B.Sc. 3rd Semester (Honours) Examination, 2021-22

PHYSICS

Course ID: 32411   **Course Code: SH/PHS/301/C-5**

Course Title: Mathematical Physics - II

Time: 1 Hour 15 Minutes   **Full Marks: 25**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words
As far as practicable

Section-I

1. Answer any *five* questions: $1 \times 5 = 5$

(a) Simplify $(\cos 2\pi/3 + i \sin 2\pi/3)$.

(b) What is cyclic co-ordinate?

(c) Discuss the nature of singularity of the function $f(z) = \frac{1 - \cosh z}{z^2}$ at $z = 0$.

(d) $A = \begin{bmatrix} i & 1-i & 2 \\ -1-i & 3i & i \\ -2 & i & 0 \end{bmatrix}$, Show that matrix A is Skew-Hermitian.

(e) A bag contains 7 red and 8 black balls. Find the probability of drawing a red ball.

(f) Write down the expression of Gauss normal distribution function.

(g) Write down Hamilton's canonical equations of motion.

(h) Define Dirac delta function.

Section-II

2. Answer any *two* questions: $5 \times 2 = 10$

(a) Discuss the analyticity of the function $f(z) = z - \bar{z}$

(b) A Lagrangian is in the form $L = \frac{1}{2}\alpha \dot{q}^2 - \frac{1}{2}\beta q^2$, where α and β are constant, Find -

(i) Hamiltonian of the system.

(ii) The equation of motion.   (3+2)

(c) Prove that $\delta(bt) = \frac{\delta(t)}{|b|}$.

(d) Evaluate the integral $I = \oint z^{1+i}\, dz$ over the positively oriented unit circle.   P.T.O

Section-III

3. Answer any *one* question: $10 \times 1 = 10$

(a) Find the eigenvalues and normalized eigenvectors of the real symmetric matrix

$$A = \begin{pmatrix} 1 & 1 & 3 \\ 1 & 1 & -3 \\ 3 & -3 & -3 \end{pmatrix}$$

(3+7)

(b) Find the residue of $f(z) = \frac{z}{(z^2+1)^2}$ at $z = i$. Find $I = \int_0^{2\pi} \frac{d\theta}{5+4\cos\theta}$ using residue theorem. (3+7)

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