BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN | | | | | | | | | | |

Course Code 22MATS21

Second Semester B.E. Degree Summer Semester Examinations, September/October 2025

MATHEMATICS-II FOR COMPUTER SCIENCE & ENGINEERING STREAM

Duration: 3 hrs **Max. Marks: 100**

Note: ***1. Answer any* FIVE *full questions, choosing* ONE *full question from each module.***
2. Use of Mathematics Formula Handbook is permitted.
3. Missing data, if any, may be suitably assumed.

Q. No		Question	Marks	(RBTL:CO:PI)
		Module-1		
1.	**a.**	Find the angle between the surface $x^2+y^2+z^2=9$ and $z=x^2+y^2-3$ at $(2,-1,2)$.	**06**	**(2:1:1.2.1)**
	b.	If $\vec{F}=(x+y+1)i+j-(x+y)k,$ show that $\vec{F}.\text{ curl }\vec{F}=0.$	**07**	**(2:1:1.2.1)**
	c.	Show that $\vec{F}=(y+z)i+(z+x)j+(x+y)k$ is irrotational and hence find a scalar function ϕ such that $\vec{F}=\nabla\phi.$	**07**	**(2:1:1.2.1)**
		(OR)		
2.	**a.**	Find the scale factors for cylindrical system.	**06**	**(2:1:1.2.1)**
	b.	Prove the spherical polar co-ordinate system is orthogonal.	**07**	**(2:1:1.2.1)**
	c.	Express the vector $\overline{A}=zi-2xj+yk$ in cylindrical co-ordinates.	**07**	**(2:1:1.2.1)**
		Module-2		
3.	**a.**	Solve $\frac{d^3y}{dx^3}-2\frac{d^2y}{dx^2}+4\frac{dy}{dx}-8y=0$	**06**	**(2:2:1.2.1)**
	b.	Solve $\left(D^2+5D+6\right)y=e^x$	**07**	**(2:2:1.2.1)**
	c.	Solve $y''-4y'+13y=\sin 2x$	**07**	**(2:2:1.2.1)**
		(OR)		
4.	**a.**	Solve $\left(D^2+3D+2\right)y=1+3x+x^2.$	**06**	**(2:2:1.2.1)**
	b.	Solve $x^2y''+xy'+9y=3x^2+\sin(3\log x).$	**07**	**(2:2:1.2.1)**
	c.	Solve $(1+x)^2\frac{d^2y}{dx^2}+(1+x)\frac{dy}{dx}+y=\sin 2\left[\log(1+x)\right].$	**07**	**(2:2:1.2.1)**
		Module-3		
5.	**a.**	Find the Laplace transform of the following functions: (i) $e^{-2t}\sinh 4t$ (ii) $t\cos at$	**06**	**(2:3:1.2.1)**
	b.	Find the Laplace transform of $2^t+\frac{\cos 2t-\cos 3t}{t}$	**07**	**(2:3:1.2.1)**

Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)**

	c.	If $f(t)=\begin{cases} E, & 0<t<a \\ -E, & a<t<2a \end{cases}$, show that $L\left[f(t)\right]=\frac{E}{s}\tanh\left(\frac{as}{2}\right)$.	**07**	**(2:3:1.2.1)**

(OR)

6.	**a.**	Find the inverse Laplace transform of the function $\frac{4s+5}{(s+1)^2(s+2)}$.	**06**	**(2:3:1.2.1)**
	b.	Using convolution theorem, obtain the inverse Laplace transform of the function $\frac{s}{\left(s^2+a^2\right)^2}$.	**07**	**(2:3:1.2.1)**
	c.	Using Laplace Transform technique, solve $y''-2y'+y=e^{2t}$ subject to the conditions, $y(0)=0, y'(0)=-1$.	**07**	**(2:3:1.2.1)**

Module-4

7.	**a.**	Use Newton-Raphson method to find the real root of the equation $x\sin x+\cos x=0$ near $x=\pi$. Carry out three iterations.	**06**	**(2:4:1.2.1)**
	b.	Use Newton's forward interpolation formula to find $f(38)$	**07**	**(2:4:1.2.1)**

x	**40**	**50**	**60**	**70**	**80**	**90**
$f(x)$	**184**	**204**	**226**	**250**	**276**	**304**

	c.	From the following table find the number of students who have obtained (i) less than 45 marks (ii) between 40 and 45 marks by using appropriate interpolation formula.	**07**	**(2:4:1.2.1)**

Marks	**30-40**	**40-50**	**50-60**	**60-70**	**70-80**
Number of students	**31**	**42**	**51**	**35**	**31**

(OR)

8.	**a.**	Using Newton's divided difference formula to find $f(4)$ given	**06**	**(2:4:1.2.1)**

x	**0**	**2**	**3**	**6**
$f(x)$	**-4**	**2**	**14**	**158**

	b.	Use Lagrange's interpolation formula to find $f(4)$ given	**07**	**(2:4:1.2.1)**

x	**0**	**1**	**2**	**5**
$f(x)$	**2**	**3**	**12**	**147**

	c.	Evaluate $\int_0^1 \frac{dx}{1+x}$ taking seven ordinates by applying Simpson's 3/8th rule. Hence deduce the value of $\log_e 2$.	**07**	**(2:4:1.2.1)**

Module-5

9.	**a.**	Use Taylor's series method to find y at $x=0.1$, considering terms up to the third degree given that $\frac{dy}{dx}-2y=3e^x$, $y(0)=0$	**06**	**(2:5:1.2.1)**

Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)**

	b.	Using Modified Euler's method find $y(0.1)$, correct to four decimal places solving the equation $\frac{dy}{dx} = x - y^2$, $y(0) = 1$ taking $\mathrm{h} = 0.1$.	**07**	**(2:5:1.2.1)**
	c.	Given $\frac{dy}{dx} = 3x + \frac{y}{2}$, $y(0) = 1$, compute $y(0.2)$ by taking $\mathrm{h} = 0.2$ using Runge-Kutta method of fourth order.	**07**	**(2:5:1.2.1)**

(OR)

10.	**a.**	Use Taylor's series method to find y at x=0.1 considering terms up to 3rd degree given that $\frac{dy}{dx} = x^2 + y^2$ and y (0) =1.	**06**	**(2:5:1.2.1)**
	b.	Using modified Euler's method to find y(0.1) correct to four decimal places solving the equation $\frac{dy}{dx} = x - y^2$, y(0)=1 taking h=0.1	**07**	**(2:5:1.2.1)**
	c.	Given $\frac{dy}{dx} = 3x + \frac{y}{2}$, y(0)=1, compute y(0.2) by taking h=0.2 using Range-Kutta method of fourth order.	**07**	**(2:5:1.2.1)**

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