

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 r.m.s value of a signal? What is the basis of defining the r.m.s value? Calculate the form factor and peak factor of the signal given in Fig. 1. 2+2+6

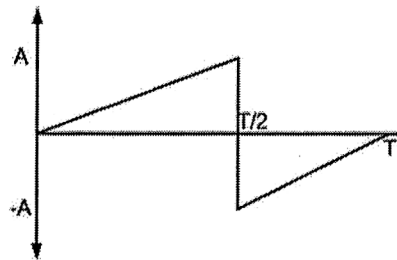


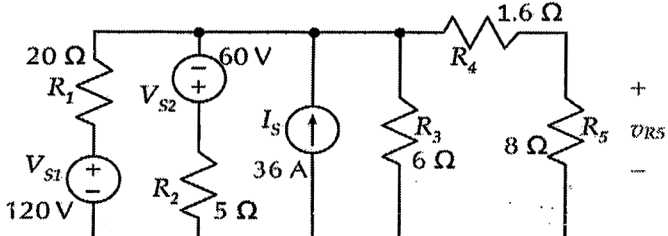
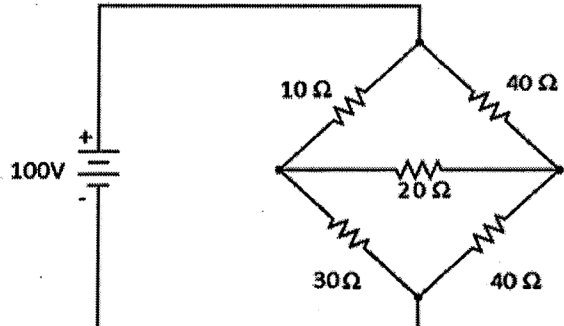
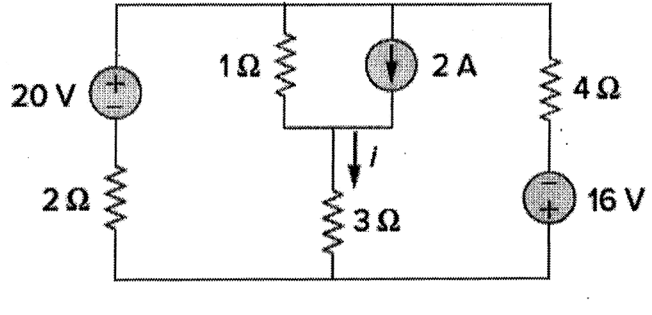
Fig. 1.

- (b) What is power factor of an ac circuit? How is it related with the power in the circuit? Discuss briefly the variation of power factor with the elements of the circuit. 2+2+2
2. (a) Discuss about the current characteristics of a parallel combination of R-C components under pure sinusoidal voltage. What do you mean by instantaneous power? Calculate instantaneous power for the parallel combination of R-C components under pure sinusoidal voltage. 3+2+3
- (b) A series combination of R-L consists of resistance $R = 10\Omega$ and $L = 10\text{mH}$ is connected in parallel with capacitance $C = 200\ \mu\text{F}$. Determine the frequency at which resonance will take place in the circuit. If the applied voltage be 250 V at 50 Hz, determine the current and voltage drops across R, L and C. 8

Solve the above-mentioned problem through taking the help of relevant phasor diagram.

3. (a) What are the energy storage and energy dissipating elements? With relevant waveforms, derive the expression of energy storage within a capacitor when an alternating voltage is applied to it. 1+5
- (b) A voltage $v(t) = 100 \sin(314 t - 20^\circ)$ is applied to a circuit and a steady current of $i(t) = 10 \sin(314 t + 10^\circ)$ is obtained. Determine (i) the power factor of the circuit and (ii) the power delivered to the circuit. Draw the phasor diagram. 5
- (c) With the help of single line diagram, discuss briefly how power is transmitted from generating station to the consumers end. 5
4. (a) What is Thermocouple? With proper example, discuss about the different types of thermocouple. 2+4
- (b) What do you mean by LVDT? Discuss briefly the operation of LVDT with Bourdon tube. 2+3
- (c) What are the selection criteria of transducer for specific application. 5
5. Write short notes on the following topics 4×4
 - (i) Voltage Triangle
 - (ii) Series Resonance
 - (iii) Impedance and Admittance
 - (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 voltage drop v_{R5} in the circuit below using source transformation method. 	6
b)	State and explain Thevenin's theorem. Find the current through 20 Ω resistance using Thevenin's theorem. 	10
2. a)	Correct or Justify: An ideal current source and an ideal voltage source have internal resistances of infinite and zero value, respectively.	4
b)	State and explain superposition theorem. Find the value of current through 3 Ω resistance using superposition theorem. 	4+8

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3. a)	What do you understand by soft and hard magnetic material? Describe their application in a magnetic circuit using examples.	6
b)	A ring of 30-cm mean diameter is made using a cylindrical iron rod of diameter 2.5 cm. A saw-cut 1-mm wide is made through the ring to create an air gap. A coil with 400 turns of wire is wound on the ring. Calculate the current required in the exciting coil to produce a flux of 2.5 mWb in the ring. Assume the relative permeability of iron at this flux density as 800. Neglect any leakage or fringing of the magnetic field.	10
4. a)	Describe the construction and working principle of megger?	8
b)	What are the merits and demerits of dynamometer type instruments?	8
5. a)	Describe the construction and working principle of a PMMC instrument. Derive the expression for deflection if the instrument is spring controlled.	10
b)	Calculate the resistance of shunt required to make a milli-ammeter which gives maximum deflection for a current of 15 mA, and which has a resistance of $5\ \Omega$, read up to 15 A.	6