QP Code:R262G013 Reg. No | | | | | | | | | | AY 25

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET UNIVERSITY)

M.Sc. (Second Semester – Regular/Supplementary) Examinations, May – 2026

24MPCMA12003 – Partial Differential Equations

(Mathematics)

Time: 3 hrs Maximum: 60 Marks

Answer ALL questions

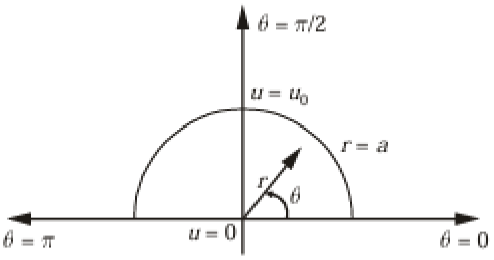
(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions		CO #	Blooms Level
a.	Form a PDE by eliminating arbitrary constants from $z = ax + by + ab$	CO1	K3
b.	Classify the PDE $u_{xx} - 2\ \sin x\ u_{xy} - \cos^2 x\ u_{yy} - \cos x\ u_y = 0$	CO2	K2
c.	Write various solutions of the diffusion equation $\frac{\partial T}{\partial t} = \alpha \frac{\partial^2 T}{\partial t^2}$.	CO3	K1
d.	State the maximum-minimum principle related to diffusion equation	CO4	K1
e.	Write the sufficient conditions for the existence of Laplace transform.	CO5	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions		Marks	CO #	Blooms Level
2. a.	Form a PDE by eliminating the arbitrary function from $f(x + y + z, x^2 + y^2 + z^2) = 0$	4	CO1	K3
b.	Find the integral surface of the linear PDE $x(y^2 + z)p - y(x^2 + z)q = (x^2 - y^2)z$	6	CO1	K1
	(OR)			
c.	Find the partial differential equation of the family of planes, the sum of whose x, y, z intercepts is equal to unity.	4	CO1	K3
d.	Find the complete integral of $x^2p^2 + y^2q^2 - 4 = 0$ using Charpit's method.	6	CO1	K3
3.a.	Write different solutions of the Laplace's equation $u_{xx} + u_{yy} = 0$. Use it to solve the Dirichlet's problem for rectangle given by $$\nabla^2 u = 0, 0 \le x \le a, 0 \le y \le b$$ $$BCs': u(x, b) = u(a, y) = 0, u(0, y) = 0,$$ $$\text{and } u(x, 0) = f(x).$$	10	CO2	K2, K3
	(OR)			
b.	Find the steady state temperature distribution in a semi-circular plate of radius a, insulated on both the faces with its curved boundary kept at a constant temperature U_0 and its bounding diameter kept at zero temperature as described as in the figure below	10	CO2	K1



4.a.	Solve the one-dimensional diffusion equation in the region $0 \leq x \leq \pi, t \geq 0$ subject to the conditions (i) T remains finite as $t \to \infty$ (ii) $T = 0$, if $x = 0$ $and\ \pi\ for\ all\ t$ (iii) At $t = 0, T = \begin{cases} x, & 0 \leq x \leq \frac{\pi}{2} \\ \pi - x, & \frac{\pi}{2} \leq x \leq \pi \end{cases}$	10	CO3	K3
	(OR)			
b.	The ends A and B of a rod, 10 cm in length, are kept at temperatures 0°C and 100°C until the steady state condition prevails. Suddenly the temperature at the end A is increased to 20°C, and the end B is decreased to 60°C. Find the temperature distribution in the rod at time t.	10	CO3	K3
5.a.	Find all the solutions of the one dimensional wave equation $u_{tt} - c^2 u_{xx} = 0$ using variable separable method.	5	CO4	K2
b.	Obtain the solution of the wave equation$u_{tt} = c^2 u_{xx}$ under the following conditions (i) $u(0,t) = u(2,t) = 0$ (ii) $u(x,0) = \sin^3\left(\frac{\pi x}{2}\right)$ (iii) $u_t(x,0) = 0$	5	CO4	K1
	(OR)			
c.	A uniform string of line density ρ is stretched to tension ρc^2 and executes a small transverse vibration in a plane through the undisturbed line of string. The ends $x = 0, L$ of the string are fixed. The string is at rest, with the point $x = b$ drawn aside through a small distance ε and released at time $t = 0$. Find an expression for the displacement $y(x,t)$.	10	CO4	K3
6.a.	Solve the following IBVP using the Laplace transform technique: $PDE: u_t = u_{xx}, \qquad 0 < x < 1, t > 0$ $BCs': u(0,t) = 1, u(1,t) = 1, t > 0$ $IC: u(x,0) = 1 + \sin \pi x, 0 < x < 1.$	10	CO5	K3
	(OR)			
b.	Using Fourier transform method to solve the heat conduction equation given by $k\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}, -\infty < x < \infty, t > 0$ Subject to $BCs': u(x,t)\ and\ u_x(x,t)\ both\ \to 0\ as\ \lvert x \rvert \to \infty$ $IC: u(x,0) = f(x), -\infty < x < \infty$	10	CO5	K3

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