Progressive Education Society's
Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16
(Autonomous)
End Semester Examination: December 2023
Faculty: Science and Technology

Program: B.Sc. Code (Gen03)   **Semester:** III   **SET: B**
Program (Specific): General B.Sc.   **Course Type: Core course**
Class: S.Y.B. Sc. (Gen)   **Max. Marks: 35**
Name of the Course: Mathematical Method in Physics-I
Course Code: 23-PHY-231   **Time: 2Hr**
Paper: I

Instructions to the candidate:

1) *There are 4 sections in the question paper. Write each section on separate page.*
2) *All Sections are compulsory.*
3) *Figures to the right indicate full marks.*
4) *Draw a well labeled diagram wherever necessary.*
5) *Use of calculator and log table is allowed.*

SECTION: A

Q1) Answer the following (<u>any 5/7</u>) **5**

   i)   What is mean by explicit function?

   ii)   What is partial differentiation?

   iii) State any two physical quantities which depend upon two or more physical quantities.

   iv)   What is Solenoidal vector field?

   v)   What is lamellar vector field?

   vi)   State De-Moivre's theorem.

   vii) Define Vector product of two vectors.

SECTION: B

Q2) Answer the following (<u>any 5/7</u>) **10**

   i)   Prove that $\sin^2 \Theta + \cos^2 \Theta = 1$.

   ii)   Explain division of two complex numbers using Argand diagram.

   iii) Prove that $| A \times B |$ gives us area of parallelogram.

iv) A particle moves from a point (3,-4,-2) meter to a point (-2, 3 , 5) meter under the influence of a force $\vec{F} = -2\vec{i} + 3\vec{j} + 4\vec{k}$ newton. Calculate work done by the force.

v) Explain scalar and vector fields with examples

vi) Explain rotational and irrotational vector fields with suitable diagram.
Show that $\nabla \cdot \nabla \emptyset = \nabla^2 \emptyset$.

vii) Find the total differential of the function $f(x,y) = y \exp (x+y)$.

SECTION: C

Q3) Answer the following (<u>any 4/6</u>)   **12**

   i) Derive exponential form of complex number Z.

   ii) Show that $\cos 2 \Theta = \cos^2 \Theta - \sin^2 \Theta$.

   iii) If $\vec{A} = 2\vec{i} - 3\vec{j} - \vec{k}$ and $\vec{B} = \vec{i} + 4\vec{j} - 2\vec{k}$. Find AxB and BxA.

   iv) Determine the volume of the parallelopiped defined by vectors $\vec{A} = 2\vec{i} - \vec{j} - \vec{k}$
,$\vec{B} = \vec{i} + 2\vec{j} - 3\vec{k}, \vec{C} = 3\vec{i} + 2\vec{j} + 5\vec{k}$

   v) Prove the vector identity $\nabla \times \nabla \emptyset = 0$.

   vi) Show that vector $F = (y^2+2x\ z^2)\ i + (2xy - z)\ j + (2x^2z - y +2z)\ k$ is irrotational.

SECTION: D

Q4) Answer the following (<u>any 2/4</u>)   **8**

   i) Using partial differentiation verify two theorems in case of ideal gas (PV=RT).

   ii) Prove $(A \times B \times C) = (A \cdot C)\ B - (A \cdot B)\ C$.

   iii) If $\vec{A} = 3\vec{i} + 5\vec{j} + 7\vec{k}$ and $\vec{B} = \vec{i} - 2\vec{j} + 4\vec{k}$, Find dot product and cross product of two vectors.

   iv) If $Z = (\frac{2+i}{3-i})^2$ is complex number. Find value of x and y.

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