CBCS SCHEME

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BMATC201

Second Semester B.E/B.Tech. Degree Supplementary Examination, June/July 2024
Mathematics – II for Civil Engineering Stream

Time: 3 hrs. Max. Marks:100

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

		Module – 1	M	L	C
1	a.	Evaluate : $\int_0^1\int_0^{x^2}\int_0^{x+y}(x-2y+z)dzdydx$.	7	L3	CO1
	b.	Evaluate : $\int_0^1\int_1^{2-x} xy\,dy\,dx$ by changing the order of integration.	7	L3	CO1
	c.	Show that : $\int_0^{\pi/2}\frac{d\theta}{\sqrt{\sin\theta}}\times\int_0^{\pi/2}\sqrt{\sin\theta}\,d\theta=\pi$.	6	L2	CO1
		OR			
2	a.	Evaluate : $\int_0^1\int_x^{\sqrt{2-x^2}}\frac{x}{\sqrt{x^2+y^2}}dy\,dx$ by changing into polars.	7	L3	CO1
	b.	Find the area of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ by double integration.	7	L3	CO1
	c.	Write a modern mathematical tool program to evaluate the double integral $\int_0^1\int_x^{\sqrt{x}}(x^2+y^2)dydx$.	6	L2	CO5
		Module – 2			
3	a.	Find the angle between the surfaces $x^2+y^2+z^2=9$ and $z=x^2+y^2-3$ at the point P(2, –1, 2).	7	L3	CO2
	b.	Show that $\vec{f}.\text{curl}\,\vec{f}=0$ where $\vec{f}=(x+y+1)\hat{i}+\hat{j}-(x+y)\hat{k}$.	7	L2	CO2
	c.	Find the constants 'a' and 'b' such that, $\vec{f}=(axy+z^3)\hat{i}+(3x^2-z)\hat{j}+(bxz^2-y)\hat{k}$ is irrotational. Then find ϕ such that $\vec{f}=\nabla\phi$.	6	L3	CO2

		OR			
4	a.	If $\vec{F} = (3x^2 + 6y)\hat{i} - 14yz\,\hat{j} + 20xz^2\,\hat{k}$. Evaluate $\int_C \vec{F} \cdot d\vec{r}$ along the curve given by $x = t,\ y - t^2,\ z = t^3$ from $t = 0$ to $t = 1$.	7	L3	CO2
	b.	Evaluate : $\int_C (xy - x^2)dx + x^2y\,dy$ where 'C' is the closed curve formed by $y = 0,\ x = 1$ and $y = x$ by Green's theorem.	7	L3	CO2
	c.	Write a modern mathematical tool program to find the gradient of $\phi = xy^2 + 2yz - 7$.	6	L3	CO5
		Module – 3			
5	a.	Form the partial differential equation from $z = f(y + x) + g(y + 2x)$ by eliminating arbitrary functions.	7	L2	CO3
	b.	Solve $\frac{\partial^2 z}{\partial x^2} - 16z = 0$, given that $z = 0$, $\frac{\partial z}{\partial x} = 4\sin y$ when $x = 0$.	7	L3	CO3
	c.	With usual notations derive the dimensional heat equation.	6	L2	CO3
		OR			
6	a.	Form the partial differential equation by eliminating arbitrary function 'ϕ' from $\phi(x + y + z, x^2 + y^2 - z^2) = 0$.	7	L3	CO4
	b.	Solve $\frac{\partial^2 z}{\partial x \partial y} = \sin x \cos y$, given $\frac{\partial z}{\partial y} = -2\cos y$ when $x = 0$ and $z = 0$ when $y = n\pi$.	7	L3	CO4
	c.	Solve $x(y^2 - z^2)P + y(z^2 - x^2)\phi = z(x^2 - y^2)$.	6	L3	CO4
		Module – 4			
7	a.	Find the approximate value of the real root of the equation $x^3 - 3x = 4 = 0$ using Regula – Falsi method (carry out 3 iterations).	7	L3	CO4
	b.	Given f(40) = 184, f(50) = 204, f(60) = 226, f(70) = 250, f(80) = 276, f(90) = 304. Find f(85) using suitable interpolation formula).	7	L3	CO4
	c.	Evaluate $\int_0^1 \frac{dx}{1 + x^2}$ by using Simpson's 1/3rd rule taking four equal strips and hence deduce an approximate value of π.	6	L3	CO4

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<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>8</td><td>a.</td><td>Use Newton – Raphson method to find a real root of $x \sin x + \cos x = 0$ near $x = \pi$ (carry out 3 iterations).</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>Applying Lagrange's interpolation formula to find y when x = 4, given :<table><tr><td>x</td><td>0</td><td>2</td><td>3</td><td>6</td></tr><tr><td>y</td><td>707</td><td>819</td><td>866</td><td>966</td></tr></table></td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>Evaluate $\int_{4}^{5.2} \log_e^x \, dx$ taking six equal strips by applying Trapezoidal Rule.</td><td>6</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="6" align="center">Module – 5</td></tr>
<tr><td>9</td><td>a.</td><td>Use Taylor's series method to find y(0.1) from $\frac{dy}{dx} = x^2 + y$ with y(0) = 10. (consider the terms upto fourth degree).</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>Given $\frac{dy}{dx} = 1 + \frac{y}{x}$, y = 2 at x = 1. Find the approximate value of y at x = 1.2 by taking step size h = 0.2 applying modified Euler's method.</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>Apply Milne's method to compute y(0.4) correct to four decimal places given $\frac{dy}{dx} = x^2 + \frac{y}{2}$ and the data y(1) = 2, y(1.1) = 2.2156, y(1.2) = 2.4659, y(1.3) = 2.7514.</td><td>6</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>10</td><td>a.</td><td>Using modified Euler's method, find y(0.2) by taking h = 0.2, given that $\frac{dy}{dx} = x + \lvert\sqrt{y}\rvert$ and y = 1 at x = 0 initially.</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>Using Runge – Kutta method of fourth order, find y(0.2) for the equation : $\frac{dy}{dx} = \frac{y-x}{y+x}$, y(0) = 1 taking h = 0.2.</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>Write a modern mathematical tool program to solve $\frac{dy}{dx} = 3e^x + 2y$, y(0) = 0 by Runge – Kutta fourth order method.</td><td>6</td><td>L2</td><td>CO5</td></tr>
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