (d) Derive the emf equation of DC Generator.
  - (e) A 20kVA, 440/220V, 1- $\phi$ , 50Hz transformer has iron loss of 324W. The copper loss is found to be 100 W when delivering half full-load current. Determine.
    - (i) Efficiency when delivering full-load current at 0.8 pf lagging.
    - (ii) Percent of full-load kVA when the efficiency will be maximum.
  - (f) Compare the amount of copper used in between auto-transformer and two-winding transformer of same rating.

3. The total iron loss in a 460V, 50Hz single-phase transformer is 2400W. When a 230V, 25Hz supply is applied, the total iron loss is 800W. Calculate the hysteresis loss and eddy current loss at normal voltage and frequency of 460V. 10
4. A 230V dc shunt motor runs at 800 rpm and takes armature current of 50A. Find the resistance to be added to the field circuit to increase the speed to 1000 rpm at armature current of 80A. Assume flux proportional to field current.  $R_a = 0.15\Omega$  and  $R_f = 250\Omega$ . 10
5. A 20 kVA, 1- $\phi$ , 50Hz, 2200/200V transformer gave the following results :  
OC Test : 2200V applied to primary, Power = 220W.  
SC Test : Power required to circulate full-load current in SC secondary 240W.  
Calculate the efficiency at full-load and half-load at pf 0.8 lagging. 10
6. Explain short-circuit test of 1- $\phi$  transformer. 10
7. Explain about the process of commutation in DC machines. 10

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