Sl. No. of Ques. Paper	: 401 C
Unique Paper Code	: 222181
Name of Paper	: **Physics – I**
Name of Course	: **B.Sc. (Hons) Maths. / B.Sc. (Mathematical Science)**
Semester	: **I**

Duration : 3 hours

Maximum Marks : 75

Attempt five questions in all. Question No. 1 is compulsory. Select at least two questions from each of Sections A and B.

1   Attempt any five: 3x5=15

(a)   Determine a unit vector perpendicular to plane containing
$a = 2i - 6j - 3k$
$b = 4i + 3j - k$

(b)   Prove: $(A \times B) \cdot (C \times D) = (A \cdot C)(B \cdot C) - (B \cdot C)(A \cdot D)$

(c)   Show that gradient of field describing motion is irrotational

(d) $div(sA) = s\ divA + A \cdot grad\ s$

(e)   Show that $A = (6xy + z^3)i + (3x^2 - z)j + (3xz^2 - y)k$ is irrotational.

(f)   Show that $F = (2xy + z^3)i + x^2j + 3xz^2k$ is a conservative force field.
Find the scalar potential

(g)   State Stokes' theorem. Write it in rectangular form.

Section A

2   (a)   Find the resultant of two S.H.M. of equal period, when they are   10
perpendicular to one another. Discuss different cases.

(b)   A mass of 25×10^{-3} kg is suspended from the lower end of the vertical
spring having a force constant 25 N/m. The mechanical resistance of
the system is 1.5 N/m . The mass is displaced vertically and released.   5
Find whether the motion is oscillatory? If so calculate the period of
oscillation.

3   (a)   Define moment of inertia. State and prove theorem of perpendicular
axis.   5

10

(b) Find the moment of inertia of an annular circular lamina about an axis along its diameter.

4 (a) What are elastic and inelastic collision? Discuss elastic collision in one dimension for two particles.   6

(b) A particle of mass m_1 experiences a perfectly elastic collision with a stationary particle of mass m_2. Determine the ratio of m_1/m_2 if after a head-on collision the particles fly apart in opposite directions with equal velocities.   5

(c) Calculate the group velocity when the two waves
$$Y_1 = 10 \sin (2\pi t - 5x)$$
$$Y_2 = 15 \sin (5\pi t + 5x)$$
Superimpose. Y_1 and Y_2 are in meters.   4

Section B

5 (a) What is interference? Give the necessary conditions to obtain sustainable and discernable interference fringes.   1+4

(b) Derive an expression for optical path difference in thin films due to reflected light. Obtain the conditions for maxima and minima.   4+4

(c) Explain the colours in thin films.   2

6 (a) Distinguish between Fresnel and Fraunhofer class of diffraction.   2

(b) Give construction and theory of plane transmission grating. Discuss the intensity distribution.   7+3

(c) Show that the resolving power of grating is proportional to the order of diffraction.   3

7 (a) What do you understand by polarization of light? How do you obtain plane polarized light by reflection and refraction?   1+6

(b) State and explain Brewster's Law.   2

(c) What are quarter and half wave plates? Discuss one application of each.   6