

PARTIAL DIFFERENTIAL EQUATIONS

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	The first order PDE $f(x, y, z, p, q) = 0$ can have (i) unique complete integral (ii) two complete integral (iii) three complete integral (iv) atleast one complete integral	K1	CO1
	2	The order of the PDE formed by eliminating the arbitrary function ϕ from $z = \phi(x^2 + y^2)$ is ____ (i) 0 (ii) 1 (iii) 2 (iv) 3	K2	CO1
2	3	The one dimensional wave equation is ____ (i) Hyperbolic (ii) Parabolic (iii) Elliptic (iv) Circular	K1	CO2
	4	The particular integral for $(D^2 - D'^2)z = e^{x+y}$ is ____ (i) $\frac{x}{2}e^{x+y}$ (ii) $\frac{y}{2}e^{x+y}$ (iii) $\frac{x^2}{2}e^{x+y}$ (iv) $\frac{xy}{2}e^{x+y}$	K2	CO2
3	5	The solution of Laplace equation is called ____ function (i) Poisson (ii) Wave (iii) Harmonic (iv) Fourier	K1	CO3
	6	The force of attraction F and the gravitational potential function ψ is related by which equation? (i) $F = \nabla \psi$ (ii) $F = \nabla \cdot \psi$ (iii) $F = \nabla x \psi$ (iv) $F = \nabla^2 \psi$	K2	CO3
4	7	The equation $(\nabla^2 + k^2)\psi = 0$ is called ____ equation (i) Poisson's (ii) Helmholtz's (iii) Volterra's (iv) Cauchy's	K1	CO4
	8	In transverse vibration of a membrane the wave velocity is given by the equation (i) $c^2 = \frac{T}{\sigma}$ (ii) $c^2 = T\sigma$ (iii) $c^2 = T + \sigma$ (iv) $c^2 = T - \sigma$	K2	CO4
5	9	If c is the concentration of the diffusion substance, then diffusion current vector J is given by ____ first law (i) Fink's (ii) Newton's (iii) Keplers (iv) Green's	K1	CO5
	10	To solve one dimensional diffusion equation $u_t = ku_{xx}$, $x \in [0, L]$, $t > 0$, how many initial and boundary conditions are required? (i) 1,2 (ii) 2,2 (iii) 2,1 (iv) 1,1	K2	CO5

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SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Estimate the complete and singular integral of the PDE $z = px + qy + \frac{q}{p} - p$.	K2	CO1
	(OR)			
	11.b.	Write the surface which intersects the surface of the system $z(x + y) = c(3z + 1)$ and which passes through $x^2 + y^2 = 1, z = 1$.		
2	12.a.	If the operator $F(D, D')$ is reducible then develop the condition that the order of the linear factors occur is unimportant.	K3	CO2
	(OR)			
	12.b.	Reduce the equation $z_{xx} = x^2 z_{yy}$ to canonical form.		
3	13.a.	Derive the necessary condition for the system of surfaces $f(x, y, z) = c$ to be the equipotential surfaces.	K3	CO3
	(OR)			
	13.b.	Identify that $v = r \cos \theta$ is the solution of the Laplace equation, r, θ, ϕ are spherical polar coordinates.		
4	14.a.	Analyze the occurrence of wave equation in Longitudinal vibrations in a Bar.	K4	CO4
	(OR)			
	14.b.	Discover the Greens Function for the Half space $z \geq 0$.		
5	15.a.	Infer the temperature $\theta(\rho, t)$ in the infinite cylinder $0 \leq \rho < a$ when the initial temperature is $f(\rho)$ and the surface $\rho = a$ is maintained at zero temperature.	K4	CO5
	(OR)			
	15.b.	Examine the solution of the diffusion equation using the method of separation of variables.		

SECTION -C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks

(3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Express the complete integral of $px + qy = pq$ by Charpits method.	K2	CO1
2	17	Estimate the solution of the PDE $(D^2 - 3DD' + 2D'^2)z = e^x \cosh y$	K2	CO2
3	18	Build Dirichlet problem for a sphere.	K3	CO3
4	19	The points of trisection of a string are pulled aside through a distance ϵ on opposite sides of the equilibrium and the string is released from rest. Discover an expression for the displacement of the string at any time.	K4	CO4
5	20	Discover the Green's function for the thick plate of infinite radius bounded by the parallel planes $z = 0, z = a$.	K4	CO5

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END