CBCS SCHEME

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BPHYM102/202

First/Second Semester B.E./B.Tech. Degree Examination, June/July 2025
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. *M : Marks , L: Bloom's level , C: Course outcomes.*
3. *VTU Hand Book is permitted.*

		Module – 1	M	L	C
Q.1	a.	Obtain a differential equation for a body undergoing forced oscillation and mention expression for amplitude and phase of oscillation. Discuss the three cases for variation of amplitude with frequency in forced oscillation.	10	L2	CO1
	b.	What are shock waves? Mention three properties and applications of shock waves.	6	L2	CO1
	c.	The distance between the two pressure sensors in a shock tube is 150 mm. The time taken by a shock wave to travel the distance is 0.3 ms. 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.	Describe the construction and working of hand operated Reddy shock tube. Mention any two key features of Reddy shock tube.	10	L2	CO1
	b.	Discuss the conditions for resonance and explain the sharpness of resonance.	5	L2	CO1
	c.	A 20gm oscillator with natural frequency 10 rad/s is vibrating in damping medium. The damping force is proportional to the velocity of the vibration. If the damping coefficient is 0.17 how does the oscillation decay?	5	L3	CO1
		Module – 2			
Q.3	a.	Define Young's modulus, Bulk modulus and rigidity modulus. Derive relation between Y, n and σ.	10	L2	CO2
	b.	Discuss the different types of beams and mention their engineering application.	6	L2	CO2
	c.	Calculate the extension produced in a wire of length 2 m and radius 0.13 cm due to a force of 15 N applied along its length (Given : Young's modulus of wire Y = 2.1×10^{11} N/m^2.	4	L3	CO2
		OR			
Q.4	a.	Derive the expression for bending moment in terms of moment of inertia and hence arrive at the expression for bending moment for a beam for circular and rectangular cross section.	10	L2	CO2
	b.	Discuss fatigue failures.	5	L2	CO2
	c.	Calculate the Possion's ratio for the material given that Y = 12.25×10^{10} N/m^2 and n = 4.55×10^{10} N/m^2.	5	L3	CO2

		Module – 3			
Q.5	**a.**	Derive expression for thermo emf in terms of T_1 and T_2.	**8**	**L2**	**CO3**
	b.	Describe the construction and working of thermoelectric generator (TEG)	**7**	**L2**	**CO3**
	c.	The thermo emf of a Cu-Fe thermocouple is 2160 μV when the cold junction is at 0°C and hot junction at 250°C. Calculate the constants a and b if the neutral temperature is 330 °C.	**5**	**L3**	**CO3**
		OR			
Q.6	**a.**	Discuss Seebeck effect, and Peltier effect with their coefficients.	**8**	**L2**	**CO3**
	b.	Explain the construction and working of thermocouples. Mention their advantages.	**7**	**L2**	**CO3**
	c.	The emf in lead – iron thermocouple, one junction of which is at 0°C, is given by $E = 1784t - 2.4t^2$ (in μ volts) where t is temperature in °C. Find the neutral temperature, π and σ.	**5**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Explain the construction and working of porous plug experiment with neat diagram.	**8**	**L2**	**CO4**
	b.	Explain the Liquefaction of Helium.	**8**	**L2**	**CO4**
	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**	**CO4**
		OR			
Q.8	**a.**	Explain Joule Thomson effect. Derive $\Delta T = \frac{P_1 - P_2}{C_p}\left[\frac{2a}{RT} - b\right]$	**8**	**L2**	**CO4**
	b.	Explain briefly the application of cryogenics in food processing and aerospace.	**8**	**L2**	**CO4**
	c.	Calculate inversion temperature of gas. Given a = 0.244 atm L^2/mol^2, b = 0.027L/mol and R = 0.0821 L atm/K /mol.	**4**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	With neat diagram, explain the principle construction and working of Scanning Electron Microscope (SEM).	**8**	**L2**	**CO5**
	b.	With neat diagram, explain the principle, construction and working of Atomic Force Microscope (AFM).	**8**	**L2**	**CO5**
	c.	The spacing between principal planes of NaCl crystal is 2.82 Å, it is found that first order Bragg reflection occur at an angle of 10°. Calculate the wavelength of X-rays.	**4**	**L3**	**CO5**
		OR			
Q.10	**a.**	Describe the construction and working of transmission electron microscope (TEM).	**8**	**L2**	**CO5**
	b.	Define nano-material and nano composite and classify the nano-materials based on the dimensional constraints.	**7**	**L2**	**CO5**
	c.	Determine the crystallite size given the wavelength of X-rays 10nm, the peak width 0.5° and peak position 25° for a cubic crystal given K = 0.94.	**5**	**L3**	**CO5**

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