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B.Sc. (Hons.) Physics (Semester – 1st)
MATHEMATICS-I
Subject Code: BMATH5101
Paper ID: [19131502]

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A **(2 marks each)**

Q1 Attempt the following:

a Define the non-singular matrix

b Find the rank of the 2×2 matrix $\begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$

c Define the symmetric matrix with example

d What is meant by Eigenvalue?

e What is meant by diagonalization?

f Define the scalar product of two vectors.

g Define the directional derivative

h Write the statement of Gauss' divergence theorem

i Define vector product.

j Write the statement of Cayley-Hamilton Theorem

Section – B **(5 marks each)**

Q2 Find the eigenvalues of the 2 x 2 matrix $\begin{bmatrix} 0 & -2 \\ 3 & 4 \end{bmatrix}$

Q3 Find the cross product of the given two vectors: $\vec{X} = 5\vec{i} + 6\vec{j} + 2\vec{k}$ and $\vec{Y} = \vec{i} + \vec{j} + \vec{k}$

Q4 Find the gradient of the function f(x,y) = x + y.

Q5 Find the value of the determinant $\begin{vmatrix} 3 & 2 & 5 \\ 9 & -1 & 4 \\ 2 & 3 & -5 \end{vmatrix}$

Q6 Let there be two vectors [6, 2, -1] and [5, -8, 2]. Find the dot product of the vectors.

Section – C **(10 marks each)**

Q7 Using Green's formula, evaluate the line integral $\oint_C (x-y)dx + (x+y)dy$, where *C* is the circle $x^2 + y^2 = a^2$.

Q8 Determine the divergence of a vector field in two dimensions: $F(x, y) = 6x^2i + 4yj$.

Q9 Solve the following equations by matrix inversion

$$2x + y + 2z = 0,$$
$$2x - y + z = 10,$$
$$x + 3y - z = 5.$$