Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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

Course Code 2 2 M A T E 2 1

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

MATHEMATICS-II FOR ELECTRICAL & ELECTRONICS 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 directional derivatives of $\emptyset = x^2yz + 4xz^2$ at $(1,-2,-1)$ along $2i - j - 2k$.	**06**	**(2:1:1.2.1)**
	b.	If $\vec{r} = xi + yj + zk$ and $r = \lvert\vec{r}\rvert$ prove that $\nabla(r^n) = nr^{n-2}\vec{r}$	**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 $\emptyset$ such that $\vec{F} = \nabla\emptyset$	**07**	**(2:1:1.2.1)**
		(OR)		
2.	**a.**	Find the total work done by the force represented by $\vec{F} = 3xyi - yj + 2zxk$ in moving a particle round the circle $x^2 + y^2 = 4$	**06**	**(2:1:1.2.1)**
	b.	Evaluate $\int_C (xy + y^2)dx + x^2dy$ by Green's theorem in a plane, where C is the closed curve of the region bounded by $y = x$ and $y = x^2$	**07**	**(2:1:1.2.1)**
	c.	Evaluate $\vec{F} = (2x - y)i - yz^2j - y^2zk$ by Stoke's theorem, where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$, C is its boundary	**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.**	Use the method of variations of parameters to solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}$	**06**	**(2:2:1.2.1)**
	b.	Solve $x^2y'' + xy' + 9y = 3x^2 + \sin(3\log x)$	**07**	**(2:2:1.2.1)**

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

	c.	Solve $(2x+1)^2y''-6(2x+1)y'+16y=8(2x+1)^2$	07	(2:2:1.2.1)

Module-3

5.	a.	Find the Laplace transform of the following functions $e^{-2t}(2\cos 5t-\sin 5t)$	06	(2:3:1.2.1)
	b.	Find the Laplace transform of the following functions $\frac{cosat-cosbt}{t}$	07	(2:3:1.2.1)
	c.	Find the Laplace transform of the following functions $[e^{t-1}+\sin(t-1)]u(t-1)$	07	(2:3:1.2.1)

(OR)

6.	a.	Find the inverse Laplace transform of the following functions. $\frac{s+2}{s^2+36}+\frac{4s-1}{s^2+25}$	06	(2:3:1.2.1)
	b.	Using convolution theorem, obtain the inverse Laplace transform of the function $\frac{s}{(s^2+a^2)^2}$	07	(2:3:1.2.1)
	c.	Solve the initial value problem by using Laplace transforms $\frac{d^2y}{dt^2}+4\frac{dy}{dt}+4y=e^{-t}; y(0)=0, y'(0)=0$	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 interpolation formula. — 07 — (2:4:1.2.1)

Marks	30-40	40-50	50-60	60-70	70-80
No. of students	31	42	51	35	31

(OR)

8. a. Using Newton's divided difference formula find $f(8)$,$f(15)$ from the following data. — 06 — (2:4:1.2.1)

x	4	5	7	10	11	13
$f(x)$	48	100	294	900	1210	2028

b. 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)

c. Write a Scilab program to compute the area using Trapezoidal rule — 07 — (2:4:1.2.1)

x	0	0.1	0.2	0.3	0.4
y	1	1.2	1.4	1.6	1.8

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Module-5

9.	a.	Employ Taylor's series method to find y at x=0.1 given that $\frac{dy}{dx} - 2y = 3e^x$, y(0)=0	06	(2:5:1.2.1)
	b.	Given $\frac{dy}{dx} = 1 + \frac{y}{x}$, y=2 at x=1, find y at x=1.2 taking h=0.2 by applying Modified Euler's method.	07	(2:5:1.2.1)
	c.	Solve: $(y^2 - x^2)dx = (y^2 + x^2)dy$ for x=0.2 given that y=1 at x=0 by applying R-K method of order 4	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 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 R-K method of fourth order.	07	(2:5:1.2.1)

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