CBCS SCHEME

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BPHYM102/202

First/Second Semester B.E./B.Tech.Degree Examination, June/July 2023
Applied Physics for ME Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define force constant. Derive the expressions for equivalent force constant for two springs connected in series and parallel combination.	9	L2	CO1
	b.	Describe the construction and working of Reddy shock tube with the help of a diagram.	7	L2	CO1
	c.	The distance between the two pressure sensors in shock tube is 100 mm. The time taken by a shock wave to travel this distance is 195 microsecond. If the velocity of sound under the same condition is 340 m/s. Find the Mach number of the shock wave.	4	L3	CO1
		OR			
Q.2	a.	Obtain a differential equation for a body undergoing forced oscillation and mention expression for amplitude and phase of forced oscillation.	8	L2	CO1
	b.	What are shock waves? Mention three characteristics and applications of shock waves.	7	L2	CO1
	c.	In series resonance experiment, a 50 μF capacitor, when connected in series with a coil having a resistance of 40 Ω, resonates at 1000 Hz. Calculate the inductance of the coil for the resonant circuit.	5	L3	CO5
		Module – 2			
Q.3	a.	Define bending moment. Derive the expression for bending moment interms of moment of inertia.	10	L2	CO1
	b.	Explain the nature of elasticity with the help of stress-strain diagram.	6	L2	CO1
	c.	The Bulk modulus for a material is 60×10^9 N/m^2 and its modulus of rigidity is 40×10^9 N/m^2. Calculate its Young's modulus for the given material.	4	L3	CO1
		OR			
Q.4	a.	Define Young's modulus, Bulk modulus and rigidity modulus. Derive the relation between Y, η and σ.	9	L2	CO1
	b.	Explain the various types of beams and mention their engineering applications.	6	L2	CO1
	c.	Calculate the force required to produce an extension of 1 mm in steel wire of length 2 m and diameter 1 mm. (Given : Young's modulus of wire, Y = 2×10^{11} N/m^2).	5	L3	CO1
		Module – 3			
Q.5	a.	Discuss the Seebeck effect and Peltier effect with their coefficients.	8	L2	CO2
	b.	Describe the construction and working of Thermoelectric Generator (TEG).	7	L2	CO2

	c.	The thermo emf of a thermocouple is 1200 μV when the cold junction is at 0 °C and hot junction at 100 °C. Calculate the constants a and b if the neutral temperature is 300 °C.	5	L3	CO2
		OR			
Q.6	a.	Describe the construction and working of Thermocouples. Mention their advantages.	9	L2	CO2
	b.	Explain the application of thermoelectricity on Refrigerator.	6	L2	CO2
	c.	The emf in microvolts of a thermocouple, one junction of which is at 0 °C is given by $e = 1600\,T - 4T^2$ where T °C is the temperature of hot junction. Find the neutral temperature and Peltier coefficient.	5	L3	CO2
		Module – 4			
Q.7	a.	Derive $\Delta T = \frac{(P_1 - P_2)}{C_P}\left[\frac{2a}{RT} - b\right]$ and hence discuss three cases.	9	L2	CO3
	b.	Describe the construction and working of Platinum Resistance Thermometer.	7	L2	CO3
	c.	In Joule-Thomson experiment temperature changes from 100 °C to 150 °C for pressure change of 20 MPa to 170 MPa. Calculate Joule-Thomson coefficient.	4	L3	CO3
		OR			
Q.8	a.	Describe the construction and working of Porous plug experiment. What conclusions have been drawn from it.	9	L2	CO3
	b.	Explain the construction and working of Lindey's air Liquefier.	7	L2	CO3
	c.	In a diffraction grating experiment the laser light undergoes second order diffraction for diffraction angle 1.48°. The grating constant $d = 5\times10^{-5}$ m and the distance between the grating and screen is 1 m, find the wavelength of LASER light.	4	L3	CO5
		Module – 5			
Q.9	a.	With a neat diagram, explain the principle, construction and working of Scanning Electron Microscopy.	8	L2	CO4
	b.	Explain the construction and working of X-ray diffractometer.	7	L2	CO4
	c.	Determine the crystal size when the peak width is 0.5° and peak position 30° for a cubic crystal. The wavelength of X-rays used is 100 Å and the Scherrer's constant K = 0.92.	5	L3	CO4
		OR			
Q.10	a.	Describe the principle, construction and working of Atomic Force Microscopy with the help of a neat diagram.	8	L2	CO4
	b.	Describe the principle, construction and working of Transmission Electron Microscopy.	8	L2	CO4
	c.	A beam of monochromatic X-rays is diffracted by NaCl crystal with a glancing angle of 12° for first order. Calculate the wavelength of X-rays if interplanar spacing of the crystal is 2.82 Å.	4	L3	CO4

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