U.S.N.										

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

Autonomous Institute Affiliated to VTU

October 2024 Supplementary Examinations

Programme: B.E. **Semester: II**
Branch: EEE/ECE/MD/EIE/ETE **Duration: 3 hrs.**
Course Code: 23MA2BSMES/22MA2BSMES **Max Marks: 100**
Course: Mathematical Foundation for Electrical Stream – 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.

			CO	PO	Marks
		UNIT – 1			
1	a)	Evaluate $\int_{x=0}^{1}\int_{y=x}^{\sqrt{x}} xy\,dydx$ by changing the order of integration.	1	1	**6**
	b)	Show that $\Gamma\left(\frac{1}{2}\right)=\sqrt{\pi}$ using $\Gamma(n)=2\int_0^\infty e^{-x^2}x^{2n-1}dx$.	1	1	**7**
	c)	Find the volume of the tetrahedron bounded by the planes $x=0, y=0, z=0, \frac{x}{2}+\frac{y}{3}+\frac{z}{4}=1$ using triple integration.	2	1	**7**
		OR			
2	a)	Evaluate the integral $\int_{-a}^{a}\int_{0}^{\sqrt{a^2-x^2}}\sqrt{x^2+y^2}\,dydx$ by changing into polar coordinates.	1	1	**6**
	b)	Evaluate $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)dzdydx$.	1	1	**7**
	c)	Show that $\int_0^{\pi/2}\sqrt{\sin\theta}\,d\theta\times\int_0^{\pi/2}\frac{1}{\sqrt{\sin\theta}}d\theta=\pi$.	1	1	**7**
		UNIT – 2			
3	a)	Find the directional derivative of $\phi=x^2yz+4xz^2$ at the point $P(1,-2,-1)$ in the direction of the vector $2\hat{i}-\hat{j}-2\hat{k}$.	2	1	**6**
	b)	Show that $\vec{F}=(6xy+z^3)\hat{i}+(3x^2-z)\hat{j}+(3xz^2-y)\hat{k}$ is irrotational. Also, find ϕ such that $\vec{F}=\nabla\phi$.	2	1	**7**
	c)	Apply Green's theorem to evaluate $\oint_C (xy+y^2)dx+x^2dy$ where 'C' is the closed curve of the region bounded by $y=x$ and $y=x^2$.	2	1	**7**
		UNIT – 3			
4	a)	Let $V=R^3$ be the vector space of the ordered triplets of real numbers over the field of real numbers. Verify which of the following are subspaces of R^3. i. $W=\{(x_1,x_2,x_3)\mid x_1+x_2+x_3=0\}$. ii. $W=\{(a,b,c)\mid a\geq 0\}$.	1	1	**6**

		b)	Find the basis and dimension of the subspace spanned by the subset $W=\left\{\begin{pmatrix}1 & -5\\ -4 & 2\end{pmatrix}, \begin{pmatrix}1 & 1\\ -1 & 5\end{pmatrix}, \begin{pmatrix}2 & -4\\ -5 & 7\end{pmatrix}, \begin{pmatrix}1 & -7\\ -5 & 1\end{pmatrix}\right\}$ of the vector space of all 2×2 matrices over $\mathbb{R}$.	*1*	*1*	**7**
		c)	Find the matrix of linear transformation $T: R^3 \to R^2$ defined by $T(x,y,z)=(2x,4y+5z)$ with respect to the bases $B=\{(1,0,0),(0,1,0),(0,0,1)\}$ for R^3 and $C=\{(1,1),(0,1)\}$ for R^2.	*1*	*1*	**7**
			OR			
	5	a)	Show that the set $B=\{(1,1,0),(1,0,1),(0,1,1)\}$ is a basis of the vector space $V_3(\mathbb{R})$.	*1*	*1*	**6**
		b)	Let $\mathbb{R}^+$ be the set of all positive real numbers. Define vector addition as $u+v=uv\ \forall u,v\in\mathbb{R}^+$ and scalar multiplication by $k.u=u^k\ \forall u\in\mathbb{R}^+, k\in\mathbb{R}$. Show that $\mathbb{R}^+$ is a vector space over the field of real numbers.	*1*	*1*	**7**
		c)	Let $T: V \to W$ be a linear transformation defined by $T(x,y,z)=(x+y,x-y,2x+z)$. Find the range, null space, rank, nullity and hence verify the rank nullity theorem.	*1*	*1*	**7**
			UNIT – 4			
	6	a)	Find a real root of the equation $3x=\cos x+1$ correct to 4 decimal places using Newton-Raphson method.	*1*	*1*	**6**
		b)	From the following table, estimate the number of students who obtained marks between 40 and 45. Marks: 30-40, 40-50, 50-60, 60-70, 70-80 No. of students: 31, 42, 51, 35, 31	*2*	*1*	**7**
		c)	Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Weddle's rule taking seven ordinates.	*1*	*1*	**7**
			UNIT - 5			
	7	a)	Employ Taylor series method to obtain an approximate value of y at $x=0.2$ for the differential equation $y'=2y+3e^x,\ y(0)=0$ by considering terms up to fourth degree.	*1*	*1*	**6**
		b)	Apply Runge-Kutta fourth order method to find $y(0.2)$ for the differential equation $\frac{dy}{dx}=x+y,\ y(0)=1$ taking $h=0.2$.	*1*	*1*	**7**
		c)	Compute $y(0.4)$ using Milne's predictor-corrector method, given $\frac{dy}{dx}=xy+y^2$, $y(0)=1,\ y(0.1)=1.1169,\ y(0.2)=1.2773$ and $y(0.3)=1.5049$.	*1*	*1*	**7**

Marks	30-40	40-50	50-60	60-70	70-80
No. of students	31	42	51	35	31

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