Seat No.	

B.Sc. (Part-III) (Semester - V) (CBCS) Examination, January - 2023

PHYSICS

DSE - E1 : Mathematical Physics (Paper - IX)

Sub. Code: 79677

Day and Date : Tuesday, 03 - 01 - 2023 **Total Marks : 40**

Time : 2.30 p.m. to 4.30 p.m.

Instructions : **1)** **All questions are compulsory.**
2) **Use of scientific calculator is allowed.**

Q1) Choose the correct alternatives. **[8]**

a) Every partial differential equation involves at least_____independent variables.

i) 1 ii) 2

ii) 3 iv) 4

b) The three-dimensional Laplace equation is given by_____.

i) $\frac{\partial^3 u}{\partial x^3}+\frac{\partial^3 u}{\partial y^3}+\frac{\partial^3 u}{\partial z^3}=0$ ii) $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}+\frac{\partial^2 u}{\partial z^2}=0$

iii) $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}=0$ iv) $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=\frac{\partial^2 u}{\partial t^2}$

c) The method of separation of variables converts the given partial differential equation into_____Differential equation.

i) partial ii) partial ordinary

iii) ordinary iv) none of these

d) Legendre's differential equation has general solution in the form_____.

i) $y = A\,P_n(x)$ ii) $y = B\,Q_n(x)$

iii) $y = A\,P_n(x) + B\,Q_n(x)$ iv) $y = A\,P_n(x) - B\,Q_n(x)$

P.T.O.

e) Which of the following is false?

i) $\Gamma 1 = 1$ ii) $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$

iii) $\beta(3, 4) = \beta(4, 3)$ iv) $\Gamma n = n!$

f) $erf(x) + erf_c(x)$=_____.

i) 1 ii) 2

iii) 0 iv) none of these

g) The argument of complex number $-1 - \sqrt{3}i$ is_____.

i) $\frac{\pi}{3}$ ii) $\frac{2\pi}{3}$

iii) $\frac{4\pi}{3}$ iv) $\frac{5\pi}{6}$

h) To solve the equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = 0$ by method of separation of variables, we assume the solution in the form $u(x, y, z)$ =_____.

i) $X(x)\,Y(y)\,Z(t)$ ii) $X(x)\,Y(y)$

iii) $X(x)\,Y(y)\,Z(z)$ iv) $X(x)\,Z(z)$

Q2) Attempt any two of the following. **[16]**

a) Obtain the solution of wave equation in two dimensions using variable separable method.

b) What are properties of beta function? Show that

$$\beta(m,n) = 2\int_0^{\frac{\pi}{2}} \sin^{2m-1} x \cdot \cos^{2n-1} x\,dx$$

c) If z_1 and z_2 are two complex numbers then explain $z_1 \times z_2$ and $\frac{z_1}{z_2}$ by geometry.

Q3) Attempt any four of the following. **[16]**

a) Define Order and Degree of partial differential equation. State two examples.

b) Explain in brief the method of solving following second order partial differential equation, $\frac{\partial^2 u}{dx^2} = \frac{1}{k}\frac{\partial x}{dt}$

c) Define:

i) Ordinary point.

ii) regular singularities and

iii) irregular singularities of the second order differential equation.

iv) Find the singularities of the following differential equation.

1) $2x^2\frac{d^2y}{dx^2} + 7x(x+1)\frac{dy}{dx} + 3y = 0$.

2) $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + x^2 - 4 = 0$.

v) Define Gamma Function. Prove any two properties of it.

vi) Represent the complex number $Z_1 \times Z_2$ geometrically for two complex number Z_1 and Z_2.

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