Enrolment No. 2412020601030

BHAGWAN MAHVIR UNIVERSITY

B.TECH SEMESTER II EXAMINATION SUMMER 2025

Subject Code: 2010200201 **Date:09/06/2025**

Subject Name: Mathematics-II-Theory

Time:2.00PM TO 4.30PM **Total Marks: 60**

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

			Marks
Q.1	(a)	Evaluate $\int_0^1\int_0^2 (x^2+y^2)\,dy\,dx$	02
	(b)	Solve $(D^2+9)y=\cos 4x$	04
	(c)	Show that $\vec{F}=(y^2-z^2+3yz-2x)\hat{i}+(3xz+2xy)\hat{j}+(3xy-2xz+2z)\hat{k}$ is both solenoidal and irrotational.	06
Q.2	(a)	Let R^3 have the Euclidean inner product. For which value of k are $u=(2,1,3)$ *and* $v=(1,7,k)$ orthogonal?	02
	(b)	Find $L\{t^2\cosh 3t\}$	04
	(c)	Solve $\frac{\partial^2 z}{\partial x^2}-2\frac{\partial z}{\partial x}+\frac{\partial z}{\partial y}=0$ by the method of separation of variables.	06
		OR	
	(c)	Solve $y''-4y'+4y=\frac{e^{2x}}{x}$ by the method of variation of parameter.	06
Q.3	(a)	Find $\nabla\phi$ if $\phi=x^2+y^2+z^2$ at (1, -1, 1).	02
	(b)	Sate First shifting theorem using it find $L\{(t+1)^2e^t\}$.	04
	(c)	Find the power-series solution of the equation $\frac{d^2y}{dx^2}+y=0$ about $x_0=0$.	06
		OR	
Q.3	(a)	State Green's theorem in the plane.	02
	(b)	Using Convolution theorem, find inverse Laplace of $\frac{s}{(s^2+a^2)^2}$	04
	(c)	Solve $x(y-z)p+y(z-x)q=z(x-y)$.	06
Q.4	(a)	Form the partial differential equation $z=(x-2)^2+(y-3)^2$.	02
	(b)	Find the directional derivative of $\phi=xy^2+yz^2$ at the point (2, -1,1) in the direction of the vector $\hat{i}+2\hat{j}+2\hat{k}$.	04
	(c)	Determine whether the set V of all pairs of real numbers (x,y) with the operations $(x_1,y_1)+(x_2,y_2)=(x_1+x_2+1,y_1+y_2+1)$ and $k(x,y)=(kx,ky)$ is a vector space.	06
		OR	
Q.4	(a)	Solve $\sqrt{p}+\sqrt{q}=1$.	02

(b) If $\vec{F} = x^2\hat{i} + xy^2\hat{j}$, evaluate $\int_C \vec{F}.d\vec{r}$ from (0,0) to (1,1) along the path $y = x$. **04**

(c) Let R^3 have the Euclidean inner product. Use the Gram- Schmidt process to transform the basis vectors $u_1 = (1,0,0)$, $u_2 = (3,7,-2)$, $u_3 = (0,4,1)$ into an orthonormal basis. **06**

Q.5 (a) Solve $(4x^2D^2 + 16xD + 9)y = 0$ **02**

(b) Evaluate $\int_0^2 \int_1^2 \int_0^{yz} xyz\, dx\, dy\, dz$ **04**

(c) Evaluate $\int_0^a \int_y^a \frac{x}{x^2 + y^2} dx\, dy$ by transforming into polar coordinates. **06**

OR

Q.5 (a) Solve $\frac{\partial^2 z}{\partial x^2} = z$. **02**

(b) Find the area common to the cardiods $r = a(1 + \cos\theta)$ and $r = a(1 - \cos\theta)$. **04**

(c) Change the order of integration and evaluate $\int_0^2 \int_0^{4-x^2} \frac{xe^{2y}}{4 - y} dy\, dx$. **06**