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 $\text{div}\vec{F}$ and $\text{curl}\vec{F}$.	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: 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.	7	L3	CO4
	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 x: 0, 2, 3, 6 f(x): –4, 2, 14, 158	7	L3	CO4
	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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