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

Autonomous Institute Affiliated to VTU

December 2023 Supplementary Examinations

Programme: B.E. **Semester: II**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 22MA2BSMCV **Max Marks: 100**
Course: Mathematical Foundation for Civil Engineering-2

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)	Apply double integration to find the area between the polar curves cardioid $r = 4(1 - \cos\theta)$ and circle $r = 4$.		CO1	PO1	**6**
	b)	Evaluate $\iiint_R \frac{dx\,dy\,dz}{(1+x+y+z)^3}$ over the region R bounded by the planes $x=0, y=0, z=0$ and $x+y+z=1$.		CO1	PO1	**7**
	c)	Let D be the triangular region bounded by the lines $y=0$, $y=2x$ and $x+2y=1$. Find the mass of the lamina with density given by $\rho(x,y)=x$.		CO2	PO1	**7**
		OR				
2	a)	Show that $\int_0^{\pi/2}\sqrt{\sin\theta}\,d\theta \times \int_0^{\pi/2}\frac{1}{\sqrt{\sin\theta}}\,d\theta = \pi$.		CO1	PO1	**6**
	b)	Evaluate $\int_0^1\int_{x^2}^{2-x} x\,y\,dy\,dx$ by changing the order of integration.		CO1	PO1	**7**
	c)	Find the volume of the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$.		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 normal to the surface $x\log z - y^2 = -4$ at (-1,2,1).		CO1	PO1	**6**
	b)	If $f=\left(x^2+y^2+z^2\right)^{-n}$ find div(grad f) and determine n if div(grad f) $=0$.		CO1	PO1	**7**

		c)	Apply Green's theorem to evaluate $\oint_c (xy+y^2)dx+x^2\,dy$ where 'c' is the closed curve of the region bounded by $y=x$ and $y=x^2$.	*CO1*	*PO1*	**7**
			UNIT - III			
	4	a)	Form the partial differential equation by eliminating the arbitrary function from $F(x^2+y^2+z^2, z^2-2xy)=0$.	*CO1*	*PO1*	**6**
		b)	Solve the partial differential equation $(x^2-yz)p+(y^2-zx)q=z^2-xy$.	*CO1*	*PO1*	**7**
		c)	Derive the one-dimensional heat equation $u_t=c^2u_{xx}$.	*CO1*	*PO1*	**7**
			OR			
	5	a)	Obtain the partial differential equation of family of spheres having center in xy-plane with constant radius.	*CO1*	*PO1*	**6**
		b)	Solve $\frac{\partial^2 z}{\partial x \partial y}=\frac{x^2}{y}$ by using direct integration subject to conditions $z(x,1)=x^2$ and $z(1,y)=y^2$.	*CO1*	*PO1*	**7**
		c)	Solve $\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial t}+u$ by the method of separation of variables subject to the condition $u(x,0)=6e^{-3x}$.	*CO1*	*PO1*	**7**
			UNIT - IV			
	6	a)	Apply Newton-Raphson method to find an approximate root of the equation $x\log_{10}(x)+1.5x^2=1.2$ in $(1,2)$ correct to 4 decimals places.	*CO1*	*PO1*	**6**
		b)	If the number of persons earning below 100 dollars is 600, estimate the number of persons having income between 200 and 250 from the following data: Income: 100-200 | 200-300 | 300-400 | 400-500 No. of persons: 425 | 360 | 150 | 65	*CO1*	*PO1*	**7**
		c)	A plane area is bounded by a curve, the x – axis and two extreme ordinates. The area is divided into six figures by equidistant ordinates 2 inches apart, the heights of the ordinates being 21.65, 21.04, 20.35, 19.61, 18.75, 17.80 and 16.75 respectively. Find the approximate value of the area by using Simpson's $3/8^{th}$ rule.	*CO2*	*PO1*	**7**
			UNIT-V			
	7	a)	Apply Taylor series method to find the solution of initial value problem $\frac{dy}{dx}=\log(x+y), y(1)=2$ up to third degree term and hence compute $y(1.5)$ and $y(2.0)$.	*CO1*	*PO1*	**6**
		b)	Apply fourth order Runge-Kutta method to find an approximate solution of an initial value problem $\frac{dy}{dx}=\frac{y^2-x^2}{y^2+x^2}$ with $y(0)=1$ at $x=0.2$ taking h=0.2 as the step length.	*CO1*	*PO1*	**7**

		c)	Find an approximate solution of the initial value problem at $x = 1.4$, given $x^2 \frac{dy}{dx} + xy = 1, y(1) = 1, y(1.1) = 0.996,$ $y(1.2) = 0.986,$ and $y(1.3) = 0.972$ using Milne's predictor-corrector method.	*CO1*	*PO1*	**7**

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