CBCS SCHEME

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BPHYM102/202

First/Second Semester B.E./B.Tech Degree Supplementary Examination, June/July 2024

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.

			M	L	C
		Module – 1			
Q.1	**a.**	Define spring constant. Obtain expression for equivalent force constant for two springs connected in series and parallel combination.	**9**	**L2**	**CO1**
	b.	Obtain a differential equation for a body undergoing forced oscillation and mention expression for amplitude and phase of oscillation.	**6**	**L2**	**CO1**
	c.	A mass of 0.5kg causes an extension of 0.03m in a spring and the system is set for oscillations. Find the force constant of the spring, angular frequency and the time period of the resulting oscillations.	**5**	**L3**	**CO2**
		OR			
Q.2	**a.**	Describe the construction and working of hand operated Reddy shock tube. Mention any two key feature of Reddy shock tube.	**10**	**L2**	**CO1**
	b.	Discuss the conditions for resonance and explain the sharpness of resonance.	**6**	**L2**	**CO1**
	c.	The distance between the two pressure sensors in a shock tube is 150mm. The time taken by a shock wave to travel the distanced is 0.3ms, if the velocity of sound under the same condition is $340ms^{-1}$. Find the Mach number of the shock wave.	**4**	**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**	**CO1**
	b.	With neat diagram explain the stress-strain curve for elastic materials.	**6**	**L2**	**CO1**
	c.	Calculate the Poisson's ratio for the material given that $y = 12.25 \times 10^{10} N/m^2$ and $\eta = 4.55 \times 10^{10} N/m^2$.	**4**	**L3**	**CO2**
		OR			
Q.4	**a.**	Explain the term bending moment. Show the bending moment of a thin uniform bar of rectangular cross section is $\frac{Ybd^3}{12R}$.	**10**	**L2**	**CO1**
	b.	What is the fracture of elastic materials? Discuss on ductile and brittle fractures.	**6**	**L2**	**CO1**
	c.	Calculate the force required to procedure an extension of 1mm in steel wire of length 2m and diameter 1mm [Young's modulus for steel is $2 \times 10^{11} N/m^2$].	**4**	**L3**	**CO1**

Module – 3					
Q.5	**a.**	Discuss seebeck effect and peltier effect with their co-efficient.	**8**	**L2**	**CO2**
	b.	State and explain laws of thermo electricity's.	**8**	**L2**	**CO2**
	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.	**4**	**L3**	**CO2**
OR					
Q.6	**a.**	Derive expression for thermo emf in terms of T_1 and T_2.	**8**	**L2**	**CO2**
	b.	What are thermoelectric materials? Explain low, mid and high temperature thermoelectric materials.	**8**	**L2**	**CO2**
	c.	For Fe – Cu thermocouple it is observed that the thermo emf is zero when one of the junctions is at 20°C and other one is at some higher temperature. If the neutral temperature is 285°C, Calculate the higher temperature. Hence find out the temperature of inversion, if the cold junction temperature is at – 20°C.	**4**	**L3**	**CO2**
Module – 4					
Q.7	**a.**	Explain Joule Thomson effect show that, $\Delta T = \frac{(P_1 - P_2)}{C_P}\left[\frac{2a}{RT} - b\right]$.	**10**	**L2**	**CO3**
	b.	Explain the liquefaction of Helium.	**6**	**L2**	**CO3**
	c.	Calculate inversion temperature of gas. Given $a = 0.244$atm L^2/mol^2, $b = 0.027$ L/mol and $R = 0.0821$ L atm/K/mol.	**4**	**L3**	**CO3**
OR					
Q.8	**a.**	Explain the construction and working of porous plug experiment with neat diagram.	**10**	**L2**	**CO3**
	b.	Explain briefly the applications of cryogenics in food processing and a aerospace.	**6**	**L2**	**CO3**
	c.	In Joule Thomson experiment temperature changes from 100°C to 150°C for pressure change of 20MPa to 170MPa. Calculate Joule Thomson co-efficient.	**4**	**L3**	**CO3**

		Module – 5			
Q.9	**a.**	With neat diagram, explain the construction and working of x-ray diffractometer.	**10**	**L2**	**CO4**
	b.	Define nano-material and nano-composite and classify the nano-materials based on the dimensional constraints.	**6**	**L2**	**CO4**
	c.	First order Bragg reflection occurs when a monochromatic beam of x-rays of wavelength 0.675 Å is incident on a crystal at a glancing angle of 4.85°. What is the glancing angle for third order Bragg reflection to occur?	**4**	**L3**	**CO4**
		OR			
Q.10	**a.**	Describe the construction and working of atomic force microscopy.	**8**	**L2**	**CO4**
	b.	Give the principle, construction and working of Scanning Electron Microscope (SEM).	**8**	**L2**	**CO4**
	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.	**4**	**L3**	**CO4**

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