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Course Code

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Second Semester B.E. Degree Examinations, July 2026
APPLIED MATHEMATICS FOR CIVIL STREAM-II

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

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO: PI)</u>												
<u>Module-1</u>															
1.	a. Compute a real root of $x \log_{10} x - 1.2 = 0$ by the method of false position. Carry out three iterations.	06	(2 :1: 1.2.1)												
	b. Find the cube root of 37 correct to 3 decimal places using Newton-Raphson method.	07	(2 :1: 1.2.1)												
	c. The area of a circle (A) corresponding to diameter (D) is given below:	07	(2 :1: 1.2.1)												
	<table><tr><td>D</td><td>80</td><td>85</td><td>90</td><td>95</td><td>100</td></tr><tr><td>A</td><td>5026</td><td>5674</td><td>6362</td><td>7088</td><td>7854</td></tr></table>	D	80	85	90	95	100	A	5026	5674	6362	7088	7854		
D	80	85	90	95	100										
A	5026	5674	6362	7088	7854										
	Find the area of the diameter 105 using an appropriate interpolation formula.														
(OR)															
2.	a. Find $f(9)$ from the data by Newton's divided difference formula	06	(2 :1: 1.2.1)												
	<table><tr><td>x</td><td>5</td><td>7</td><td>11</td><td>13</td><td>17</td></tr><tr><td>$f(x)$</td><td>150</td><td>392</td><td>1452</td><td>2366</td><td>5202</td></tr></table>	x	5	7	11	13	17	$f(x)$	150	392	1452	2366	5202		
x	5	7	11	13	17										
$f(x)$	150	392	1452	2366	5202										
	b. Use Lagrange's interpolation formula to find $f(4)$ given	07	(2 :1: 1.2.1)												
	<table><tr><td>x</td><td>0</td><td>2</td><td>3</td><td>6</td></tr><tr><td>$f(x)$</td><td>-4</td><td>2</td><td>14</td><td>158</td></tr></table>	x	0	2	3	6	$f(x)$	-4	2	14	158				
x	0	2	3	6											
$f(x)$	-4	2	14	158											
	c. By using Simpson's $1/3^{\text{rd}}$ rule evaluate $\int_0^6 \frac{dx}{1+x^2}$ by considering seven ordinates.	07	(2 :1: 1.2.1)												
<u>Module-2</u>															
3.	a. Use Taylor's method to find y at x=0.1 considering terms up to the third degree given that $\frac{dy}{dx} = x^2 + y^2$ and $y(0) = 1$.	06	(2 :2: 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 :2: 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 :2: 1.2.1)												

(OR)

4. a. Apply Milne's predictor-corrector formula to find $y(0.4)$ using the values $y(0)=1$, $y(0.1)=1.1113$, $y(0.2)=1.2507$, $y(0.3)=1.426$, given that $\frac{dy}{dx} = x^2 + y^2$. Write the answer approximating correct to four decimal places. 06 (2 :2: 1.2.1)
- b. If $\frac{dy}{dx} = 2e^x - y$, $y(0) = 2$, $y(0.1) = 2.010$, $y(0.2) = 2.040$ and $y(0.3) = 2.090$, find $y(0.4)$ using Milne's method. 07 (2 :2: 1.2.1)
- c. Apply Adams-Bashforth method to solve the equation $(y^2 + 1)dy - x^2 dx = 0$ at $x = 1$ given $y(0) = 1$, $y(0.25) = 1.0026$, $y(0.5) = 1.0206$ And $y(0.75) = 1.0679$. Find $y(1)$ by using Adams – Bash forth predictor-corrector method. Apply the corrector formula twice. 07 (2 :2: 1.2.1)

Module-3

5. a. Evaluate: $\int_0^1 \int_x^{\sqrt{x}} xy dy dx$ 06 (2 :3: 1.2.1)
- b. Find the area of the circle $x^2 + y^2 = a^2$ by double integration 07 (2 :3: 1.2.1)
- c. Change the order of the integration and hence evaluate $\int_0^1 \int_{\sqrt{y}}^1 dx dy$. 07 (2 :3: 1.2.1)

(OR)

6. a. Prove that: $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$. 06 (2 :3: 1.2.1)
- b. Prove that : $\beta(m, n) = \frac{\Gamma(m) \cdot \Gamma(n)}{\Gamma(m+n)}$. 07 (2 :3: 1.2.1)
- c. Show that: $\int_0^\infty \sqrt{y} e^{-y^2} dy \times \int_0^\infty \frac{e^{-y^2}}{\sqrt{y}} dy = \frac{\pi}{2\sqrt{2}}$. 07 (2 :3: 1.2.1)

Module-4

7. a. Find the unit vector normal to the following surfaces at the indicated points $x^2y + 2xz = 4$ at $(2, -2, 3)$. 06 (2 :4: 1.2.1)
- b. Find the angle between the surface $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at $(2, -1, 2)$. 07 (2 :4: 1.2.1)
- c. If $\vec{F} = \nabla(xy^3z^2)$ find $\text{div}\vec{F}$ and $\text{curl}\vec{F}$ at the point $(1, -1, 1)$. . 07 (2 :4: 1.2.1)
- (OR)
8. a. If $\vec{F} = xyi + yzj + xzk$, evaluate $\int_C \vec{F} \cdot d\vec{r}$ where C is the curve represented by $x = t, y = -t^2, z = t^3, -1 \leq t \leq 1$. 06 (2 :4: 1.2.1)
- b. Evaluate $\int (3x^2 - 8y^2)dx + (4y - 6xy)dy$, by Green's theorem in a plane, where C is the boundary of the region enclosed by $y = \sqrt{x}$ and $y = x^2$. 07 (2 :4: 1.2.1)
- c. Evaluate the vector $\vec{F} = (x^2 + y^2)i - 2xyj$ by Stoke's theorem taken round the rectangle bounded by $x = 0, x = a, y = 0, y = b$. 07 (2 :4: 1.2.1)

Module-5

9. a. Form the Partial differential equation by eliminating the arbitrary constants from $(x - a)^2 + (y - a)^2 + z^2 = c^2$. 06 (2: 5: 1.2.1)
- b. Form the PDE eliminating the arbitrary function from $z = y^2 + 2f\left[\frac{1}{x} + \log y\right]$ 07 (2: 5: 1.2.1)
- c. Form the PDE eliminating the arbitrary function from $f(x^2 + y^2, z - xy) = 0$. 07 (2: 5: 1.2.1)

(OR)

10. a. Solve $\frac{\partial^2 z}{\partial y^2} = z$, given that when $y = 0, z = e^x$ and $\frac{\partial z}{\partial y} = e^{-x}$ 06 (2: 5: 1.2.1)
- b. Solve $\frac{\partial^2 z}{\partial x^2} = a^2 z$, given that when $x = 0, \frac{\partial z}{\partial x} = a \sin y$ and $\frac{\partial z}{\partial y} = 0$. 07 (2: 5: 1.2.1)
- c. Derive one-dimensional heat equation in the standard form. 07 (2: 5: 1.2.1)

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