This question paper contains 3 printed pages.

5696 *Your Roll No.* .....

Credit Course for B.Sc. (H) / Sem. I **B**

MATHEMATICS

Paper – Physics I

Time : 3 hours *Maximum Marks* : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

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

1. Attempt any *five*:

   (*a*) Find the volume of parallelopiped with adjacent sides:

   $$\mathbf{OA}=3\mathbf{i}-\mathbf{j}$$
   $$\mathbf{OB}=\mathbf{j}+2\mathbf{k}$$
   $$\mathbf{OC}=\mathbf{i}+5\mathbf{j}+4\mathbf{k}$$

   (*b*) Find $\iint \mathbf{F} \cdot \mathbf{n}\, ds$, where,

   $$\mathbf{F}=(2x+3z)\mathbf{i}-(xz+y)\mathbf{j}+(y^2+2z)\mathbf{k}.$$

   (*c*) Prove that curl curl $\mathbf{F}$ = grad div $\mathbf{F}-\nabla^2\mathbf{F}$.

   (*d*) What do you mean by line and surface integrals?

   (*e*) State Stokes' theorem.

P. T. O.

(*f*) Define scalar and vector fields. Give *one* example of each.

(*g*) If the dot product of two vectors **A** and **B** is zero, find the angle between them. 5×3=15

SECTION A

2. (*a*) State Newton's laws of motion and discuss their limitations. 6

(*b*) State and prove work energy theorem. Is the theorem valid for all forces? 2+5+2

3. (*a*) What do you mean by rigid body? Define the radius of gyration. How is it calculated in case of rigid body? 2+2+2

(*b*) What are forced oscillations? Derive differential equation for a forced harmonic oscillator and find its solution. Discuss the transient as well as steady state terms in the complete solution. 2+2+3+2

4. (*a*) What are coupled oscillations? Establish equation of motion for two coupled pendulums. 2+3

(*b*) Distinguish between travelling and standing waves. Define the phase and group velocity of a wave and obtain a relation between them. 4+1+1+4

SECTION B

5. (*a*) What do you mean by coherent sources? Explain

the formation of coherent sources in the case of a biprism. How is the separation between such coherent sources measured in the experiment with biprism? 2+3+5

(*b*) A parallel beam of sodium light ($\lambda=5890\times10^{-8}$ cm) is incident on a thin glass plate ($\mu=1\cdot5$) such that the angle of refraction into the plate is 60°. Calculate the smallest thickness of the plate which will make it appear dark by reflection. 5

6. (*a*) Derive the expression for intensity distribution in case of Fraunhofer diffraction through a single slit. 10

(*b*) Distinguish between the dispersive and the resolving power of plane diffraction grating. 5

7. (*a*) Explain plane and linearly polarized light. 3

(*b*) Explain the construction of a quarter-wave plate. How can it be used in the production and detection of (*i*) circularly, (*ii*) elliptically polarized light? 4+2+2+2+2