

# SASTRA DEEMED UNIVERSITY

(A University under section 3 of the UGC Act, 1956)

## End Semester Examinations

February 2022

Course Code: EEE104

Course: **PRINCIPLES OF ELECTRICAL ENGINEERING**

Question Paper No. : UGF085

Max. Marks:100

### PART – A

Answer all the questions

10 x 2 = 20 Marks

1. A wire of length 1 m has a resistance of 2 ohms. What is the resistance of the second wire, whose specific resistance is double the first, if the length of the wire is 3 meters and the diameter is double the first?
2. Two point charges  $+Q$  and  $+4Q$  are placed at a distance 'a' apart on a horizontal plane. Where should the third charge be placed for it to be in equilibrium?
3. The maximum resistance of a rheostat is  $4.8\ \Omega$ , and the minimum resistance is  $0.5\ \Omega$ . Find the voltage across the rheostat for each condition when the current is 1.2 A.
4. A metal filament lamp whose resistance varies with temperature takes 0.3 A at 230 V. If the voltage is reduced to 115 V, will the current be halved? Explain your answer.
5. In a series RLC circuit, if the value of L and C are 100mH and  $100\mu\text{F}$ , respectively. Find the resonant frequency in Hz.
6. A transformer steps up the voltage from primary to secondary in the ratio of 1:10. Can we expect the output power to be the same as the input power?

7. Classify secondary measurement instruments based on their functions.
8. Why are parallel connections preferred in domestic wiring instead of series connections?
9. How is the rating of a fuse selected?
10. List the different factors to be considered to decide between a single-phase and three-phase supply connection for a newly constructed home.

### PART – B

Answer any four questions

4 x 15 = 60 Marks

11. (a) A discharged battery is charged at 8A for 2 hours, after which it is discharged through a resistor of 'R' Ohm. If the discharge period is 6 hours and the terminal voltage remains fixed at 12V, find the value of R assuming the Ampere-hour efficiency of the battery as 80%. (10)
- (b) Draw the one-line diagram of an electric power system and describe the significance of each element used. (5)
12. (a) Using only 1k $\Omega$  resistors, synthesize a resistor of 3/5k $\Omega$ . Use no more than four 1k $\Omega$  resistors. (5)
- (b) Using the superposition theorem, find the voltage across 4 $\Omega$  resistance in Figure 1 below. (10)

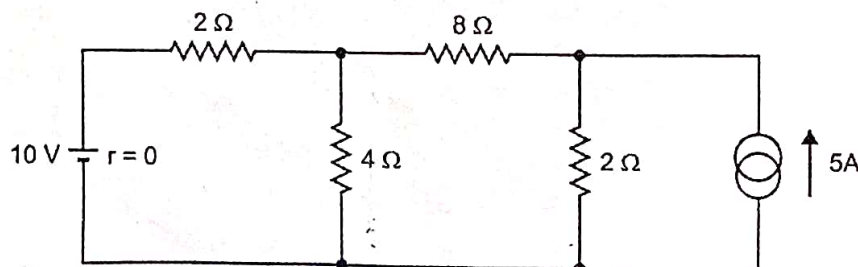


Figure 1

13. (a) Draw a star circuit using resistors, write the required expressions to transform the circuit to a delta circuit. (5)
- (b) A coil having a resistance of  $7\ \Omega$  and an inductive impedance of  $j9.98\ \Omega$  is connected to a 230 V, 50 Hz supply. Calculate (i) the circuit current (ii) phase angle (iii) power factor (iv) power consumed, and (v) voltage drop across resistor and inductor. (10)
14. (a) Distinguish between node and junction in an electric network. (5)
- (b) State the significance of the B-H curve and explain the method to sketch the B-H curve of any given material. (10)
15. (a) Compare Electric and Magnetic circuits. (5)
- (b) The primary and secondary windings of a 500 kVA transformer have resistances of  $0.42\ \Omega$  and  $0.0019\ \Omega$ , respectively. The primary and secondary voltages are 11000 V and 400 V, respectively, and the core loss is 2.9 kW, assuming the power factor of the load to be 0.8. Calculate the efficiency on
- (i) full load. (5)
- (ii) half load. (5)
16. (a) Explain in detail about different types of wiring systems and accessories. (10)
- (b) Compare the moving coil and moving iron instruments. (5)

### PART – C

**Answer the following**

**1 x 20 = 20 Marks**

17. (a) A homeowner consumes 700 kWh in January. Determine the electricity bill for the month using the following residential rate schedule:
- Base monthly charge of 45.00 rupees
- First 100 kWh per month at 2.50 rupees/kWh.
- Next 200 kWh per month at 3.5 rupees/kWh.
- Over 300 kWh per month at 5 rupees/kWh.
- Calculate the average cost per kWh if only 350 kWh are consumed in July when the family is on vacation most of the time. (10)



- (b) A factory operates at 0.8 power factor lagging and has a monthly demand of 750 kVA. The monthly power rate is Rs. 8.50 per kVA. To improve the power factor, 250 kVA capacitors are installed in which there is negligible power loss. The installed cost of equipment is Rs. 20,000, and fixed charges are estimated at 10% per year. Calculate the annual saving effected using capacitors.
- (10)

\*\*