

# BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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Course Code 

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## Second Semester B.E. Degree Examinations, September/October 2023 Mathematics for CSE 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

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO: PI)</u>
<b>MODULE – 1</b>			
1.	a. Find the directional derivatives of $\phi = x^2yz + 4xz^2$ 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
<b>OR</b>			
2.	a. Prove that the cylindrical co-ordinate system is orthogonal.	06	3:1:1.2.1
	b. Express the vector $\vec{F} = z\hat{i} - 2x\hat{j} + y\hat{k}$ in cylindrical co-ordinates.	07	2:1:1.2.1
	c. Obtain an expression for curl in orthogonal curvilinear coordinates.	07	3:1:1.2.1
<b>MODULE – 2</b>			
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
<b>OR</b>			
4.	a. Solve $\frac{d^3y}{dx^3} + 2 \frac{d^2y}{dx^2} + \frac{dy}{dx} = e^{-x} + \sin 2x$	06	3:2:1.2.1
	b. Use the method of variations of parameters to solve $\frac{d^2y}{dx^2} - 6 \frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}$	07	3:2:1.2.1
	c. Solve $(2x + 1)^2 y'' - 6(2x + 1)y' + 16y = 8(2x + 1)^2$	07	3:2:1.2.1
<b>MODULE – 3</b>			
5.	a. Find the Laplace transform of the following functions	06	1:3:1.2.1
	i) $3\sqrt{t} + \frac{4}{\sqrt{t}}$ ii) $\frac{1-e^{-at}}{t}$		

- b. Find  $L[f(t)]$  if  $f(t) = \begin{cases} t, & 0 < t < \pi \\ \pi - t, & \pi < t < 2\pi \end{cases}$  07 1:3:1.2.1
- c. Express the function  $f(t) = \begin{cases} \sin t, & 0 < t \leq \frac{\pi}{2} \\ \cos t, & t > \frac{\pi}{2} \end{cases}$  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  $\frac{5s+3}{(s-1)(s^2+2s+5)}$  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  $\sin 57^\circ$  using an appropriate interpolation formula, given  $\sin 45^\circ = 0.7071$ ,  $\sin 50^\circ = 0.7660$ ,  $\sin 55^\circ = 0.8192$ ,  $\sin 60^\circ = 0.8660$  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

#### MODULE – 5

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:  $y(1) = 2$ ,  $y(1.1) = 2.2156$ ,  $y(1.2) = 2.4649$ ,  $y(1.3) =$  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  $x_0 = 1, y_0 = 1.2, x_f = 1.1, h = 0.01$  07 3:5:1.2.7

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