U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Semester End Main Examinations

Programme: B.E. **Semester: II**
Branch: Common to all Branches **Duration: 3 hrs.**
Course Code: 21MA2BSACN **Max Marks: 100**
Course: Advanced Calculus and Numerical Methods

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Evaluate $\int_0^5 \int_0^{x^2} x(x^2+y^2)\,dx\,dy$.	CO2	PO1	**6**
	b)	Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\,dx\,dy$ by changing to polar coordinates.	CO2	PO1	**7**
	c)	Show that area between the parabolas $y^2=4ax$ and $x^2=4ay$ is $16/3\, a^2$.	CO2	PO1	**7**
		OR			
2	a)	Evaluate $\int_{-1}^{1} \int_0^z \int_{x-z}^{x+z} (x+y+z)\,dx\,dy\,dz$.	CO2	PO1	**6**
	b)	Evaluate $I=\int_0^{4a} \int_{x^2/4a}^{2\sqrt{ax}} dy\,dx$ by changing the order of integration.	CO2	PO1	**7**
	c)	Evaluate the integral $\int_0^1 \frac{1}{\sqrt{1+x^4}}dx$ in terms of beta and gamma function.	CO2	PO1	**7**
		UNIT - II			
3	a)	Find the directional derivative of $f(x,y,z)=xy^2+yz^3$ at the point (2, -1, 1) in the direction of vector $\hat{i}+2j+2k$.	CO2	PO1	**6**
	b)	Find $div\,\vec{F}$ and $curl\,\vec{F}$ where $\vec{F}=grad(x^3+y^3+z^3-3xyz)$.	CO2	PO1	**7**
	c)	Apply the Green's theorem to evaluate $\oint_C [(y-\sin x)dx+\cos x dy]$ where C is the plane triangle formed by the lines $y=0$, $x=\pi/2$ and $y=2x/\pi$.	CO2	PO1	**7**

Q. No.		Question	CO	PO	Marks
		OR			
4	a)	Find the angle between the surfaces $x^2+y^2+z^2=9$ and $z=x^2+y^2-3$ at the point (2, -1, 2).	CO2	PO1	**6**
	b)	Find the work done in moving a particle in the force field $\vec{F}=3x^2\,\hat{i}+(2xz-y)\,j+zk$ along the straight line from (0, 0, 0) to (2, 1, 3).	CO2	PO1	**7**
	c)	Apply Stokes' theorem to evaluate $\int_C (x+y)\,dx+(2x-z)\,dy+(y+z)\,dz$ where C is the boundary of the triangle with vertices (2, 0, 0), (0, 3, 0) and (0, 0, 6).	CO2	PO1	**7**
		UNIT - III			
5	a)	Form the partial differential equation by eliminating arbitrary constants from $2z=\frac{x^2}{a^2}+\frac{y^2}{b^2}$.	CO2	PO1	**6**
	b)	Solve the partial differential equation $x^2(y-z)p+y^2(z-x)q=z^2(x-y)$.	CO2	PO1	**7**
	c)	Apply the method of separation of variables to solve $\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial t}+u$ with $u(x,0)=6e^{-3x}$.	CO2	PO1	**7**
		UNIT - IV			
6	a)	Apply Newton-Raphson method to find the positive root of $x^4-x=10$ correct to three decimal places.	CO2	PO1	**6**
	b)	Find the cubic polynomial which takes the following values: $\begin{array}{\|c\|c\|c\|c\|c\|}\hline x & 0 & 1 & 2 & 3 \\ \hline f(x) & 1 & 2 & 1 & 10 \\ \hline\end{array}$ Hence, evaluate $f(4)$.	CO2	PO1	**7**
	c)	Evaluate $\int_0^6 \frac{1}{1+x^2}\,dx$ using Simpson's $1/3$ rule by taking seven ordinates.	CO2	PO1	**7**
		UNIT - V			
7	a)	Approximate $y(0.1)$ and $y(0.2)$ using Taylor series method up to fourth degree terms for $\frac{dy}{dx}=x^2y-1$, $y(0)=1$.	CO2	PO1	**6**
	b)	Apply modified Euler's method to find an approximate value of $y(0.2)$, given that $\frac{dy}{dx}=y+e^x$, $y(0)=0$.	CO2	PO1	**7**
	c)	Apply the fourth order Runge – Kutta method to approximate $y(0.2)$, given that $\frac{dy}{dx}=x+y$, $y(0)=1$ taking $h=0.2$.	CO2	PO1	**7**

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