

B.E. MECHANICAL ENGINEERING FIRST YEAR FIRST SEMESTER - 2025**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
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Answer any three questions

1. (a) What do you mean by the average value of a signal? What is the basis of defining the average value? Calculate the form factor and peak factor of the signal given in Fig. 1. 2+2+6

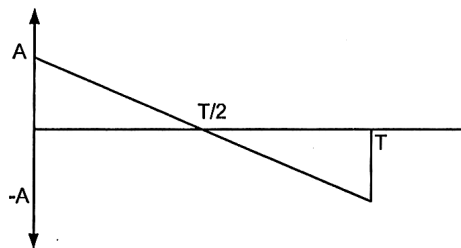


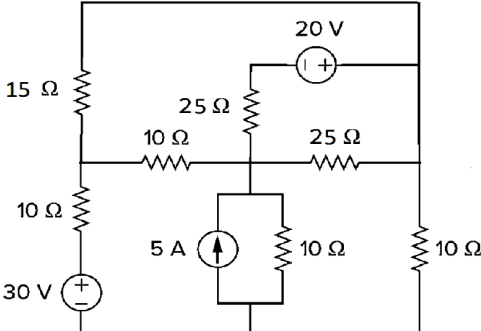
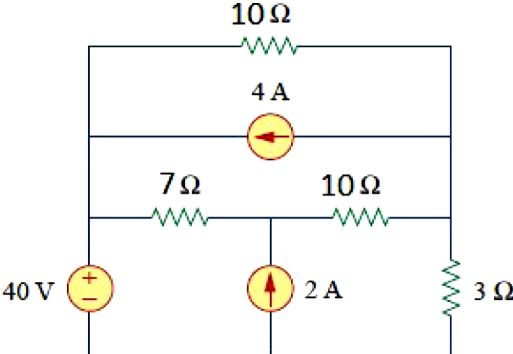
Fig. 1.

- (b) What is active power of an ac circuit? Derive the expression of active power of a series R-C circuit using relevant diagrams. 2+4
2. (a) What do you understand by admittance? Calculate the admittance of series R-L circuit using phasor diagram. Also, derive the expression of power factor of the circuit. 2+4+2
- (b) Two currents i_1 and i_2 are given by the expressions $i_1 = 10 \sin (314t + \pi/4)$ amperes and $i_2 = 8 \sin (314t - \pi/3)$ amperes Find (a) $i_1 + i_2$ and (b) $i_1 - i_2$. Express the answer in the form $i = I_m \sin (314t \pm \phi)$. 4
- (c) A coil is in series with a $20 \mu\text{F}$ capacitor across a 230V, 50Hz supply. The current taken by the circuit is 8 A and the power consumed is 200 W. Calculate the inductance of the coil if the power factor of the circuit is (i) leading (ii) lagging. 4

[Turn over

3. (a) What are the energy storage and energy dissipating elements? With relevant waveforms, derive the expression of energy storage within an inductor when an alternating voltage is applied to it. 1+5
- (b) A resistance R, an inductance $L = 0.01$ H and a capacitance C are connected in series. When a voltage $V = 400 \cos(300t - 10^\circ)$ V is applied to the series combination, the current flowing is $10\sqrt{2} \cos(300t - 55^\circ)$ amperes. Find R and C. 5
- (c) Discuss briefly how power is transmitted from generating station to the consumers end with the help of single line diagram. 5
4. (a) What is Thermistors? Discuss about the different types of thermocouple with examples. 2+4
- (b) What do you mean by LVDT? Discuss briefly the operation of LVDT with Bourdon tube. 2+3
- (c) Discuss about the selection criteria of transducers for different applications. 5
5. Write short notes on the following topics 4×4
 - (i) Power Triangle
 - (ii) Parallel Resonance
 - (iii) Impedance and Susceptance
 - (iv) Electrical transducer

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No. of question	Part II (50 Marks) <u>Answer any three questions (2 marks reserved for neat and well-organized answer)</u>	Marks
1. a)	Find the current through $15\ \Omega$ resistor using Thevenin's theorem. 	12
b)	You have been provided two 20 V source. Show how would you connect them in proper parallel and series connection to supply a load.	4
2. a)	State and explain Maximum Power Transfer theorem for DC circuits. Find out the efficiency of the circuit in maximum power cases.	8
b)	Find the value of current through $3\ \Omega$ resistor using superposition theorem. 	8
3. a)	Explain the Hysteresis Curve(B-H) of a magnetic material from Domain-Theory of magnetism point of view.	8

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b)	The mean length of a magnetic circuit is 50 cm with cross-sectional area 8 cm ² and relative permeability of the core material being 300. When a magnetizing coil carries a current of 10 A, the magnetic flux produced in the core is 4mWb. Find: (i) reluctance of the magnetic circuit (ii) flux density in the core (iii) magnetic field intensity (iv) number of turns of the coil.	8
4. a)	Why damping is necessary in an analog indicating instrument? Describe the various methods damping employed in analog indicating instruments.	12
b)	State the difference between spring control and gravity control in instrument.	4
5. a)	Derive the governing equation of moving iron(MI) instrument with a neat figure.	10
b)	A PMMC instrument has the coil resistance of 50 Ω and gives full scale deflection while carrying a current of 50 mA. Find the shunt resistance to be connected to the meter to measure the current up to 10 A.	6