

Instructions:-

- The marks are indicated in the right-hand margin.  
There are **NINE** questions in this paper.  
Attempt **FIVE** questions in all.  
Question No. 1 is compulsory.

Choose the correct option of the following: ( Answer any seven)

[2 x 7 = 14]

- (a) The property of a material which opposes the creation of magnetic flux in it is known as  
(i) conductance (ii) magnetomotive force (iii) permeance (iv) reluctance
- (b) The current drawn by a 220 V d.c. motor of armature resistance  $0.5 \Omega$  and back e.m.f. of 200 V is  
(i) 40 A (ii) 44 A (iii) 400 A (iv) 440 A
- (c) In an auto-transformer, power is transferred through  
(i) conduction process only (ii) induction process only  
(iii) both conduction and induction processes (iv) mutual coupling
- (d) A Buchholz relay is used for  
(i) Protection of transformer against all internal faults  
(ii) Protection of transformer against all external faults  
(iii) Protection of transformer against both internal and external faults  
(iv) Protection of induction motors.
- (e) Why is the armature of a dc machine made of silicon steel stampings?  
(i) To reduce hysteresis loss (ii) To reduce eddy current loss  
(iii) For the ease with which the slots can be created  
(iv) To achieve high permeability
- (f) The armature reaction AT in a dc machine  
(i) are in the same direction as the main poles  
(ii) are in direct opposition to the main poles  
(iii) make an angle of  $90^\circ$  with the main pole axis  
(iv) make an angle with the main pole axis which is load dependent
- (g) The dummy coils in d.c machines are useful to  
(i) increase the efficiency (ii) improve the commutation  
(iii) reduce the cost of the machine  
(iv) maintain the mechanical balance of armature
- (h) If the speed of a DC shunt motor is increased, the back emf of the motor will  
(i) Increase (ii) Decrease (iii) Remain same (iv) Become zero
- (i) What is the average coil emf generated in a 4-pole DC machine having flux/pole equal to 0.1 wb rotating at 1500 rpm? (No. of coil sides = 100)
- (j) Two transformers when operating in parallel will share the load depending upon which of the following?  
(i) Magnetizing current (ii) Leakage reactance

(iii) Per unit impedance

(iv) Efficiency

- Q.2** (a) Draw and explain the no-load phasor diagram of a 1-phase transformer. Discuss how primary leakage flux is accounted for in the phasor diagram. [7]  
(b) Give some transformer applications in electronic and control circuits. [3]  
(c) Define MMF and flux. [4]
- Q.3** (a) The maximum efficiency of a 50 kVA transformer is 97.4% and occurs at 90% of full load, at unity power factor. Calculate the efficiency at- [7]  
(i) full load at 0.8 power factor;  
(ii) half the full load at 0.9 power factor  
(b) What are the two functions of commutator in d.c machines? [7]
- Q.4** (a) A 4-pole, 32-conductor, DC generator is lap wound and is running at a speed of 1500 r.p.m. Assuming per pole to be 10Wb, find the EMF generated by the DC machine. [6]  
(b) Draw the open circuit and load characteristics of a separately excited DC generator. Also explain the curvature that is seen in an open circuit characteristic of a self-excited DC generator. [8]
- Q.5** (a) What is meant by efficiency & regulation of a transformer and how is it affected by the power factor of the load supplied by it? [7]  
(b) The primary and secondary winding of a 40 kva, 6600/250v, single phase transformer has resistance of 10 ohm and 0.02 ohm respectively. The leakage reactance as referred to primary is 35 ohm. Find [7]  
(i) full load voltage regulation at a power factor 0.8 lagging?  
(ii) Primary voltage required to circulate full load current when secondary is short circuited?
- Q.6** (a) Discuss in detail the conditions required for successful parallel operation of three-phase transformer. [7]  
(b) Compare the characteristics of auto transformer and two winding transformer in terms of KVA rating losses and voltage regulation. [7]
- Q.7** (a) Derive the condition of zero voltage regulation in a single phase transformer. Also show that the magnitude of maximum voltage regulation equals the per unit value of equivalent leakage impedance. [7]  
(b) Two single phase transformers rated 600 KVA and 500 KVA respectively are connected in parallel to supply a load of 100 KVA at 0.8 lagging power factor. The resistance and reactance of the first transformer are 3% and 6.5% respectively and of the second transformer 1.5% and 8% respectively. Calculate the KVA loading and the power factor at which each transformer operates. [7]
- Q.8** (a) Explain the armature reaction phenomena in a DC machine. What methods can be used to reduce the effect of armature reaction? [7]  
(b) A dc series motor connected to a 440 V supply, runs at 600 rpm. When taking a current of 50 A. Calculate the value of resistance which when inserted in series with the motor, will reduce the speed to 400 rpm. The gross torque being then half its previous value. The resistance of the motor is 0.2  $\Omega$ . [7]
- Q.9** Write short notes on the following [14]  
(a) Critical resistance and critical speed of dc generator.  
(b) Cooling methods of transformer.  
(c) Hysteresis & eddy current losses.