

CBCS SCHEME

USN

1BPHYC102/202

First/Second Semester B.E./B.Tech. Degree Examination, June/July 2026 Physics for Sustainable Structural Systems (CV 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 Formula Hand Book is permitted.

Module – 1			M	L	C
Q.1	a.	Define the Simple Harmonic Motion (SHM). Illustrate it with a suitable example. Formulate the differential equation of SHM.	08	L2	CO1
	b.	What are the forced oscillations. Derive the expression for amplitude of oscillations for a system undergoing forced oscillations.	08	L2	CO1
	c.	A compact SUV of mass 1060 kg is supported by a spring system. When an additional load of 70 kg is applied at the center of gravity, the suspension compresses by 2.2 cm. When the vehicle encounters a road hump, the suspension undergoes vertical oscillations. Determine the time period of these oscillations.	04	L3	CO1
OR					
Q.2	a.	Define the stiffness factor (spring constant) based on Hooke's Law. Derive the expressions for the equivalent effective spring constant for spring systems in series and parallel combination.	08	L2	CO1
	b.	Derive the expression for decay in amplitude of oscillations of a mechanical system under damped oscillations.	08	L2	CO1
	c.	A mechanical system with a natural frequency of 500 Hz is subjected to a periodic driving force of amplitude $100 \times 10^{-5} \text{ N/kg}$ in the presence of damping characterized by $0.01 \times 10^{-3} \text{ rad/s}$ per unit mass. Determine the maximum amplitude of vibration of the system.	04	L3	CO1
Module – 2					
Q.3	a.	Discuss the propagation of waves through beams, rods, and slabs.	08	L2	CO2
	b.	Explain the P-waves, S-waves, Love waves, and Rayleigh waves.	08	L2	CO2
	c.	First earthquake has the magnitude of 7.6 and the second earthquake is 1000 time more powerful than the first one. Estimate the magnitude of second earthquake.	04	L3	CO2
OR					
Q.4	a.	Define the earthquake and brief about the cause of earthquake.	08	L2	CO2
	b.	Define the tsunami and explain in detail about the causes and adverse effects of tsunami waves.	08	L2	CO2
	c.	Calculate the intensity of the Bhuj earthquake occurred in 2001 with the magnitude of 7.7 on Richterscale.	04	L2	CO2

Module – 3

Q.5	a.	Derive the expression for reverberation time using Sabine's assumptions.	08	L2	CO3
	b.	Explain the absorption power and Absorption coefficient along with the expressions. Mention the requisites for acoustics in auditorium.	08	L2	CO3
	c.	The volume of the hall is 5400 m^3 . The total absorption is 594 OWU m^2 . What is the reverberation time?	04	L2	CO3

OR

Q.6	a.	Discuss the sound insulation and its measurements. Explain the methods of sound insulation.	08	L2	CO3
	b.	State the Radiometry and explain the radiation quantities along with SI units.	08	L2	CO3
	c.	The dimension of a classroom is $20 \times 15 \times 5 \text{ m}^3$. The reverberation time is 3.5 second. Calculate the total absorption of the surface and average absorption coefficient.	04	L2	CO3

Module – 4

Q.7	a.	What is the non-destructive testing? Discuss the benefits of NDT.	08	L2	CO4
	b.	Explain the working principle and procedure involved in the Eddy Current Testing method.	08	L2	CO4
	c.	The ultrasonic waves with frequency 2 MHz is used in the testing the material defect. If its speed is 6046 ms^{-1} , then what is the depth of the defect?	04	L3	CO4

OR

Q.8	a.	Define ultrasonic waves. Explain the generation of ultrasonic waves using piezoelectric crystal method.	08	L2	CO4
	b.	Explain the shadow formation in radiographic testing, and image distortion.	08	L2	CO4
	c.	The ultrasonic pulses travel through 26 mm thick sample in a pulse echo method testing, with the speed of 6000 ms^{-1} . Estimate the echo time.	04	L3	CO4

Module – 5

Q.9	a.	Explain the types of smart materials and give the qualitative description.	08	L2	CO5
	b.	List the types of sensors, explain the working principle of vibration sensors.	08	L2	CO5
	c.	A piezoelectric crystal with a charge sensitivity of 2 pC/N and relative permittivity of 5 has an area of 1 cm^2 and a thickness of 1 mm. If a force of 24 N is applied perpendicular to its surfaces, calculate the voltage generated across the crystal.	04	L3	CO5

OR

Q.10	a.	What are the shape memory alloys and explain the phase transformation in SMA.	08	L2	CO5
	b.	Explain the use of sensors in intelligent structures.	08	L2	CO5
	c.	In an experiment, an electric field of 1 MV/m is applied to a dielectric material, producing a longitudinal strain of 6×10^{-4} . Calculate the electrostrictive coefficient of the material.	04	L3	CO5
