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B.Sc. (Hons.) Chemistry (Semester – 1st)

MATHEMATICS-I

Subject Code: BMATH5101

Paper ID: [19131607]

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) What do you mean by rank of a non-zero matrix?
b) Define orthogonal matrices.
c) Find a normal vector of the surface $X^2 + Y^2 = 25$ at point P(4,3,8)
d) Give the statement of Stokes theorem.
e) What do you mean by flux of a vector field?
f) What direction does curl **v** have if **v** is the vector parallel to the xz- plane?
g) What is the gradient? How is it related to directional derivatives?
h) How will you define homogeneous system of linear equation?
i) Differentiate between scalar and vector fields with examples.
j) State Cayley-Harmitian theorem.

Section-B **(5 marks each)**

Q2. Find the value of the tetrahedron whose vertices are the points A(2,-1,-3), B(4,1,3), C(3,2,-1) and D(1,4,2).

Q3. Find the gradient and unit normal to the level surface $x^2 + y – z = 4$ at (2,0,0).

Q4. If $\emptyset = 2xyz^2$, $\vec{F} = xy\hat{i} - z\hat{j} + x^2\hat{k}$ and C is the curve $x = t^2,\ y = 2t,\ z = t^3$ from $t = 0\ to\ t = 1$. Evaluate the line integrals $\int_C \emptyset\, .\, d\vec{r}$

Q5. Use Cayley-Harmitian theorem to find inverse of the matrix $[1\ 2\ -1\ 0\ 1\ 2\ 0\ 0\ 3\ ]$

Q6. Diagonalize, if possible, the matrix $[6\ 0\ 9\ 0\ 7\ 1\ 0\ -4\ 3\ ]$

Section-C **(10 marks each)**

Q7. Give the physical interpretation of Divergence of a vector field.

Q8. If $\vec{F} = 4xz\hat{i} - y^2\hat{j} + yz\hat{k}$. Evaluate $\iint_S \vec{F}.\vec{n}$ ds where S is the surface of the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0 & z = 1.

Q9. Find k, if the equations x + 2y – 3z = -2, 3x – y - 2z = 1, 2x + 3y - 5z = k are consistent.