

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(MID SEMESTER EXAMINATION)

CLASS: IMSC  
BRANCH: MATHEMATICS

SEMESTER : III  
SESSION : MO/2025

SUBJECT: MA201R1 PARTIAL DIFFERENTIAL EQUATIONS

TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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		CO	BL
Q.1(a)	Derive a PDE by eliminating the arbitrary function $f$ from $z=xy + f(x^2 + y^2)$ .	[2]	1 3
Q.1(b)	Solve $z(xp - yq) = y^2 - x^2$ .	[3]	1 3
Q.2	Find the integral surface of $x^3p + y(3x^2 + y)q = z(2x^2 + y)$ which passes through the curve $C_0: x_0 = 1, y_0 = s, z_0 = s(1+s)$ , where $s$ is the defining parameter of the curve.	[5]	1 4
Q.3(a)	Find a complete integral of $(p + q)(z - xp - yq) = 1$ .	[2]	2 3
Q.3(b)	Solve $pq = px + qy$ .	[3]	2 4
Q.4(a)	Find the domains in which $u_{xx} + 4u_{xy} + (x^2 + 4y^2)u_{yy} = \cos(x+y)$ is parabolic, elliptic, and hyperbolic.	[2]	2 3
Q.4(b)	Convert the following PDE in its canonical form: $u_{xx} - 4u_{yy} + u_x + u_y = 0$ .	[3]	2 3
Q.5	Derive the D'Alembert solution of $u_{tt} = c^2 u_{xx}$ , $(-\infty < x < \infty, t > 0)$ with $u(x,0) = \sin x$ , $u_t(x,0) = \cos x$ .	[5]	3 4

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