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## First/Second Semester B.E. Degree Examination, Dec.2023/Jan.2024 Basic Electrical Engineering

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, choosing ONE full question from each module.**

### Module-1

- 1 a. State Ohm's law. Mention its limitations. (06 Marks)
- b. Define RMS value of an alternating quantity. Obtain an expression for it in terms of maximum value. (07 Marks)
- c. A resistance of  $10\ \Omega$  is connected in series with two resistances each of  $15\ \Omega$  arranged in parallel. What resistance must be shunted across this parallel combination so that the total current taken shall be  $1.5\ \text{A}$  with  $20\ \text{V}$  applied. (07 Marks)

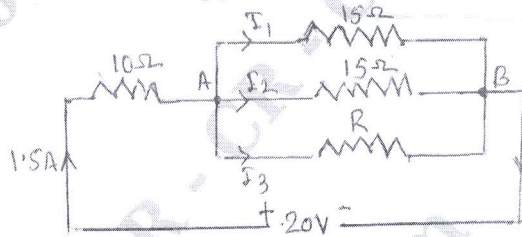


Fig. Q1 (c)

**OR**

- 2 a. Illustrate with examples, Kirchoff's laws as applied to an electric circuit. (06 Marks)
- b. Analyze the relationship between voltage and current, when AC is applied to pure resistive circuit and also draw the waveforms for voltage current and power. (07 Marks)
- c. An emf given by  $400\sin 418t$  is applied to a certain circuit. The current taken is  $2.4\sin(418t - 1.37)$ . Find
  - (i) Frequency
  - (ii) Phase angle between voltage and current
  - (iii) The resistance of the circuit. (07 Marks)

### Module-2

- 3 a. Analyse the R-L series circuit when AC is applied. Draw the phasor diagram. (06 Marks)
- b. Develop the relation between line and phase values of current and voltage, write 3- $\phi$  power equation for star connected 3-phase system. (07 Marks)
- c. A voltage of  $200\ \text{V}$  is applied to a series circuit consisting of a resistor, an inductor and a capacitor. The respective voltages across these components are  $170$ ,  $150$  and  $100\ \text{V}$  and the current is  $4\ \text{A}$ . Find the power factor of the circuit. (07 Marks)

**OR**

- 4 a. With respect to AC circuit, explain Real Power, Reactive power and Apparent power and mention their units. (06 Marks)
- b. Show that 2 wattmeters are sufficient to measure power in a 3-phase balanced star connected circuit with the aid of neat circuit diagram and phasor diagram. (07 Marks)
- c. When a 3-phase balanced impedances are connected in star across a 3-phase  $415\ \text{V}$ ,  $50\ \text{Hz}$  supply. The line current drawn is  $20\ \text{A}$  at a lagging pf of  $0.4$ . Determine the parameters of the impedances in each phase. (07 Marks)

**Module-3**

- 5 a. With neat sketch, explain the constructional details of DC generator. (06 Marks)  
 b. Discuss the constructional details and working principle of the single phase transformer. (07 Marks)  
 c. A 4-pole DC shunt motor takes 22 A from 220 V supply. The armature and field resistances are respectively  $0.5 \Omega$  and  $100 \Omega$ . The armature is lap connected with 300 conductors. If the flux per pole is 20 mwb, calculate the speed and gross torque. (07 Marks)

**OR**

- 6 a. Discuss the characteristics of shunt and series motors and mention atleast one application. (06 Marks)  
 b. Derive the expression for emf of single phase transformer. List the various losses of the transformer. (07 Marks)  
 c. A 125 KVA transformer has a primary voltage of 2000 V at 60 Hz. Primary turns are 182 and the secondary turns are 40. Neglecting losses calculate  
 (i) No load secondary emf  
 (ii) Full load primary and secondary currents  
 (iii) Flux in the core. (07 Marks)

**Module-4**

- 7 a. Derive the emf equation for synchronous generator with usual notations. (06 Marks)  
 b. Define slip of an induction motor and derive expression for rotor current frequency. (07 Marks)  
 c. A 6-pole 3 phase star connected alternator has an armature with 90 slots and 8 conductor per slot and revolves at 1000 rpm, the flux per pole being 0.05 weber. Calculate the emf generated if the winding factor is 0.97 and  $K_C = 1$ . (07 Marks)

**OR**

- 8 a. With the help of 3-phase waveforms show that the magnetic field in 3-phase induction motor is rotating in nature having constant magnitude. (06 Marks)  
 b. Discuss the comparative study between salient and non-salient synchronous generator. (07 Marks)  
 c. If the emf in the stator of an 8-pole induction motor has a frequency of 50 Hz and that in the rotor 1.5 Hz, at what speed is the motor running and what is the slip? (07 Marks)

**Module-5**

- 9 a. Discuss the concept of power transmission and power distribution with single line diagram. (06 Marks)  
 b. Discuss working of fuse and MCB. **CMRIT LIBRARY BANGALORE - 560 037** (07 Marks)  
 c. Describe the operation of RCCB with its benefits. (07 Marks)

**OR**

- 10 a. Define electric shock and mention safety precautions to avoid shock. (06 Marks)  
 b. Explain the construction of plate earthing with neat sketch. (07 Marks)  
 c. A 1000 W electric geyser is used for 1 hour, 10 bulbs each of 40 W for 5 hours per day by a consumer. Calculate the cost of electricity at the price 8.50 / unit. (07 Marks)

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