

Seat
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मध - 016

Electrical Circuits and Machines (1040)

P. Pages : 2

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt all **five** questions.
5. From each question attempt sub-question such that every question is attempted for 20 mark.
6. Use of non-programmable calculator is allowed.
7. Assume suitable data if necessary.

UNIT - I

1. a) i) State and derive the condition for maximum power transfer theorem. 5
ii) What do you understand by balance three phase load ? 5
b) Derive the expression for total power consumed by three phase load using two wattmeter method. And also explain the variation of wattmeter reading with respect load load power factor. 10
c) Two wattmeters connected to measure the input to a balanced three-phase circuit indicate 2500 watt. & 500 watt respectively. Find the power factor of the circuit
a) When both readings are positive.
b) When the latter readings is obtained after reversing the connections to the current coil of one instrument. 10

UNIT - II

2. a) Derive and prove the relation for DC motor. 10
i) $\text{Speed} \propto \frac{\text{Back emf}}{\text{Field current}}$
ii) Armature torque \propto field flux x Armature current.
b) i) Explain speed-armature current (N/I_a) and torque-armature current (T_a/I_a) characteristic of DC shunt and DC series motor. 5
ii) What are the different losses and power stages in DC motors. 5

- c) A d.c shunt motor runs at 900 rpm from a 460 volt supply when taking an armature current of 25 Ampere. Calculate the speed at which it will run from 230 volt supply when taking an armature current of 15 ampere. The resistance of the armature circuit is 0.8Ω . Assume the flux per pole at 230 volt to have decreased to 75% of its value at 460 volt. 10

UNIT - III

3. a) i) What is current transformer (CT) ? What are its applications. 5
 ii) What is an auto transformer ? What are the application of auto-transformer. 5
- b) A transformer is rated at 100 KVA. At full load its copper loss is 1200 watt and its iron loss 960 watt. Calculate :
 i) The efficiency at full load, unity power factor.
 ii) The efficiency at half load, 0.8 power factor lagging.
 iii) The efficiency at 75% full load, 0.7 power factor lagging. 10
- c) Draw and explain the procedure to obtain equivalent circuit for single phase transformer. 10

UNIT - IV

4. a) A 3 phase, star connected alternator is rated at 1600 KVA, 13500 V. The armature effective resistance and synchronous reactance are 1.5Ω and 30Ω respectively per phase. Calculate the percentage regulation for a load of 1280 kw at power factor
 i) 0.8 leading. ii) unity. 10
- b) Why is synchronous motor not self - starting ? What methods are generally used to start the synchronous motor ? 10
- c) What are 'V' - curves of synchronous motor ? What are the main characteristics of synchronous motor ? 10

UNIT - V

5. a) Sketch the torque slip characteristic of 3 - phase induction motor. Derive the condition for maximum torque under running condition. 10
- b) Why single-phase induction motors do not have starting torque ? Explain any one method to make motor self starting. 10
- c) Explain the operation and application of
 i) Stepper motor. ii) Servo motor. 10
