Model Question Paper 1- 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	State and explain law of conservation of angular momentum. Derive the expression for work done by a torque.	08
	B	Derive Kepler's second law of planetary motion.	08
	C	Calculate the angular velocity of the wheel of a vehicle moving at a speed of 180 km/h. The diameter of the wheel is 0.11m.	04
		OR	
Q.02	A	What is elastic and inelastic collisions. Discuss elastic collision between two particles which do not 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 grinder is in the form of a circular disc of mass 10 kg and diameter 0.4m. Calculate the constant torque that has to be applied so that the disc acquires an angular velocity of 4 revolution/second in 5 seconds. Also calculate the rate at which work is done by torque at the end of 5 seconds.	04
		Module-2	
Q. 03	A	Obtain an expression for kinetic energy of a rotating body.	08
	B	Derive an expression for moment of inertia of rectangular lamina.	08
	C	A fly wheel is a uniform disc of mass 72 kg and radius 0.5 m. Calculate Moment of Inertia and its kinetic energy when it is rotating at 70 r.p.m	04
		OR	
Q.04	A	State and prove the theorem of perpendicular axes as applied to moment of inertia.	10
	B	Define moment of Inertia and explain its physical significance.	06
	C	Calculate the MI of a rectangular plate of mass 1 kg about an axis through its center of gravity and perpendicular to its plane. Its length is 0.2 m and breadth 0.1m. Find its radius of gyration about the same axis	04
		Module-3	
Q. 05	A	Define simple harmonic motion. Obtain an expression for total energy of a particle executing simple harmonic motion.	10
	B	Define Resonance. Explain Helmholtz resonator.	06
	C	A 20 gm 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.	04
		OR	

Q. 06	A	Obtain an expression for amplitude of vibration of a body undergoing forced vibration.	08
	B	Derive an expression for the period of oscillation of flat spiral spring.	08
	C	A particle executing a S.H.M has a maximum displacement of 4 cm and its acceleration at a distance of 1 cm from its mean position is 3 cm/s^2. What will be its velocity when it is a distance of 3 cm from its mean position.	04
Module-4			
Q. 07	A	Describe Cavendish method for determining the value of gravitational constant. Mention any two drawbacks of this experiment	08
	B	Obtain an expression for time period of oscillations of compound pendulum.	08
	C	A body weighs 90 kg on the surface of the earth. How much will it weigh on the surface of the Mars whose mass is 1/9 and radius 1/2 that of the earth.	04
OR			
Q. 08	A	Obtain an expression for Gravitational potential and field at a point due to spherical shell at a point outside the shell	08
	B	Explain bar pendulum and how the value of g can be determined using bar pendulum	08
	C	Given G= 6.670 x 10^{-11}newton-m^2/kg^2, the radius of the earth R=6.4x10^6 m and its mean density 5.51 gm/cc. calculate the acceleration due to gravity at the earth surface.	04
Module-5			
Q. 09	A	Obtain an expression for bending moment of a beam for a circular cross section.	08
	B	Explain longitudinal and lateral strain coefficients and establish relation in terms of Poisson's ratio.	08
	C	A steel wire 4 min length and 2.4 x 10^{-7} m^2 in a cross sectional area is stretched by a force of 36 N . Calculate stress, strain and increase in length	04
OR			
Q. 10	A	Define different elastic moduli and obtain relation between them.	08
	B	Obtain an expression for couple required to produce unit twist in uniform cylinder rod fixed at one end.	08
	C	Calculate the Poisson's ratio for the material given that Y=12.25 x 10^{10} N/m^2 & η=4.55 x 10^{10} N/m^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	C0.1	
	(b)	L_2	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_2	CO.2	
	(c)	L_3	CO.2	
Q.4	(a)	L_1 L_2	CO.2	

	(b)	L_2	CO.2	
	(c)	L_3	CO.2	
Q.5	(a)	L_1 L_2	CO.3	
	(b)	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_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_2	CO.5	
	(b)	L_2	CO.5	
	(c)	L_3	CO.5	
Q.10	(a)	L_1	CO.5	
	(b)	L_2	CO.5	
	(c)	L_3	CO.5	

Bloom's Taxonomy Levels	**Lower order thinking skills**		
	Remembering(knowledge):L_1	Understanding Comprehension): L_2	Applying (Application): L_3
	Higher order thinking skills		
	Analyzing (Analysis): L_4	Valuating (Evaluation): L_5	Creating (Synthesis): L_6