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 Examinations, September/October 2023
Mathematics for EEE Stream- II

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

Note: *1. Answer any* **FIVE** *full questions, choosing* **ONE** *full question from each module.*
2. 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	1:1:1.2.1
	b.	Show that $\vec{F} = \frac{xi+yj}{x^2+y^2}$ is both solenoidal and irrotational	07	3:1:1.2.1
	c.	If $\vec{r} = xi + yj + zk$ and $r = \|\vec{r}\|$ prove that $\nabla^2(r^n) = n(n+1)\, r^{n-2}$	07	3:1:1.2.1
		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	1:1:1.2.1
	b.	Verify Green's theorem in a plane for $\int(3x^2 - 8y^2)dx + (4y - 6xy)dy$, where C is the boundary of the region enclosed by $y = \sqrt{x}$ and $y = x^2$	07	3:1:1.2.1
	c.	Verify Stoke's theorem for $\vec{F} = (2x - y)i - yz^2j - y^2zk$ where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$, C is its boundary.	07	3:1:1.2.1
		MODULE – 2		
3.	a.	Solve $(D^4 + 4D^3 - 5D^2 - 36D + 36)y = 0$	06	3:2:1.2.1
	b.	Solve $\frac{d^2y}{dx^2} - 4y = \cosh(2x - 1) + 3^x$	07	3:2:1.2.1
	c.	Solve $x^3\frac{d^3y}{dx^3} + 3x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + 8y = 65\cos(\log x)$	07	3:2:1.2.1
		OR		
4.	a.	Solve $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = e^{-x} + sin2x$	06	3:2:1.2.1
	b.	Use the method of variations of parameters to solve $\frac{d^2y}{dx^2} + y = \frac{1}{1+sinx}$	07	3:2:1.2.1
	c.	Solve $(2x + 1)^2y'' - 6(2x + 1)y' + 16y = 8(2x + 1)^2$	07	3:2:1.2.1

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

MODULE – 3

5.	a.	Find the Laplace transform of the following functions i) $3\sqrt{t}+\frac{4}{\sqrt{t}}$ ii) $\frac{1-e^{-at}}{t}$	06	1:3:1.2.1
	b.	Find the Laplace transform of the full wave rectifier $f(t)=E\ \sin wt,\ \ 0<t<\pi/w$ having period $\frac{\pi}{w}$	07	1:3:1.2.1
	c.	Express the function $f(t)=\begin{cases}\sin t, & 0<t\le\frac{\pi}{2}\\ \cos t, & t>\frac{\pi}{2}\end{cases}$ in terms of Heaviside unit step function and hence find their Laplace transform.	07	2:3:1.2.1

OR

6.	a.	Find the inverse Laplace transform of $\frac{4s+5}{(s+1)^2(s+2)}$	06	1:3:1.2.1
	b.	Find $L^{-1}\left[\frac{1}{(S+1)(S^2+1)}\right]$ using Convolution theorem.	07	1:3:1.2.1
	c.	Solve the following 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	3:3:1.2.1

MODULE – 4

7.	a.	Compute a real root of $x\ \log_{10}x-1.2=0$ by the method of false position. Carry out three iterations.	06	3:4:1.2.1
	b.	Find the number of students from the following table who have obtained (i) less than 45 marks (ii) between 40 and 45 marks. By using interpolation formula.	07	1:4:1.2.1

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

	c.	Find $\sin 57^0$ using an appropriate interpolation formula, given $\sin 45^0=0.7071$, $\sin 50^0=0.7660$, $\sin 55^0=0.8192$, $\sin 60^0=0.8660$	07	1:4:1.2.1

OR

8.	a.	Use Lagrange's interpolation formula to find $f(4)$ given	06	3:4:1.2.1

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

	b.	Use trapezoidal rule to estimate $\int_0^2 e^{x^2}\,dx$ taking 10 intervals	07	3:4:1.2.1
	c.	Evaluate $\int_0^6\frac{dx}{1+x^2}$ by using Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule, by considering seven ordinates.	07	3:4:1.2.1

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

MODULE – 5

			Marks	RBTL:CO:PI
9.	a.	Use Taylor's series method to find y(4.1) given that $\frac{dy}{dx}=\frac{1}{x^2+y}$ and y (4) =4	06	3:5:1.2.1
	b.	Find y at x=1.2 taking h=0.2, Given $\frac{dy}{dx}=1+\frac{y}{x}$, y=2 at x=1, by applying modified Euler's method.	07	1:5:1.2.1
	c.	Apply Milne's method to compute y(1.4) correct to 4 decimal places given $\frac{dy}{dx}=x^2+\frac{y}{2}$ and the following data: $y(1)=2$, $y(1.1)=2.2156$, $y(1.2)=2.4649$, $y(1.3)=2.7514$	07	3:5:1.2.1
		OR		
10.	a.	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	06	3:5:1.2.1
	b.	Using Modified Euler's method find y(20.2) given that $\frac{dy}{dx}=\log_{10}\left(\frac{x}{y}\right)$ with y(20) =5 and h=0.2	07	3:5:1.2.1
	c.	Using scilab develop a program to solve ODE using R-K fourth order method for $f=x^2+y^2$ with the conditions $x_0=1, y_0=1.2, xf=1.1, h=0.01$	07	3:5:1.2.7

** ** **

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