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May 2026	
B.Sc.(Maths/MAC) 4th SEMESTER	
Partial Differential Equations (BMH24-404)	
Time: 3 Hours	**Max. Marks:75**
Instructions:	*1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.* *2Answer any four questions from Part -B in detail.* *3. Different sub-parts of a question are to be attempted adjacent to each other.*

PART-A

Que.1(a) Define 2-Dimensional Heat equation.

(b)Form the partial differential equation of all spheres of fixed radius having centre in xy-plane.

(c) Define complete integral or complete solution.

(d)Define order and degree of the partial differential equation.

(e)Write the condition of compatibility of the partial differential equation of order one.

(f)Find the complementary function of $(D^3 - 4D^2D' + 4DD'^2)z = 0$,

where $D = \frac{\partial}{\partial x}$, $D' = \frac{\partial}{\partial y}$

(g) Classify the given PDE : $2\frac{\partial^2 u}{\partial x^2} - 5\frac{\partial^2 u}{\partial x \partial y} + 5\frac{\partial^2 u}{\partial y^2} = 0.$

(h)Write two dimensional wave equation.

(i) Solve $(D^2 - DD' - 2D)z = 0$, where $D = \frac{\partial}{\partial x}$, $D' = \frac{\partial}{\partial y}$

(j)Define characteristics and characteristics curves. (1.5*10 = 15)

PART-B

Que.2(a)Find the complete integral of $z^2 = 1 + p^2 + q^2$ using Charpit's method. (8)

(b)Using Lagrange's method, solve $(mz - ny)p + (nx - tz)q = ty - mx$. (7)

Que.3(a)Solve$(D^2 + 2DD' + D'^2)z = e^{2x+3y}$, where $D = \frac{\partial}{\partial x}$, $D' = \frac{\partial}{\partial y}$ (8)

(b)Solve the non-homogeneous PDE: $(D^2 - DD' - 2D)z = \sin(3x+4y)$,

where $D = \frac{\partial}{\partial x}$, $D' = \frac{\partial}{\partial y}$ (7)

Que.4 Classify and reduce the equation; $t - s + p - q(1 + \frac{1}{x}) + \frac{z}{x} = 0$ to canonical form, where p, q, t, s have their usual meaning. (15)

Que.5 Find the temperature in a bar whose ends x = 0 and x = 1 are insulated and initial temperature is k $\sin 2\pi x$. (15)

Que.6(a) Find the characteristics of the given equation :

$$xy\frac{\partial^2 u}{\partial x^2} - (x^2 - y^2)\frac{\partial^2 u}{\partial x \partial y} - xy\frac{\partial^2 u}{\partial y^2} + y\frac{\partial u}{\partial x} - x\frac{\partial u}{\partial y} - 2(x^2 - y^2) = 0. \quad (8)$$

(b) Solve the homogeneous PDE : $(D^3 - 4D^2D' + 4D'^2D)z = \cos(2x+y)$,

where $D = \frac{\partial}{\partial x}$, $D' = \frac{\partial}{\partial y}$ (7)

Que.7(a) Solve yt – q = xy, where t, q have their usual meaning. (8)

(b) Find the solution of two dimensional Laplace equation by using the method of separation of variable. (7)
