Ref No.:Ex/ME(M2)/ES/B/EE/T/114/2024

B.E. MECHANICAL ENGINEERING FIRST YEAR FIRST SEMESTER - 2024

SUBJECT: BASIC ELECTRICAL ENGINEERING

Time: Three Hours | Full Marks: 100 (50 Marks for each part)

Use a separate Answer-Script for each part

Two marks reserved for neat and well-organized answers

Question No.	Part-I	Marks

Answer any three questions

1. (a) Calculate Form factor and Peak factor for the periodic waveform as shown in Fig. 1. 10

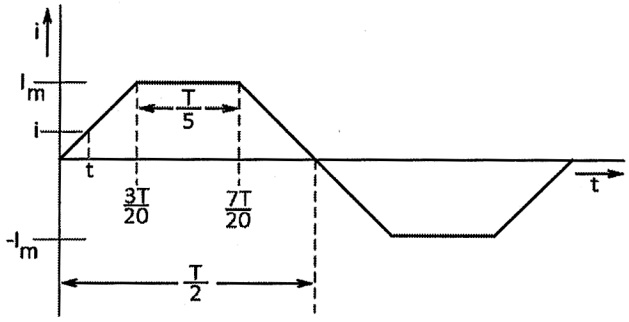

Fig. 1.

(b) Define the following terms. 6
(i) Active Power (ii) Reactive Power(iii) Power Factor

2. (a) Discuss about the current characteristics of a parallel combination of R-L components under pure sinusoidal voltage. What do you mean by instantaneous power? Calculate instantaneous power for the parallel combination of R-L components under pure sinusoidal voltage. 3+2+3

(b) A series R-L-C circuit consists of resistance R = 10Ω, inductance L = 10mH and capacitance C = 200 μF. Determine the frequency at which resonance will take place. If the applied voltage be 250 V at 50 Hz, determine the current and voltage drops across R, L and C. 8

Draw the phasor diagram of the series R-L-C circuit mentioned above.

3. (a) Calculate the impedance of the circuit in Fig.2. Also deduce the expression of frequency at resonance condition. 4+5

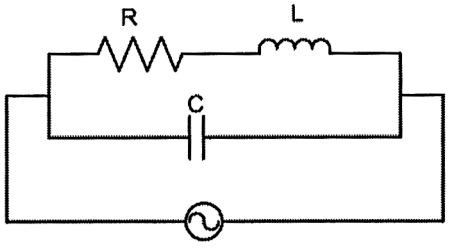

Fig. 2

(b) Describe the transfer of electrical power from generating station to the service mains using single line diagram. 7

4. (a) What do you mean by active and passive transducer? With proper example, discuss about the operation of primary and secondary transducer 2+4

(b) Discuss about the selection criteria of a transducer. Also discuss about the advantages and disadvantages of transducer. 5+5

5. Write short notes on the following topics 4×4
(i) Phasor diagram
(ii) Power triangle
(iii) Thermocouple
(iv)Electrical transducer

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Time : Three hours

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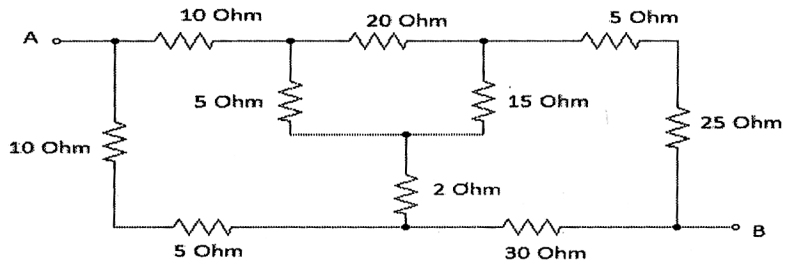
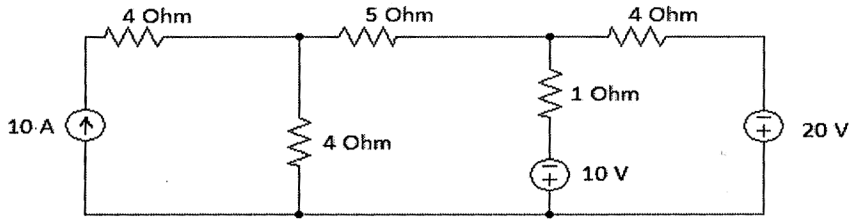
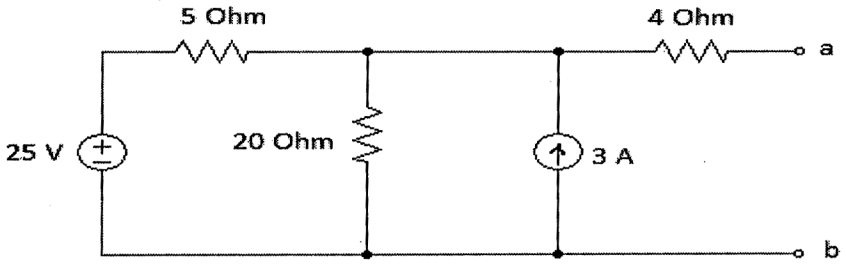
No. of question	**Part II (50 Marks)** **Answer any three questions(*2 marks reserved for neat and well-organized answer*)**	Marks
1. a)	Find the equivalent resistance between terminals A and B in the following circuit. 	6
b)	Find the current through 1 Ohm resistance in the network shown below using mesh analysis. 	10
2. a)	Find the equivalent current source between terminals a and b in the following circuit. 	4
b)	State and prove maximum power transfer theorem. Find the value of resistance R (shown in the figure below) for which it will consume maximum power and also find the maximum power.	6+6

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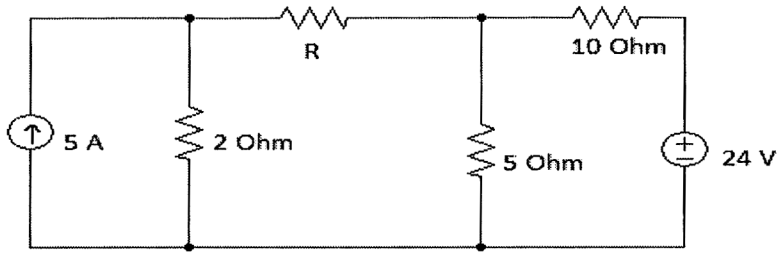

3. a)	Draw the hysteresis loop for a ferromagnetic material subjected to sinusoidal excitation. What is the significance of the area enclosed by this loop?	6
b)	In the magnetic system of the figure below, two sides are thicker than the other two sides. The depth of the core is 10 cm, the relative permeability of the core is μ_r = 2000, the number of turns N=300, and the current flowing through the coil is i=1 A. (i) Determine the flux in the core (ii) Determine the flux densities in the part of the core.	10
4. a)	What do you understand by the terms leakage flux and fringing effect?	4
b)	Explain the working principle of (i) attraction type and (ii) repulsion type of moving iron instruments with the help of a neat diagram.	12
5. a)	Describe the construction and working principle of the dynamometer type moving coil instrument. Derive the expression for deflection if the instrument is spring controlled.	10
b)	A moving coil instrument has the following data: numbers of turn=80, width of the coil=15mm, depth of coil=25mm, flux density in the gap=0.1 Wb/m^2 . Calculate the deflecting torque when carrying a current of 15mA. Also, calculate the deflection if the control spring constant is 2x10^{-6} Nm/degree.	6