Model Question Paper 2 -21BS12 I-SEM with effect from 2021 (CBCS Scheme)

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

First Semester B.Sc. Degree Examination

Subject Title: Mechanics and Properties of Matter (Physics)

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02. Draw neat sketches where ever necessary.
03. **Constants :** Speed of Light "c" = 3 $\times 10^8$ ms^{-1},Boltzmann Constant "k" = 1.38 $\times 10^{-23}$ JK^{-1}, Planck's Constant "h" = 6.625 $\times 10^{-34}$ Js, Acceleration due to gravity "g" = 9.8 ms^{-2}, Permittivity of free space "ε_0"=8.854 $\times 10^{-12}$ F m^{-1}.

		Module -1	**Marks**
Q.01	a	What is elastic and inelastic collisions. Discuss inelastic collision between two particles which stick together in laboratory frame of reference.	08
	b	Discuss the conservation of linear momentum in case of variable mass. Mention the expression for single stage rocket.	08
	c	A body of mass 0.7 kg is whirled round in a circle of radius 0.5 m. If it makes 5 revolution/s. What is its angular momentum?	04
		OR	
Q.02	a	Define angular momentum and torque and establish relation between them.	08
	b	What is central force? Derive Kepler's second law of planetary motion.	08
	c	A neutron moving with a velocity of 10^6 m/s collides with a deuteron at rest. After collision, the combined mass(triton) moves with a certain velocity. Calculate the velocity, if the mass of neutron is 1.67×10^{-27} kg and the mass of the deuteron is 3.34×10^{-27} kg.	04
		Module-2	
Q. 03	a	Derive the expression for moment of inertia of a flywheel.	08
	b	State and prove the theorem of parallel axes as applied to moment of inertia.	08
	c	A solid sphere of mass 0.05 kg and diameter 2×10^{-2}m rolls without slipping with a uniform velocity of 0.05 m/s along a straight line on a smooth horizontal table. Calculate its total energy.	04
		OR	
Q.04	a	Show that the moment of inertia of uniform circular disc about an axis passing through its center and perpendicular to its plane is $0.5MR^2$.	08
	b	Derive the expression for moment of inertia of a annular ring.	08
	c	A fly wheel of mass of 10 kg and diameter 0.2 m makes 100 rpm. Calculate its angular velocity and kinetic energy.	04
		Module-3	
Q. 05	a	Obtain an expression for amplitude of vibration of a body undergoing damped vibration.	10
	b	Define SHM. Derive differential equation of linear SHM.	06
	c	A vibrating system of natural frequency 800 cycles/s, is forced to vibrate with a periodic force/unit mass of amplitude 120×10^{-5} Newton/kg in the presence of a damping /unit mass of 0.01×10^{-3} rad/s. Calculate the maximum amplitude of vibration of the system.	04

		OR	
Q. 06	a	Derive an expression for composition of two linear SHM of equal periods acing at right angles to each other.	08
	b	Discuss the condition for resonance and hence write a note on sharpness of resonance.	08
	c	A particle executing S.H.M has velocity 3 m/s and 2 m/s when it is at distance of 0.2 m and 0.3 m respectively from its mean position. Find its length of the oscillation.	04
		Module-4	
Q. 07	a	Explain what you mean by gravitational potential at a point. Obtain expression for Gravitational potential and field at a point due to spherical shell at a point inside the shell.	08
	b	For a given compound pendulum, show that the centers of oscillation and suspensions are inter changeable.	08
	c	Calculate the mass of the earth from the following data $g=9.80 m/s^2$, G= 6.670 x 10^{-11} newton-m^2/kg^2 and R=6.38x10^6 m.	04
		OR	
Q. 08	a	Explain Newton's law of gravitation. How the value of g can be determined by Cavendish method.	09
	b	Explain bar pendulum and how the value of g can be determined using bar pendulum.	07
	c	A uniform circular disc of diameter 20 cm vibrates about a horizontal axis perpendicular to its plane and at a distance of 5 cm from the center. Calculate the time period of oscillation.	04
		Module-5	
Q. 09	a	What is a torsional pendulum? Derive the expression for period of oscillations for a torsional pendulum.	08
	b	Obtain an expression for bending moment of a beam for a rectangular cross section.	08
	c	Calculate the Young's modulus of the material of a wire of 3 m long and 1 mm radius when the force of 950 N increases its length by 5 mm.	04
		OR	
Q. 10	a	Obtain expression for young's modulus for single cantilever.	10
	b	Explain Poisson's ratio and discuss its limitations.	06
	c	Calculate the angular twist of a wire of length 0.3 m and radius of cross section $2x10^{-4}$m when a torque of $5x10^{-4}$ Nm is applied. Rigidity modulus of the material is $1.8x10^{10}$ Nm^{-2}.	04

Table showing the Bloom's Taxonomy Level, Course Outcome and Program Outcome

Question		Bloom's Taxonomy Level attached	Course Outcome	Program Outcome
Q.1	(a)	L_1 L_2	CO.1	
	(b)	L_1	CO.1	
	(c)	L_3	CO.1	
Q.2	(a)	L_1 L_2	CO.1	
	(b)	L_2	CO.1	
	(c)	L_3	CO.1	
Q.3	(a)	L_2	CO.2	

	(b)	L_1 L_2	CO.2	
	(c)	L_3	CO.2	
Q.4	(a)	L_1	CO.2	
	(b)	L_2	CO.2	
	(c)	L_3	CO.2	
Q.5	(a)	L_2	CO.3	
	(b)	L_1 L_2	CO.3	
	(c)	L_3	CO.3	
Q.6	(a)	L_2	CO.3	
	(b)	L_2	CO.3	
	(c)	L_3	CO.3	
Q.7	(a)	L_1 L_2	CO.4	
	(b)	L_2	CO.4	
	(c)	L_3	CO.4	
Q.8	(a)	L_2	CO.4	
	(b)	L_2	CO.4	
	(c)	L_3	CO.4	
Q.9	(a)	L_1 L_2	CO.5	
	(b)	L_2	CO.5	
	(c)	L_3	CO.5	
Q.10	(a)	L_2	CO.5	
	(b)	L_2	CO.5	
	(c)	L_3	CO.5	

Bloom's Taxonomy Levels	**Lower order thinking skills**		
	Remembering(knowledge):$L1$	Understanding Comprehension): $L2$	Applying (Application): $L3$
	Higher order thinking skills		
	Analyzing (Analysis): $L4$	Valuating (Evaluation): $L5$	Creating (Synthesis): $L6$