MAKE-UP EXAM

USN

BMATC201

Second Semester B.E./B.Tech. Degree Examination, Nov./Dec. 2023
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. 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 $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)\,dz\,dy\,dx$	07	L3	CO1
	b.	Evaluate $\int_{0}^{1}\int_{x}^{\sqrt{x}} xy\,dy\,dx$ by changing the order of integration.	07	L3	CO1
	c.	Derive the relation $\beta(m, n) = \dfrac{\sqrt{(m)}\,\sqrt{(n)}}{\sqrt{(m+n)}}$	06	L2	CO1
		OR			
Q.2	a.	Change the order of integration and evaluate $\int_{0}^{\infty}\int_{x}^{\infty}\frac{e^{-y}}{y}\,dy\,dx$	07	L3	CO1
	b.	Evaluate $\iint_R xy\,dx\,dy$ where R is the region bounded by the coordinate axes and the line $x + y = 1$.	07	L3	CO1
	c.	Write a modern mathematical program to evaluate the integral $\int_{0}^{3}\int_{0}^{3-x}\int_{0}^{3-x-y} xyz\,dz\,dy\,dx$	06	L3	CO5
		Module – 2			
Q.3	a.	Find the directional derivatives of $\phi = 4xz^3 - 3x^2y^2z$ at the point (2, –1, 2) in the direction of the vector $2i - 3j + 6k$.	07	L2	CO2
	b.	Find $\operatorname{div}\vec{F}$ and $\operatorname{curl}\vec{F}$ where $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$	07	L2	CO2
	c.	If $\vec{F} = (x + y + az)i + (bx + 2y - z)j + (x + cy + 2z)k$ find a, b, c such that $\operatorname{curl}\vec{F} = \vec{O}$.	06	L2	CO2
		OR			
Q.4	a.	If $\vec{F} = (3x^2 + 6y)i - 14yz\,j + 20xz^2\,k$, evaluate $\int \vec{F}.d\vec{r}$ from (0, 0, 0) to (1, 1, 1) along the curve given by $x = t$, $y = t^2$, $z = t^3$.	07	L2	CO2
	b.	Find the area between the parabolas $y^2 = 4x$ and $x^2 = 4y$ with the help of Green's theorem in a plane.	07	L2	CO2
	c.	Write a modern mathematical tool program to find the gradient of $\phi = x^2y + 2xz - 4$.	06	L3	CO5

			Marks	Level	CO
		Module – 3			
Q.5	**a.**	Form the partial differential equation by eliminating the arbitrary function from the relation $z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$	07	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 $\pi/2$.	07	L3	CO3
	c.	With usual notations derive a one dimensional heat equation.	06	L2	CO3
		OR			
Q.6	**a.**	Form the partial differential equation from the relation $z = y\,f(x) + x\,\phi(y)$	07	L2	CO3
	b.	Solve $\frac{\partial^2 z}{\partial y^2} - z = 0$ given that when y = 0, $z = e^x$ and $\frac{\partial z}{\partial y} = e^{-x}$	07	L3	CO3
	c.	With usual notations, derive one dimensional wave equation.	06	L2	CO3
		Module – 4			
Q.7	**a.**	Find a real root of $x^3 - 2x - 5 = 0$ correct to three decimal places by Regula Falsi method.	07	L3	CO4
	b.	Given sin 45° = 0.7071, sin 50° = 0.7660, sin 55° = 0.8192, sin 60° = 0.8660 find sin 57° using an approximate interpolation formula.	07	L3	CO4
	c.	Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Simpson's $\frac{1}{3}^{rd}$ rule taking four equal strips.	06	L3	CO4
		OR			
Q.8	**a.**	Find the real root of an equation $xe^x - 2 = 0$. Correct to three decimal places by the Newton – Raphson method.	07	L3	CO4
	b.	Fit an interpolating polynomial for the data f(10) = 355, f(0) = -5, f(8) = -21 f(1) = -1.4, f(4) = -125 using Newton's divided difference formula.	07	L3	CO4
	c.	Evaluate $\int_0^1 \frac{dx}{1+x}$ taking seven ordinates by applying Simpson's $\frac{3}{8}^{th}$ rule.	06	L3	CO4
		Module – 5			
Q.9	**a.**	From Taylor's series method, find y(0.1) considering upto 4^{th} degree term if y(x) = satisfies the equation $\frac{dy}{dx} = x - y^2$, y(0) = 1.	07	L3	CO4
	b.	Given $\frac{dy}{dx} = 3x + \frac{y}{2}$, y(0) = 1, find y(0.2) by taking h = 0.2 using Runge - Kutta method of 4^{th} order.	07	L3	CO4
	c.	If $\frac{dy}{dx} = 2e^x - y$, y(0) = 2, y(0.1) = 2.010, y(0.2) = 2.040, y(0.3) = 2.090, find y(0.4) correct to three decimal places by Milne's predictor and corrector method.	06	L3	CO4
		OR			
Q.10	**a.**	Using Euler's predictor and corrector formula find y(1.1) correct to three decimal places, given that $\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}$ and y = 1 at x = 1.	07	L3	CO4
	b.	Using Runge – Kutta method of 4^{th} order, find y(0.2) for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, y(0) = 1 taking h = 0.2.	07	L3	CO4
	c.	Write a modern mathematical tool program to solve $\frac{dy}{dx} = 1 + \frac{y}{x}$ at y(2) taking h = 0.2 given that y(1) = 2, using Runge – Kutta method of 4^{th} order.	06	L3	CO5