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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## May 2023 Semester End Main Examinations

**Programme: B.E.** **Semester: I / II**
**Branch: Common to all Branches** **Duration: 3 hrs.**
**Course Code: 18EE1ESELE / 18EE2ESELE** **Max Marks: 100**
**Course: Elements of Electrical Engineering** **Date: 16.05.2023**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.





### UNIT - I

1. a) State and prove Superposition theorem for dc circuit. **07**

b) Determine $I_1$, $I_2$ and $V_{XY}$ for the network shown in figure 1b using Kirchhoff's laws. **05**

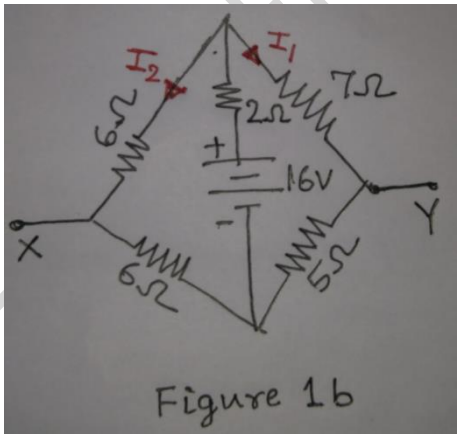

Figure 1b

c) With the help of neat sketch, name the parts of a dc machine and function of each part. **08**

**OR**

2. a) Deduce the expression for armature torque in a dc motor. **06**

b) A 4 – Pole, 500V DC Shunt motor has 720 wave connected armature conductors. The full load armature current is 60A and flux/pole is 0.03wb. Armature resistance is 0.2Ω and contact drop is 1V per brush. Calculate the full load speed of motor. **06**

c) Compute : **08**

(i) the current at node D and its direction

(ii) all the branch currents

(iii) voltage across A & D terminals for the circuit shown in figure 2c.

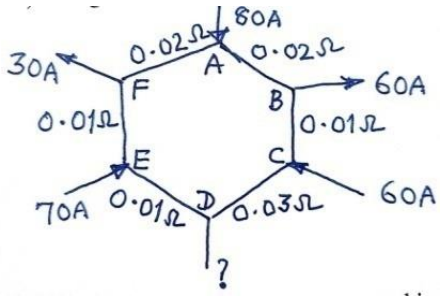


Figure 2 c

**UNIT - II**

3. a) Derive the expression for average value and effective value of an sinusoidal alternating current in terms of its maximum value. **07**

   b) A voltage of v=200 sin(377t-π/2)volts is applied to an ac circuit and the current in the circuit is i=20sin(377t-π/4) Amperes. **07**

   Determine (i) Impedance (ii) frequency (iii) circuit constants

   (iv) power factor (v) active power (vi) reactive power.

   c) Show that in a pure inductive circuit, the average power consumed is zero. Sketch the waveforms of voltage, current & power **06**

**UNIT - III**

4. a) With the help of circuit diagram & phasor diagram, derive the relationship between the line & phase values of voltage & current in 3 phase star connected load. **07**

   b) With sketches distinguish between salient pole & non salient pole rotors. **07**

   c) A three phase ,50Hz,16 pole alternator with star connected armature winding has 144 slots with 10 conductors/slot. The flux /pole is 0.03 weber. Take winding factor of 0.96, Compute i) Synchronous speed ii) Phase emf and iii) Line emf. **06**

**OR**

5. a) Derive an expression for phase emf & line emf of a three-phase star connected alternator considering pitch factor & distribution factor. **07**

   b) With the help of circuit diagram and phasor diagram, show that two wattmeter's are sufficient to measure i) active power ii) power factor in a balanced star connected load. **07**

   c) Three identical impedances each of (6+j8) Ω are connected in star across 400V,3phase, 50Hz ac supply. Determine (i) phase current (ii) phase power factor (iii) real power and (iv) apparent power. **06**

## UNIT - IV

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| 6. | a) | Explain principle of operation of a single-phase transformer and derive the emf equation. | **06** |
| | b) | A 25 kVA, single phase 11000/415V,50Hz transformer has 80 turns on the secondary. Determine (i) the number of primary turns (ii) maximum value of core flux (iii) the rated primary and secondary currents. | **06** |
| | c) | Deduce the condition for maximum efficiency of a single-phase transformer and hence obtain equation for maximum efficiency at unity power factor. | **08** |

## UNIT - V

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| 7. | a) | With the help of neat rotors of sketches, compare the features of rotors of three phase induction motors. | **06** |
| | b) | A 12 pole, 3 phase alternator is coupled to an engine running at 500rpm. It supplies an induction motor, which has a full load speed of 1440rpm. Find (i) the percentage slip (ii) the number of poles of the motor (iii) frequency of rotor current at full load. | **06** |
| | c) | What is earthing? Why earthing is needed? With a neat sketch, explain the pipe earthing method. | **08** |

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