

**B.Sc. (Hons.) Physics (Semester – 2nd)****BASIC MATHEMATICS-II****Subject Code: BMATH5202****Paper ID: [19131509]****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. If  $A = \begin{bmatrix} 2 & 7 \\ 9 & 8 \end{bmatrix}$ ,  $B = \begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$ , find  $A - B$ .

$$\Delta = \begin{vmatrix} 1 & 3 & 4 \\ 2 & -1 & 3 \\ 2 & 1 & 2 \end{vmatrix}$$

b. Find the value of the determinant

c. Show that the sequence of functions  $\{f_n\}$  where  $f_n(x) = x^n/n$  defined on  $[0, 1]$  converges uniformly to 0.

d. Define the power series with example

e. If  $f(x, y) = x^3y^5$  then calculate the partial derivatives  $\frac{\partial f}{\partial x}$  and  $\frac{\partial f}{\partial y}$ .

f. Compute the partial derivative  $\frac{\partial f}{\partial x}$  of  $f(x, y) = xy/(x^2 + y^2)$ .

g. If A is symmetric (skew-symmetric) matrix, then show  $kA$  is also symmetric (skew-symmetric) matrix.

h. If A and B are two square matrices of the same order, then AB and BA have the same characteristic roots.

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

j. What is the value of the function  $(x-1)(x-2)^2$  at its maxima?

**Section – B****(5 marks each)**

Q2. Find the radius of convergence of the series  $x + \frac{x^2}{2} + (2!/3^3)x^3 + (3!/4^4)x^4 + \dots$

Q3. Use the comparison test to determine if the series  $\sum_{n=1}^{\infty} \frac{n}{n^3 + n + 1}$  converges or diverges.

Q4. Find  $f_{xxyzz}$  for  $f(x, y, z) = z^3 y^2 \ln(x)$ .

$$A = \begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}.$$

Q5. Find the rank of the matrix

Q6. Find the equation of the tangent to the parabola  $y^2 = 4x + 5$  parallel to the line  $2x - y = 3$ .

**Section – C****(10 marks each)**

Q7. Show that the equations are consistent and solve them.

$$x + y + z = 6,$$

$$x + 2y + 3z = 14,$$

$$x + 4y + 7z = 30,$$

Q8. Let  $x(u, v) = u^2 - v^2$ ,  $y(u, v) = 2uv$ . Find the Jacobian  $J(u, v)$ .

Q9. Find  $\frac{\partial f}{\partial x}$ ,  $\frac{\partial f}{\partial y}$ ,  $\frac{\partial f}{\partial z}$  for the given function  $f(x, y, z) = x \cos z + x^2 y^3 e^z$ .