Model Question Paper

USN | | | | | | | | | | |

Course Code: 1BPHYM102

First Semester B.E. Degree Examination, January 2025
Physics of Materials (ME Stream)

TIME:3 hrs. **Max.Marks:100**

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

		Module - 1	M	L	C
Q.01	a	Discuss the theory of forced oscilaltions and hence explain the variation of amplitude with frequency.	09	L2	CO1
	b	Explain resonance and hence discuss the sharpness of resonance.	06	L2	CO1
	c	A mass 0.5kg causes an extension 0.03m in a spring and the system set for oscillations. Find the force constant and angular frequency.	05	L3	CO1
		OR			
Q.02	a	Define Stiffness factor and hence obtain expressions for equivalent force constant for two springs are connected in series and parallel combination.	07	L2	CO1
	b	Set up the differential equation for damped oscillations, mentioning the expression for the amplitude of oscillations graphically discuss the types of damping.	08	L2	CO1
	c	Calculate the resonance amplitude of the vibration of the system whose natural frequency is 1000 Hz when it oscillates in the resistive medium for which the value of damping per unit mass is 0.008 rad/s under the action of an external periodic force/unit mass of amplitude 5 N/kg, with tunable frequency.	05	L3	CO1
		Module - 2			
Q.03	a	Derive the expression for bending moment in terms of moment of inertia and hence arrive at the expression for bending moment for beams of circular and rectangular cross-section.	09	L2	CO2
	b	With neat diagram explain the stress - strain curve for elastic materials.	06	L2	CO2
	c	A wire of length 1.5 m and of radius 0.4 mm is stretched by 1.2 mm on loading. If the Young's modulus of its material is 12.5×10^{10} N/m$^{2.}$ Find the stretching force.	05	L3	CO2
		OR			
Q.04	a	Explain Young's modulus, Bulk modulus, & rigidity modulus. Derive the relation between Y, n & ϭ.	09	L2	CO2
	b	Describe fatigue and explain the interpretation of Woehler Curve.	06	L2	CO2
	c	Young's modulus of the material of a wire is 9.68×10^{10} N/m^2. A wire of this material of diameter 0.95 mm is stretched by applying a certain force. What should be the limit of this force if the strain is not to exceed 1%?	05	L3	CO2

Module - 3					
Q.05	a	Discuss the variation of thermo-EMF with temperature and hence derive the relation between inversion and neutral temperatures.	09	L2	CO3
	b	Describe Seebeck effect and Peltier effect with their coefficients.	06	L2	CO3
	c	Material **A** has S_A=+160 μV/K (vs. reference), material **B** has S_B =−40 μV/K. A junction sees ΔT=100 K. What is the emf between the two leads?	05	L3	CO3
Q.06	a	Explain the construction and working of thermocouples. Mention their advantages.	08	L2	CO3
	b	Describe the construction and working of thermoelectric generator (TEG).	07	L2	CO3
	c	For a material with Seebeck coefficient S=250 μV/K, electrical conductivity σ =1.0×10^5 S/m, thermal conductivity κ=1.5 Wm-1K-1 at temperature T=300 K. compute the thermoelectric figure of merit Z and ZT.	05	L3	CO3
Module - 4					
Q.07	a	Describe construction and working of porous plug experiment. What conclusions have been drawn from it?	08	L2	CO4
	b	Describe the process of liquefaction of oxygen by cascade process.	07	L2	CO4
	c	In Joule Thomson experiment temperature changes from 100^0 C to 150^0 C for pressure changes of 20 Mpa to 170 Mpa. Calculate Joule Thomson coefficient.	05	L3	CO4
OR					
Q.08	a	Explain the principles of liquefaction of gases and hence discss the liquefaction of oxygen by cascade process with the help of a neat diagram.	09	L2	CO4
	b	Describe construction and working of platinum resistance thermometer with a neat sketch.	07	L2	CO4
	c	Mention the properties and uses of Liquid Helium.	04	L2	CO4
Module - 5					
Q.09	a	Explain the construction and working of X-ray diffractometer with a neat sketch.	07	L2	CO5
	b	Discuss the motion of a particle in 1D potential well of infinite height and hence obtain its eigen functions and eigen values.	08	L2	CO5
	c	Calculate the glancing angle for incidence of X- rays of wavelength 0.58Å on the plane (132) of NaCl which results in second order diffraction maxima taking the lattice constant as 3.81Å.	05	L3	CO5
OR					
Q.10	a	With neat diagram, explain the principle, construction and working of scanning electron microscopy.	09	L2	CO5
	b	Explain quantum confinement in 0, 1 2 and 3 dimension and give the graphical representation of density of states.	06	L2	CO5
	c	Determine the crystal size given the wavelength of X-rays 12 nm, the peak width 0.5^0 and peak position 23^0 for a cubic crystal. Given K = 0.94	05	L3	CO5

****