SASTRA DEEMED UNIVERSITY

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

End Semester Examinations

March 2021

Course Code: **EEE104**

Course: **PRINCIPLES OF ELECTRICAL ENGINEERING**

Question Paper No. : **U066** Duration: 3 hours

Max. Marks:**100**

PART – A

Answer all the questions **10 x 2 = 20 Marks**

1. Assuming three current sources of 100 A, 50 A and 22 A are connected in series to form a circuit, what would be the resultant current flowing in the circuit? Why?

2. Using only 1kΩ resistors, synthesize a resistor of 3/5kΩ. Use no more than four 1kΩ resistors.

3. Find the electric field intensity at (0,3,4) meters in Cartesian coordinates due to a point charge Q =0.5mC at the origin.

4. A 20 μF capacitor is charged to a potential difference of 400 V and then discharged through a 100000 Ω resistor. Find the initial value of discharge current.

5. The instantaneous values of two alternating voltages are represented respectively by $v_1 = 60 \sin\theta$ volts and $v_2 = 40 \sin(\theta - \pi/3)$ volts. Write the expression for the instantaneous value of the sum of two voltages.

6. The non-zero average value of an alternating sinusoidal current waveform always denotes half-cycle average. Substantiate this statement.

7. 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?

8. Why are transformers rated in kVA (kilo Volt – Ampere)?

9. How is an earth pin different from the neutral pin in a 3-pin socket? If only a live phase wire is available, which one of the above two (neutral and earth pin) is essential to operate a lamp load.

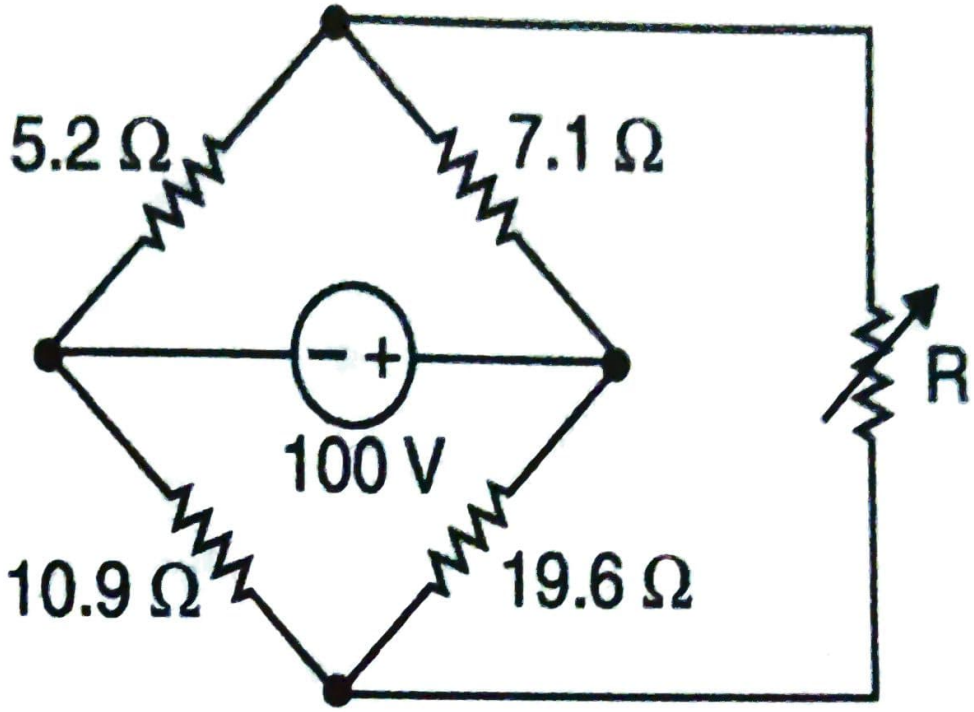
10. List the different types of protective devices used in domestic power systems.

PART – B

Answer any four questions **4 x 15 = 60 Marks**

11. An electric vehicle battery packis constructed from eight cells (4.7 V, 3000 mAh) in the following way. First, two modules are built, where each module comprises four of these cells wired in series. Next, these two modules are wired in parallel to make the battery pack. Draw the circuit for the above-said connection and calculate the following
    (i) the nominal energy capacity of the battery (inWh)
    (ii) the nominal capacity of the battery (in Ah)
    (iii)total discharge time if discharged at '4*C*' rate
    (iv)total time taken to charge if charged at '1C' rate
    (v) voltage rating of the battery pack

12. For the circuit shown in Figure below, find the value of R that will receive maximum power. Determine this power.



13. (a) Draw a star circuit using resistors; write the required expressions to transform the circuit to a delta circuit. (5)

(b) State Kirchhoff's laws as applied to an electrical circuit. Two batteries A and B are joined in parallel. Connected across the battery terminals is a circuit consisting of a battery C in series with a 25 Ω resistor, the negative terminal of C being connected to the positive terminals of A and B. Battery A has an e.m.f. of 108 V and internal resistance of 3 Ω, and the corresponding values for battery B are 120 V and 2 Ω. Battery Chas an e.m.f. of 30 V and a negligible internal resistance. Determine:

(i) the value and direction of the current in each battery (5)

(ii) the terminal voltage of battery A. (5)

14. A coil of inductance 159.2mH and resistance 20Ω is connected in series with a 60Ωresistor to a 240V, 50Hz supply. Determine

(i) the impedance of the circuit

(ii) the current in the circuit and the circuit phase angle

(iii)the voltage across the 60Ωresistor

(iv)the voltage across the coil.

(v) Draw the circuit phasor diagram showing all voltages.

15. (a) Compare Electric and Magnetic circuits. (5)

(b) The primary and secondary windings of a 500 kVA transformer have resistances of 0.42 Ω and 0.0019Ω respectively. The primary and secondary voltages are 11000V and 400V 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) Compare the moving coil and moving iron instruments. (8)

(b) Write short notes on types of earthing. (7)

PART – C

Answer the question **1 x 20 = 20 Marks**

17. (a) ADC power link is to be made between two islands separated by a distance of 24-kilo meters. The operating voltage is 500 kV, and the system capacity is 600 MW. Calculate the maximum current flow, and estimate the resistivity of the cable, assuming a diameter of 2.5 cm and a solid (not stranded) wire. (8)

(b) Consider a typical AC circuit powered by a sinusoidal source. Someone claims that the power transfer would take place during the positive half of the cycle, and then it would transfer back during the negative half, which leads to zero power transfer to the load. Examine this statement and write your explanation for this statement. (4)

(c) There are some 24 million households in a country. If every house hold replaces a single 100 W tungsten filament lamp with a low-energy bulb of 20 W,

(i) Calculate the reduction in annual demand if the bulbs are switched on for 3 hours per day.

(ii) What are the CO_2 emissions savings at 1 kg/kW h?

(iii) Compare the energy savings with the annual output of a1000 MW power station having an 80 per cent capacity factor.

(iv) What conclusions might be drawn from this for a national energy policy? (8)

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