U.S.N.										

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

Autonomous Institute Affiliated to VTU

December 2023 Supplementary Examinations

Programme: B.E. **Semester: II**
Branch: EEE/ETE/ECE/MD/EIE **Duration: 3 hrs.**
Course Code: 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.

		UNIT - I	CO	PO	Marks
1	a)	Evaluate $\int_0^a \int_{\sqrt{ax}}^a \frac{y^2 dy\,dx}{\sqrt{y^4 - a^2x^2}}$ by changing the order of integration.	CO1	PO1	**6**
	b)	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**
	c)	Show that $\int_0^\infty x e^{-x^8} dx \times \int_0^\infty x^2 e^{-x^4} dx = \frac{\pi}{16\sqrt{2}}$.	CO1	PO1	**7**
		OR			
2	a)	Find the area which is inside the circle $r = 3a\cos\theta$ and outside the cardioid $r = a(1+\cos\theta)$.	CO2	PO1	**6**
	b)	Evaluate $\iiint_R x\,y\,z\,dx\,dy\,dz$ over the region R bounded by the planes $x=0, y=0, z=0$ and $x+y+z=1$.	CO1	PO1	**7**
	c)	Prove that $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ and hence find the value of $\int_0^{\pi/2} \sqrt{\tan\theta}\, d\theta$.	CO1	PO1	**7**
		UNIT - II			
3	a)	Find the $div\,\vec{F}$ and the $curl\,\vec{F}$ of $\vec{F} = \nabla(x y^2 + y z^2 + z x^2)$.	CO1	PO1	**6**
	b)	Find the directional derivative of $f(x,y,z) = x y^2 + y z^3$ at the point $(2,-1,1)$ in the direction of normal to the surface $x\log z - y^2 = -4$ at $(-1,2,1)$.	CO1	PO1	**7**

		c)	Apply Stokes' theorem to evaluate $\oint_C (y+x)\,dx+(2x-z)\,dy+(y+z)\,dz$ where C is the boundary of the triangle with the vertices (2,0,0), (0,3,0) and (0,0,6).	CO2	PO1	**7**
			UNIT - III			
	4	a)	The set $V=\{(x,y)\ /\ x,y\in\mathbb{R}\}$ with usual addition of vectors is an abelian group. Scalar multiplication is defined as $k\cdot(x,y)=(-kx,-ky)$ where $k\in\mathbb{R}$. Verify whether V is a vector space or not.	CO1	PO1	**6**
		b)	Consider the matrix $A=\begin{bmatrix}1 & -2 & 1\\ 3 & -1 & 0\\ 1 & 4 & -2\end{bmatrix}$ which defines a linear operator on $\mathbb{R}^3$. Find the matrix of the linear transformation relative to the basis $S=\{u_1,u_2,u_3\}=\left\{\begin{bmatrix}1\\1\\1\end{bmatrix},\begin{bmatrix}0\\1\\1\end{bmatrix},\begin{bmatrix}1\\2\\3\end{bmatrix}\right\}$.	CO1	PO1	**7**
		c)	Find the basis for the range space $R(T)$, null space $N(T)$ for the linear transformation $T:R^3\to R^3$ defined by $T(x,y,z)=(x+y,x-y,2x+z)$ and also verify rank-nullity theorem.	CO1	PO1	**7**
			OR			
	5	a)	Express $M=\begin{bmatrix}3 & -1\\ 1 & -2\end{bmatrix}$ in the vector space of 2×2 matrices as a linear combination of $A=\begin{bmatrix}1 & 1\\ 0 & -1\end{bmatrix}$, $B=\begin{bmatrix}1 & 1\\ -1 & 0\end{bmatrix}$ and $C=\begin{bmatrix}1 & -1\\ 0 & 0\end{bmatrix}$.	CO1	PO1	**6**
		b)	Find the basis and dimension of the subspace spanned by the vectors $\{(1,-2,3),(1,-3,4),(-1,1,-2)\}$ in the vector space $V_3(R)$.	CO1	PO1	**7**
		c)	Find the linear transformation $T:\mathbb{R}^3\to\mathbb{R}^3$ such that $T(1,1,1)=(1,1,1)$, $T(1,2,3)=(-1,-2,-3)$ and $T(1,1,2)=(2,2,4)$.	CO1	PO1	**7**
			UNIT - IV			
	6	a)	Find the root of the equation $3x=\cos x+1$ in the interval $(0,1)$ correct to four decimal places by Newton-Raphson method.	CO1	PO1	**6**
		b)	From the following table find the number of students who obtained less than 45 marks. Also, estimate the number of students scoring marks more than 40 but less than 45.	CO2	PO1	**7**

Marks	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
No. of Students	31	42	51	35	31

		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 numerical integration.	CO2	PO1	**7**

			UNIT - V			
	7	a)	Apply Taylor series method to find the value of y at $x=0.1$ and $x=0.2$ correct to five decimals from $\frac{dy}{dx}=x^2y-1, y(0)=1$.	CO1	PO1	**6**
		b)	Apply modified Euler's method to find $y(0.2)$, given $y'=y+e^x, y(0)=0$ taking $h=0.2$.	CO1	PO1	**7**
		c)	Apply Runge-Kutta method to find an approximate value of y when $x = 0.2$ given that $\frac{dy}{dx}=\frac{y-x}{y+x}$, $y(0)=1$ and $h = 0.2$.	CO1	PO1	**7**

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