CBCS SCHEME

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BMATM201

Second Semester B.E./B.Tech. Degree Examination, June/July 2023
Mathematics-II for ME 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 $\int_0^1\int_x^{\sqrt{x}}(x^2+y^2)dydx$.	7	L3	CO1
	b.	Evaluate $\int_0^a\int_x^{\sqrt{a^2-y^2}} y\sqrt{x^2+y^2}\,dxdy$ by changing into polar.	7	L3	CO1
	c.	Show that $\gamma\left(\frac{1}{2}\right)=\sqrt{\pi}$.	6	L2	CO1
		OR			
Q.2	a.	Evaluate $\int_0^1\int_x^{\sqrt{x}} xydydx$ by changing the order of integration.	7	L3	CO1
	b.	Using double integration find the area of the plane in the form of a quadrant of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$.	7	L3	CO1
	c.	Using modern mathematical tools, write a program to evaluate : $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)dzdydx$	6	L3	CO5
		Module – 2			
Q.3	a.	If $\vec{F}=\nabla(x^3+y^3+z^3-3xyz)$, find div $\vec{F}$ and curl $\vec{F}$.	7	L2	CO2
	b.	Find the angle between the surfaces $x^2+y^2-z^2=4$ and $z=x^2+y^2-13$ at (2, 1, 2).	7	L2	CO2
	c.	Define a irrotational vector. Find the constants a, b, c such that $\vec{F}=(x+y+az)i+(bx+2y-z)j+(x+cy+2z)k$ is irrotational.	6	L2	CO2
		OR			
Q.4	a.	If $\vec{F}=xyi+yzj+zxk$, evaluate $\int_c\vec{F}\cdot d\vec{r}$ where c is the curve represented by $x=t,\ y=t^2,\ z=t^3,\ -1\le t\le 1$.	7	L3	CO2
	b.	Using Green's theorem, evaluate $\oint(3x^2-8y^2)dx+(4y-6xy)dy$, where c is the boundary of the region enclosed by $y=\sqrt{x}$ and $y=x^2$.	7	L3	CO2
	c.	Write the Modern mathematical tool program to find the divergence of the vector field $\vec{F}=x^2yz\hat{i}+y^2zx\hat{j}+z^2xy\hat{k}$.	6	L3	CO5

Module – 3

Q.5

a. Form the PDE by eliminating the arbitrary function from $f(x+y+z,\ x^2+y^2+z^2)=0$ — 7 | L2 | CO3

b. Solve $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$ for which $\frac{\partial z}{\partial y} = -2\sin y$, when x = 0 and z = 0 if y is an odd multiple of $\frac{\pi}{2}$. — 7 | L3 | CO13

c. Derive one dimensional wave equation. — 6 | L2 | CO3

OR

Q.6

a. Form the PDE by eliminating the arbitrary constants a and b from $(x-a)^2+(y-b)^2+z^2=r^2$. — 7 | L2 | CO3

b. Solve $\frac{\partial^2 z}{\partial x^2} = a^2 z$ given that x = 0, z = 0 and $\frac{\partial z}{\partial x} = a\sin y$. — 7 | L3 | CO3

c. Solve $x(y^2-z^2)p + y(z^2-x^2)q = z(x^2-y^2)$, using Lagrange's multipliers. — 6 | L3 | CO3

Module – 4

Q.7

a. Compute the real root of the equation $x\log_{10} x - 1.2 = 0$ by the Regula Falsi method taking four decimal places. Perform three approximation. — 7 | L3 | CO4

b. The population of a town is given by the following table: — 7 | L3 | CO4

Year	1951	1961	1971	1981	1991
Population	19.96	39.65	58.81	72.21	94.61

Using Forward and Backward Necoton's interpolation formula, calculate the increase in population between the years 1955 to 1985.

c. Evaluate $\int_0^1 \frac{1}{1+x^2}dx$ by taking 7 ordinates using Trapezoidal rule. — 6 | L3 | CO4

OR

Q.8

a. Using the Newton Raphson method, find the real root of the equation $x\sin x + \cos x = 0$, which is nearer to x = π, correct to three decimal places. — 7 | L3 | CO4

b. Compute the value of y when x = 4 using Lagrange's interpolation formula given — 7 | L3 | CO4

x	0	2	3	6
f(x)	–4	2	14	158

c. Evaluate $\int_0^{\pi/2} \sqrt{\cos\theta}\, d\theta$ by taking 7 ordinates using Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule. — 6 | L3 | CO4

Module – 5

Q.9

a. Use Taylor's series method to find y(0.1) from $\frac{dy}{dx} = x^2 + y^2$ and y(0) = 1. — 7 | L3 | CO4

b. Using Runge-Kutta method of order 4, find y at x = 0.2 by taking h = 0.2 and given $\frac{dy}{dx} = 3x + \frac{y}{2}$, y(0) = 1. — 7 | L3 | CO4

	c.	Applying Milne's predictor and corrector method, find y(0.8) from $\frac{dy}{dx} = x - y^2$ and given y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762.	6	L3	CO4
		OR			
Q.10	a.	Solve by using modified Euler's method $\frac{dy}{dx} = x - y^2, y(0) = 1$ taking h = 0.1, find y(0.2).	7	L3	CO4
	b.	Using Runge-Kutta method of order 4, find y at x = 0.1, given that $\frac{dy}{dx} = 3e^x + 2y$, y(0) = 0 and h = 0.1.	7	L3	CO4
	c.	Using mathematical tools, write a code to find the solution of $\frac{dy}{dx} = 1 + \frac{y}{x}$ at y(2) taking h = 0.2 given that y(1) = 2 by Runge-Kutta method of order 4.	6	L3	CO4

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