CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐

BMATS201

Second Semester B.E./B.Tech. Degree Supplementary Examination, June/July 2024

Mathematics – II for CSE Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	Evaluate $\int_{-1}^{+1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)\,dy\,dx\,dz$.	7	L2	CO1
	b.	Evaluate $\int_{0}^{a}\int_{x/a}^{\sqrt{x}/a}(x^2+y^2)\,dy\,dx$ by changing the order of integration.	7	L3	CO1
	c.	Show that $\beta(m,n)=\dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$.	6	L2	CO1
		OR			
Q.2	**a.**	Evaluate $\int_{0}^{1}\int_{0}^{\sqrt{1-y^2}}\left(x^2+y^2\right)dydx$ by changing into polar co-ordinates.	7	L3	CO1
	b.	Find the area between the parabolas $x^2=y$ and $y^2=x$ using double integration.	7	L3	CO1
	c.	Using mathematical number's, write a code to find the area of an ellipse $\dfrac{x^2}{a^2}+\dfrac{x^2}{b^2}=1$ by double integration.	6	L3	CO5
		Module – 2			
Q.3	**a.**	Find the directional derivative of $\phi=4xz^3-3x^2y^2z$ at (2, -1, 2) in the direction of the vector $2\hat{i}-3\hat{j}+6\hat{k}$.	7	L2	CO2
	b.	If $\vec{F}=\nabla(x^3+y^3+z^3-3xyz)$ find $\text{div}\,\vec{F}$ and $\text{curl}\,\vec{F}$.	7	L2	CO2
	c.	Prove that spherical co-ordinate system is orthogonal.	6	L3	CO2
		OR			
Q.4	**a.**	Find the angle betwen the normals to the surface $xy=z^2$ at the points (4, 1, 2) and (3, 3, -3).	7	L2	CO2
	b.	If $\vec{F}=(x+y+az)\hat{i}+(bx+2y-z)\hat{j}+(x+cy+2z)\hat{k}$, find a, b, c such that $\text{curl}\,\vec{F}=0$.	7	L2	CO2
	c.	Using mathematical tool write a code to find the curl of $\vec{F}=x^3\hat{i}+y^3\hat{j}+z^3\hat{k}$.	6	L3	CO5
		Module – 3			
Q.5	**a.**	Prove that the set $w=\left\{(x,y,z)\big/ x-3y+4z=0\right\}$ is a subspace of $V_3(R)$.	7	L2	CO3

<table>
<tr><td></td><td>b.</td><td>Express the matrix $M=\begin{bmatrix}4&7\\7&9\end{bmatrix}$ as a linear combination of the matrices, $P=\begin{bmatrix}1&1\\1&1\end{bmatrix}, Q=\begin{bmatrix}1&2\\3&4\end{bmatrix}, R=\begin{bmatrix}1&1\\4&5\end{bmatrix}$</td><td>7</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>Find the basis and dimension of subspace spanned by the vectors, $\{(1,-2,3),(1,-3,4)(-1,1,-2)\}$ of $V_3(R)$.</td><td>6</td><td>L3</td><td>CO3</td></tr>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>Q.6</td><td>a.</td><td>Find the matrix of linear transformation, $T:R^2\to R^2$ defined by, $T(x,y)=(2x+3y, 4x-5y)$ with respect to the basis, $B_1=\{(1,2),(2,5)\}$ of R^2.</td><td>7</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>The transformation $G:R^3\to R^3$ is defined as G(x,y,z)=(x+2y-z, y+z, x+2y-2z). Find the basis and dimension of Im(G).</td><td>7</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>If $f(t)=t+2$, $g(t)=3t-2$, $h(t)=t^2-2t-3$ and $\langle f,g\rangle=\int_0^1 f(t)g(t)dt$, find
(i) $\langle f,g\rangle$ (ii) $\langle f,h\rangle$ (iii) $\|f\|$ and $\|g\|$</td><td>6</td><td>L3</td><td>CO3</td></tr>
<tr><td colspan="6" align="center">Module – 4</td></tr>
<tr><td>Q.7</td><td>a.</td><td>Find the real root of the equation $x^3-2x-5=0$, correct to three decimal places using Regula-Falsi method. Carry out three iteration.</td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>Using Newton's forward interpolation formula find y at x = 5 from the following table:
<table>
<tr><td>x:</td><td>0</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td></tr>
<tr><td>y:</td><td>0</td><td>4</td><td>56</td><td>204</td><td>496</td><td>980</td></tr>
</table></td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Simpson's $\frac{3}{8}^{th}$ rule taking six equal intervals.</td><td>6</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>Q.8</td><td>a.</td><td>Find the real root of the equation, $xe^x-2=0$, correct to three decimal places using Newton-Raphson method. Carry out three iterations.</td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>Using Lagrange's interpolation formula find f(4) given,
<table>
<tr><td>x :</td><td>0</td><td>2</td><td>3</td><td>6</td></tr>
<tr><td>f(x) :</td><td>-4</td><td>2</td><td>14</td><td>158</td></tr>
</table></td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>Evaluate $\int_0^1 \frac{x}{1+x^2}dx$ by trapezoidal rule considering six equal intervals.</td><td>6</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="6" align="center">Module – 5</td></tr>
<tr><td>Q.9</td><td>a.</td><td>Employ Taylor's series method to obtain approximate value of y at x = 0.1 for the differential equation, $\frac{dy}{dx}=2y+3e^x$, y(0) = 0</td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>Apply Runge-Kutta method of 4th order to find an approximate value of y at x = 0.2, given that $\frac{dy}{dx}=\frac{y-x}{y+x}$, y(0) = 1.</td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>Apply Milne's method to find y(1.4) given $\frac{dy}{dx}=x^2+\frac{y}{2}$ and the following data :
y(1) = 2, y(1.1) = 2.2156, y(1.2) = 2.4649, y(1.3) = 2.7514.</td><td>6</td><td>L3</td><td>CO5</td></tr>
</table>

OR

Q.10	**a.**	Using modified Euler's method, find y(0.1) given $\frac{dy}{dx} = x - y^2$, y(0) = 1. Carry out 3 iterations.	**7**	**L2**	**CO4**
	b.	Using Runge-Kutta method of fourth order solve $\frac{dy}{dx} = \frac{1}{x+y}$, y(0.4) = 1 at x = 0.5.	**7**	**L2**	**CO4**
	c.	Using mathematical tool, write a code to solve the differential equation $\frac{dy}{dx} = x^2 + y^2$ with y(0) = 0, using Taylor's series method at x = 0.1.	**6**	**L3**	**CO5**

* * * * *