MAKE-UP EXAM

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BMATM201

Second Semester B.E./B.Tech. Degree Examination, Nov./Dec. 2023
Mathematics – II for Mechanical Engineering 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 $\int_0^1\int_x^{\sqrt{x}}(x^2+y^2)\,dy\,dx$.	6	L3	CO1
	b.	Evaluate $\int_0^{\infty}\int_x^{\infty}\frac{e^{-y}}{y}\,dx\,dy$ by changing the order of the integration.	7	L3	CO1
	c.	Show that $\Gamma(1/2)=\sqrt{\pi}$.	7	L2	CO1
		OR			
Q.2	a.	Evaluate $\int_0^a\int_0^a\int_0^a(x^2+y^2+z^2)\,dx\,dy\,dz$.	6	L3	CO1
	b.	Evaluate $\int_{-a}^{a}\int_0^{\sqrt{a^2-x^2}}\left(\sqrt{x^2+y^2}\right)dy\,dx$. By changing into polar coordinates.	7	L3	CO1
	c.	Write a mathematical tool program to find the volume of the tetrahedron bounded by the planes x = 0, y = 0 and $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$.	7	L3	CO5
		Module – 2			
Q.3	a.	Find the angle between the surfaces $x^2+y^2-z^2=4$ and $z=x^2+y^2-13$ at (2, 1, 2).	6	L2	CO2
	b.	Find the constants a, b and c such that the vector $\vec{F}=(x+y+az)i+(bx+2y-z)j+(x+cy+2z)k$ is irrotational.	7	L2	CO2
	c.	Find $\operatorname{div}\vec{F}$ and $\operatorname{curl}\vec{F}$. Where $\vec{F}=\operatorname{grad}\,(x^3+y^3+z^3-3xyz)$ at (1, 1, 1).	7	L2	CO2
		OR			
Q.4	a.	Using Greens theorem, evaluate $\oint_c(3x^2-8y^2)dx+(4y-6xy)dy$, where c is the closed curve of the region bounded by $y=\sqrt{x}$ and $y=x^2$.	6	L3	CO2
	b.	Use Stokes Theorem to evaluate $\int_c\vec{F}.\vec{dr}$, where $\vec{F}=(x^2+y^2)i-2xyj$ and c is bounded by the lines $x=\pm a$, y = 0, y = b.	7	L3	CO2
	c.	Write the modern mathematical tool program to find the curl of vector field. $\vec{F}=x^2yzi+y^2zxj+z^2xyk$.	7	L3	CO5
		Module – 3			
Q.5	a.	Form the partial differential equation by eliminating the arbitrary constants from the relation $(x-a)^2+(y-b)^2+z^2=4$.	6	L2	CO3

	b.	Solve $\frac{\partial^2 z}{\partial y^2} = z$ given that $y = 0$, $z = e^x$ and $\frac{\partial z}{\partial y} = e^{-x}$.	7	L3	CO3
	c.	Solve : $x^2(y - z)p + y^2(z - x)q = z^2(x - y)$ using Lagrange's multipliers.	7	L3	CO3
		OR			
Q.6	a.	Form the partial differential equation by eliminating the arbitrary function from $\phi(x^2 + y^2 + z^2, xyz) = 0$.	6	L2	CO3
	b.	Solve $\frac{\partial^2 z}{\partial x \partial y} = \frac{x}{y}$, given that $\frac{\partial z}{\partial x} = \log x$ when $y = 1$ and $z = 0$ when $x = 1$.	7	L3	CO3
	c.	Derive one dimensional wave equation.	7	L2	CO3
		Module – 4			
Q.7	a.	Find an approximate value of the root of the equation $xe^x = 2$ in the interval (0.5, 1) using Regula-Falsi method correct to 4-decimal places carryout 4 iterations.	6	L3	CO4
	b.	Using Newton's backward interpolation formula find y at x = 5.2 for the data. x: 1, 2, 3, 4, 5 y: 10, 26, 58, 112, 194	7	L3	CO4
	c.	Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ by using Simpson's 1/3rd rule by taking 7 ordinates.	7	L3	CO4
		OR			
Q.8	a.	Find the real root of the equation Tanx = x near x = 4.5 by Newton's – Raphson method correct to 4-decimal places.	6	L3	CO4
	b.	Using Newton's divided difference formula find f(5) from the following data: x: 0, 2, 3, 4, 7, 9 y: 4, 26, 58, 112, 466, 922	7	L3	CO4
	c.	Evaluate $\int_4^{5.2} (\log x) dx$ by using Trapezoidal rule by taking 7 ordinates.	7	L3	CO4
		Module – 5			
Q.9	a.	Using Taylors series method to solve $\frac{dy}{dx} = (x + y)$ with y(1) = 0 at the points x = 1.1 and 1.2 upto 4th approximation.	6	L2	CO4
	b.	Using Runge-Kutta method of fourth order find y(0.2) given that $\frac{dy}{dx} = (x + y^2); y(0) = 1$ Taking h = 0.2.	7	L3	CO4
	c.	Using modified Euler's method find y at x = 0.2 given that $\frac{dy}{dx} = 3x + \frac{y}{2}$; y(0) = 1 taking h = 0.1. Carryout 3-modification in each step.	7	L3	CO4
		OR			
Q.10	a.	Using Runge-Kutta method of fourth order find y(0.1) given that $\frac{dy}{dx} = 3e^x + 2y$, with y(0) = 0 taking h = 0.1.	6	L3	CO4
	b.	Given $\frac{dy}{dx} = (x - y^2)$ and the data y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762 compute y(0.8) by Milne's method.	7	L3	CO4
	c.	Using mathematical tools write a code to find the solution of $\frac{dy}{dx} = \left(1 + \frac{y}{x}\right)$ at y(2) taking h = 0.2 given that y(1) = 2 by Runge-Kutta method.	7	L3	CO5