U.S.N.										

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

Autonomous Institute Affiliated to VTU

September 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.

			CO	PO	Marks
		UNIT - 1			
1	a)	Evaluate $\int_0^a \int_{x^2/a}^{2a-x} xy\,dy\,dx$ by changing the order of integration.	1	1	6
	b)	Evaluate $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)\,dz\,dy\,dx$.	1	1	7
	c)	Prove that $\int_0^\infty xe^{-x^8}dx \times \int_0^\infty x^2e^{-x^4}dx = \frac{\pi}{16\sqrt{2}}$.	1	1	7
		OR			
2	a)	Evaluate $\int_0^1 \frac{dx}{\sqrt{1-x^4}}$ in terms of the Gamma function.	1	1	6
	b)	Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} e^{x^2+y^2}\,dx\,dy$ by transforming into polar coordinates.	1	1	7
	c)	Find the volume of the tetrahedron bounded by the planes $x=0, y=0, z=0$ and $\frac{x}{2}+\frac{y}{3}+\frac{z}{6}=1$ using triple integrals.	2	1	7
		UNIT – 2			
3	a)	Apply Green's theorem to evaluate $\int_C (3x^2-8y^2)dx+(4y-6xy)dy$, where C is the curve made up of the parabolas $y^2=x$ and $x^2=y$.	2	1	6
	b)	If $\vec{r}=x\hat{i}+y\hat{j}+z\hat{k}$ and $r=\lvert\vec{r}\rvert$, prove that $grad\left(div\left(\frac{\vec{r}}{r}\right)\right)=-\frac{2\vec{r}}{r^3}$.	1	1	7
	c)	Show that the vector $\vec{F}=(2x+yz)\hat{i}+(4y+zx)\hat{j}+(xy-6z)\hat{k}$ is irrotational and hence find its scalar potential.	2	1	7
		UNIT – 3			
4	a)	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	6

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.

	b)	Find the subset of $S=\{u_1,u_2,u_3,u_4\}$ of $\mathbb{R}^5$ that forms a basis for $W=span(u_i)$ where $u_1=(1,1,1,2,3)$, $u_2=(1,2,-1,-2,1)$, $u_3=(3,5,-1,-2,5)$ and $u_4=(1,2,1,-1,4)$.	*1*	*1*	**7**
	c)	Determine whether the vectors $v_1=(1,2,-3,1)$, $v_2=(3,7,1,-2)$ and $v_3=(1,3,7,-4)$ are linearly independent or not.	*1*	*1*	**7**
		OR			
5	a)	Express the polynomial $v=t^2+4t-3$ in $P(t)$ as a linear combination of the polynomials $p_1=t^2-2t+5$, $p_2=2t^2-3t$ and $p_3=t+1$.	*1*	*1*	**6**
	b)	Find the linear transformation $T:R^2\to R^2$ such that $T(1,2)=(3,0)$ and $T(2,1)=(1,2)$.	*1*	*1*	**7**
	c)	Find the basis and dimension of the row space, the column space and the null space of the matrix $A=\begin{bmatrix}1&-1&2\\2&1&-1\\3&0&1\end{bmatrix}$.	*1*	*1*	**7**
		UNIT - 4			
6	a)	Find the root of the equation $2x-5=3\sin x$ that lies in the interval $(2.7,\ 3)$ correct to four decimal places by Newton-Raphson method.	*1*	*1*	**6**
	b)	A rocket is launched from the ground. Given below are distances(s) at different time (t). Apply Lagrange's interpolation formula to find the distance at t =2.5 secs. t (in seconds): 0, 1, 2, 3 s (in kms): 0, 20, 60, 120	*2*	*1*	**7**
	c)	Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by considering seven equidistant ordinates and hence find an approximate value of π.	*1*	*1*	**7**
		UNIT - 5			
7	a)	Apply Runge-Kutta method of fourth order to solve the differential equation $\frac{dy}{dx}=x^2-y, y(0)=1$ at $x=0.1$ taking $h=0.1$.	*1*	*1*	**6**
	b)	The intensity of radiation is directly proportional to the amount of remaining radioactive substance. The differential equation is $\frac{dy}{dt}=-ky$, where $k=0.01, t_0=0, y_0=100g$. Determine how much substance will remain at the moment $t=50\sec$ by Modified Euler's method with $h=50$.	*2*	*1*	**7**
	c)	Compute $y(2)$ using Milne's predictor-corrector method, given $\frac{dy}{dx}=\frac{1}{2}(x+y)$, $y(0)=2$, $y(0.5)=2.636$, $y(1)=3.595$ and $y(1.5)=4.968$. Use corrector formula once.	*1*	*1*	**7**

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