Model Question Paper-II with effect from 2021

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Second Semester B.E Degree Examination

Advanced Calculus and Numerical Methods (21MAT21)

TIME: 03 Hours **Max. Marks: 100**

Note: Answer any **FIVE** full questions, choosing at least **ONE** question from each module.

		Module -1	**Marks**
Q.01	a	Evaluate $\int\int xy\,dxdy$ over the region bounded by the x-axis, ordinate $x = 2a$ and the curve $x^2 = 4ay$	**06**
	b	Find the volume bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$, by using double integration	**07**
	c	Show that $\int_0^{\frac{\pi}{2}} \sqrt{\sin\theta}\ d\theta \times \int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{\sin\theta}} = \pi$	**07**
		OR	
Q.02	a	Change the order of integration and hence evaluate $\int_0^{\infty}\int_x^{\infty} \frac{e^{-y}}{y} dydx$	**06**
	b	Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz\ dxdydz$	**07**
	c	Show that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$	**07**
		Module-2	
Q. 03	a	Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point $(2, -1, 2)$	**06**
	b	If $\vec{F} = x^2y\,\hat{\imath} + y^2z\,\hat{\jmath} + z^2x\,\hat{k}$, find $Curl(Curl\vec{F})$	**07**
	c	Show that $\vec{F} = (y^2 - z^2 + 3yz - 2x)\hat{\imath} + (3xz + 2xy)\hat{\jmath} + (3xy - 2xz + 2z)\hat{k}$ is both solenoidal and irrotational.	**07**
		OR	
Q.04	a	If $\vec{F} = (5xy - 6x^2)\hat{\imath} + (2y - 4x)\hat{\jmath}$, evaluate $\int_C \vec{F}\cdot d\vec{r}$ along the curve $C: y = x^3$ in the xy −plane from the point $(1, 1)\ to\ (2,\ 8)$	**06**
	b	Using Green's theorem, evaluate $\int_C (xy + y^2)\,dx + x^2dy$, where C is bounded by $y = x$ and $y = x^2$	**07**
	c	Using Stoke's theorem, evaluate $\oint_C \vec{F}\cdot d\vec{r}$, where $\vec{F} = (x^2 + y^2) - 2xy$, taken around the rectangle whose vertices are $(a, 0),\ (a, b),\ (-a, b), (-a, 0)$.	**07**
		Module-3	
Q. 05	a	Form the partial differential equation from the relation $z = f(x + at) + g(x - at)$.	**06**
	b	Solve $\frac{\partial^2 z}{\partial x^2} + \frac{\partial z}{\partial x} - 4z = 0$, given that when x = 0, z = 1 and $\frac{\partial z}{\partial x} = y$	**07**

	c	Derive one-dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$	**07**
		OR	
Q. 06	a	Form the partial differential equation from $f(x+y+z,\ x^2+y^2+z^2)=0$	**06**
	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 when y is an odd multiple of $\frac{\pi}{2}$.	**07**
	c	Solve $x(y^2-z^2)p + y(z^2-x^2)q - z(x^2-y^2) = 0$	**07**
		Module-4	
Q. 07	a	Find a real root of $x^3 - 9x + 1 = 0\ in\ (2,3)$ by the Regula-Falsi method in four iterations	**06**
	b	Using Newton's forward interpolation find y at x = 5 from the data x: 4, 6, 8, 10 y: 1, 3, 8, 16	**07**
	c	Evaluate $\int_0^{\frac{\pi}{2}} \sqrt{cos\theta}\, d\theta$ by taking 7 ordinates by Simpson's $(1/3)^{rd}$ rule.	**07**
		OR	
Q. 08	a	Using the Newton-Raphson method, find the root of $3x = cosx + 1$ correct four decimal places.	**06**
	b	Using Newton's divided difference interpolation find $f(9)$, Given that x: 5, 7, 11, 13, 17 y: 150, 392, 1452, 2366, 5202	**07**
	c	Evaluate $\int_o^1 \frac{dx}{1+x^2}$, using Simpson's $(3/8)^{th}$ rule by taking 7 ordinates.	**07**
		Module-5	
Q. 09	a	Use the Taylor series method to find $y(0.2)$ from $\frac{dy}{dx} = x^2 y - 1, with\ \ y(0) = 1$	**06**
	b	By using modified Euler's method, find y(0.2), taking h = 0.1 from $\frac{dy}{dx} = \frac{y-x}{y+x}$, with $y(0) = 1$	**07**
	c	Applying Milne's Predictor-Corrector method, find y(0.8), from $\frac{dy}{dx} = x^3 + y$, given that $y(0) = 2,\ y(0.2) = 2.073,\ y(0.4) = 2.452,\ y(0.6) = 3.023$	**07**
Q.10	a	Employ Taylor's series method to evaluate $y(0.2), taking\ h = 0.1$ from $\frac{dy}{dx} = e^x - y^2, with\ y(0) = 1$	**06**
	b	Using the Runge-Kutta method of order 4, find y at x = 0.1, given that $\frac{dy}{dx} = 3e^x + 2y,\quad y(0) = 1$	**07**
	c	Applying Milne's Predictor - Corrector method, to find y(1.4), from $\frac{dy}{dx} = x^2 + \frac{y}{2}$, given that $y(1) = 2,\ y(1.1) = 2.2156,\ y(1.2) = 2.4549,\ y(1.3) = 2.7514$	**07**

Table showing the Bloom's Taxonomy Level, Course Outcome and Program Outcome				
Question		**Bloom's Taxonomy Level attached**	**Course Outcome**	**Program Outcome**
Q.1	(a)	L2	CO 01	PO 02
	(b)	L3	CO 01	PO 03
	(c)	L2	CO 01	PO 02
Q.2	(a)	L2	CO 01	PO 02
	(b)	L2	CO 01	PO 02
	(c)	L2	CO 01	PO 02
Q.3	(a)	L2	CO 02	PO 01
	(b)	L2	CO 02	PO 02
	(c)	L2	CO 02	PO 02
Q.4	(a)	L2	CO 02	PO 02
	(b)	L3	CO 02	PO 03
	(c)	L3	CO 02	PO 03
Q.5	(a)	L2	CO 03	PO 01
	(b)	L2	CO 03	PO 02
	(c)	L3	CO 03	PO 03
Q.6	(a)	L2	CO 03	PO 02
	(b)	L2	CO 03	PO 02
	(c)	L2	CO 03	PO 02
Q.7	(a)	L2	CO 04	PO 01
	(b)	L2	CO 04	PO 01
	(c)	L2	CO 04	PO 02
Q.8	(a)	L2	CO 04	PO 01

	(b)	L2	CO 04	PO 01
	(c)	L2	CO 04	PO 02
Q.9	(a)	L2	CO 05	PO 01
	(b)	L2	CO 05	PO 01
	(c)	L2	CO 05	PO 02
Q.10	(a)	L2	CO 05	PO 01
	(b)	L2	CO 05	PO 02
	(c)	L2	CO 05	PO 02

Bloom's Taxonomy Levels	**Lower order thinking skills**		
	Remembering (knowledge): L_1	Understanding (Comprehension): L_2	Applying (Application): L_3
	Higher-order thinking skills		
	Analyzing (Analysis): L_4	Valuating (Evaluation): L_5	Creating (Synthesis): L_6