CBCS SCHEME

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BPHYM102

First Semester B.E./B.Tech. Degree Examination, Jan./Feb. 2023
Applied Physics for Mechanical 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.	What are damped oscillations? Give the theory of damped oscillations and hence discuss the case of critical damping.	10	L2	CO1
	b.	What are shock waves? Mention its applications.	5	L2	CO1
	c.	A mass of 0.4kg causes an extension of 0.02m in a spring and the system is set for oscillations. Find the force constant of the spring, angular frequency and period of resulting oscillations.	5	L3	CO5
		OR			
Q.2	a.	Define spring constant. Mention its physical significance, obtain expression for equivalent force constant for two spring connected in series and parallel.	10	L2	CO1
	b.	Describe the construction and working of Reddy shock tube.	6	L2	CO1
	c.	In a Reddy shock tube experiment, the time taken by shock waves to travel between the two sensors is 180μSec. If the distance between the two sensors is 100mm. calculate the mach number. Assume that speed of sound is 340 m/sec.	4	L3	CO1
		Module – 2			
Q.3	a.	Define Young's modulus(y), Rigidity modulus (η) and Poissons ratio (σ). Derive the relation between them.	10	L2	CO1
	b.	Explain different failure mechanisms in the materials.	6	L2	CO1
	c.	In a stretching experiment, the extension produced in a wire for a load of 1.5Kg is 0.2×10^{-2}m. The length of the wire is 2m and its radius is 0.013cm. Find the Young's modulus of the materials of the wire.	4	L3	CO1
		OR			
Q.4	a.	Explain different types of beams and mention engineering application of cantilever and I-section girder.	10	L2	CO2
	b.	With a neat diagram, explain the stress strain curve for elastic material.	6	L2	CO1
	c.	Calculate Poisson's ratio for silver, given its Young's modulus is 7.25×10^{10}N/m^2 and bulk modulus 11×10^{10}N/m^2.	4	L3	CO1

		Module – 3			
Q.5	**a.**	Describe the construction and working of thermoelectric generators (TEG). Mention their applications.	**8**	**L2**	**CO2**
	b.	State seeback effect and Peltier effect. Explain the variation of thermoelectric emf with temperature and obtain the relation between inversion temperature and neutral temperature.	**8**	**L2**	**CO2**
	c.	The thermo emf of a Cu – Fe thermocouple is 2160μ volt when the cold junction at 0°C and hot junction at 250°C. Calculate the constants a and b if the neutral temperature is 330°C.	**4**	**L3**	**CO2**
		OR			
Q.6	**a.**	Explain construction and working of thermocouples. Mention their advantages and limitations.	**8**	**L2**	**CO2**
	b.	Explain the working of thermoelectric coolers.	**8**	**L2**	**CO2**
	c.	The emf in micro-volts of a thermo couple one junction of which is at 0°C is given by $e = 1600T - 4T^2$ where T°C is the temperature of hot junction. Find neutral temperature and Peltier coefficient.	**4**	**L3**	**CO2**
		Module – 4			
Q.7	**a.**	Explain the liquefaction of oxygen by cascade process.	**8**	**L2**	**CO3**
	b.	Explain the construction and working of Porous plug experiment with neat diagram.	**8**	**L2**	**CO3**
	c.	In a Joule Thomson experiment temperature changes from 100°C to 150°C for a change of pressure from 20MPA to 170MPA. Calculate the Joule Thomson coefficient.	**4**	**L3**	**CO3**
		OR			
Q.8	**a.**	Describe the construction working and advantages of platinum resistance thermometer.	**8**	**L2**	**CO3**
	b.	What is Joule – Thomson effect? Derive $\Delta T = \frac{(P_1 - P_2)}{C_p}\left[\frac{2a}{RT} - b\right]$ and hence discuss 3 cases.	**8**	**L2**	**CO3**
	c.	Write the application of cryogenics in aerospace and food processing.	**4**	**L2**	**CO3**
		Module – 5			
Q.9	**a.**	Describe the principle, construction and working of scanning electron microscope (SEM) with a neat sketch.	**10**	**L2**	**CO4**
	b.	What are non-materials and classify the nano-materials based on the dimensional constraints.	**6**	**L2**	**CO4**

	c.	A beam of X-rays, $\lambda = 0.842$ Å is incident on a crystal at a grazing angle of 8.583°, when first order Bragg's reflection occurs. Calculate the glancing angle for 3[rd] order reflection.	4	L2	CO4
		OR			
Q.10	a.	Explain the construction and working of X-ray diffracto-meter and the crystal size is determined using Scherrer equation.	8	L2	CO4
	b.	With a neat diagram, explain the principle, construction and working of Atomic force microscope (AFM).	8	L2	CO4
	c.	Determine the wavelength of X-rays for crystal size of 1190nm, peak width 0.5° and peak position 35°, for a cubic crystal. Given Scherrer's constant K = 0.92.	4	L2	CO4

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