

B.Tech-3rd-EE, EEE
Electrical Machines

Full Marks : 70

Time : 3 hours

Answer Q. No. 1, which is compulsory and any five questions from the rest

The figures in the right-hand margin indicate marks

1. Answer the following questions : 2 × 10

- (i) How can the iron loss be minimised in a transformer ?
- (ii) Define voltage regulation of a transformer.
- (iii) What is the purpose of interpoles and compensating windings in dc machines ?
- (iv) What would happen if the dc motor is directly switched on to the supply without any starter ? Explain.

(v) A 400/200 V transformer has total resistance of 0.02 pu on its L.V. side. What would be the value when it is referred to H.V. side ?

(vi) What are the conditions for parallel operation of two single phase transformer ?

(vii) What is the advantage of cumulative compound motor over a series motor ?

(viii) Explain the difference between lap winding and wave winding.

(ix) What is the function of no-volt release coil in a three-point starter ?

(x) What is the volt-amp equation for a long shunt compound motor ?

2. (a) Develop the exact equivalent circuit of a 1-phase transformer. From this, derive the approximate equivalent circuit of the transformer. State the various assumptions made.

- (b) A 50 kVA, 6600/230 V, 1-phase transformer has H.V. and L.V. winding resistances of 7Ω and 0.008Ω respectively. With L.V. winding open, a current of 0.3 A at a pf of 0.3 (lagging) is recorded on H.V. side with the application of full rated voltage. Calculate efficiency at full load and 0.8 pf (lag). Determine also the current at which maximum efficiency occurs. 4
3. (a) A load of 100 kW at 0.8 power factor lagging is to be shared by two transformers A and B having the same rating and the same transformation ratio. For transformer A, the full load resistive drop is 1% and reactance drop 5% of normal terminal voltage. For transformer B the corresponding values are : 2% and 6%. Calculate the load kVA supplied by each transformer. 5
- (b) Explain the operation of an auto transformer. Discuss the relative merits and demerits of an auto-transformer. 5

4. (a) Draw the external characteristics of various types of dc generators in one figure on the assumption of same rated terminal voltage and same rated load current. Discuss the nature of these characteristics and compare them. 6
- (b) A 4-pole lap connected dc generator has no-load generated emf of 500 V when driven at 1200 rpm. Calculate the flux per pole if the armature has 120 slots with 6 conductors per slot. In case each conductor has a resistance of 0.01Ω , find the resistance of the armature winding. 4
5. (a) Enumerate various losses in a dc machine. Which of these losses are constant? Derive expression for the efficiency of a dc generator and a dc motor. 6
- (b) A dc shunt motor, when fed from 200 V dc source, delivers full load torque at 1000 rpm. Its supply voltage is reduced to 100 V, the motor speed becomes 800 rpm with the load torque remaining constant. Calculate the armature voltage drop at rated torque. Assume no magnetic saturation. 4

(5)

6. (a) Describe, with a neat diagram, the working of a three point starter used for a dc shunt motor. 5
- (b) A 4-pole dc series motor has wave-connected winding with 600 conductors. Total resistance of motor is 0.8Ω . When fed from 350 V dc source, the motor supplies a load of 10 kW and takes 50 A with a flux per pole of 3 mWb. For these operating conditions, calculate the developed torque and the shaft torque. 5
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7. (a) Describe four possible ways of connections of 3-phase transformers with relevant relations amongst voltages and currents on both h.v. and l.v. sides. 6
- (b) Two identical transformers each of rating 10 kVA, 200/100 V, 50 Hz transformers are connected in open delta. Calculate the kVA rating of the open delta bank when HV side is used as primary. 4

(6)

8. Write short notes on any two of the following : 5 + 5
- (i) Swinburne's test
- (ii) Armature reaction
- (iii) Scott connection
- (iv) Parallel operation of DC generators.

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