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Total No. of Questions: [09]

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 $A-B$.

b. Find the value of the determinant $\Delta=\begin{vmatrix}1 & 3 & 4\\ 2 & -1 & 3\\ 2 & 1 & 2\end{vmatrix}$.

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 samecharacteristic 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 $x + \frac{x^2}{2} + (2!/3^3)x^3 + (3!/4^4)x^4 + - - -$

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 $f(x, y, z) = z^3 y^2 \ln(x)$.

Q5. Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$.

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

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