



K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

	SUMMER-2023		
	Exam Seat No.:		
	Academic Year: 2022-2023	Semester: II	
	Name of Programme : F.Y. B. Tech	Pattern: 2022	
	Name of Course : Applied Mathematics - II	Course Code: FYE221002	
	Max. Marks: 60	Duration: 2.30 hrs	

1 This question paper contains 3 page(s).

1. Answer to each new question is to be started on a new page.

1. Assume suitable data wherever required, but justify it.

2. Use of non-programmable pocket calculator is allowed.

3. Draw the neat labelled diagrams, wherever necessary.

4. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question

Que. No.1

Solve $\frac{dy}{dx} + \frac{1}{1+x^2}y = \frac{e^{\tan^{-1}x}}{1+x^2}$

(6)

CO2

L3

Que. No.2

A Constant Electromotive Force E Volts is applied to a circuit containing constant resistance R Ohms in series and constant inductance L henries. If the initial current is zero. Show that the current builds up to half its theoretical maximum in $\frac{L}{R} \log 2$ second.

(6)

CO3

L3

Que. No.3

a)	Find value of y for x = 0.5 for the following table of x, y values using Newton's forward difference formula. <table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>y</td><td>1</td><td>5</td><td>25</td><td>100</td><td>250</td></tr></table>	x	0	1	2	3	4	y	1	5	25	100	250	(5)	CO3	L3
x	0	1	2	3	4											
y	1	5	25	100	250											
	OR															
b)	Find value of y for x = 4.5 for the following table of x, y values using Newton's Backward difference formula. <table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>y</td><td>14</td><td>30</td><td>62</td><td>116</td><td>198</td></tr></table>	x	1	2	3	4	5	y	14	30	62	116	198	(5)	CO3	L3
x	1	2	3	4	5											
y	14	30	62	116	198											
c)	1. Prove that $\Delta \nabla = \nabla \Delta = \delta^2$ 2. Evaluate $\Delta(6x^2 + 4x + 4)$, $h = \frac{1}{2}$	(5)	CO3	L3												
	OR															
d)	Prove that $(1 + \Delta)(1 - \nabla) = 1$ Evaluate $(\Delta - \nabla)x^2$, $h = 1$	(5)	CO3	L3												
e)	Find Lagrange's interpolating polynomial passing through set of points <table><tr><td>x</td><td>0</td><td>1</td><td>2</td></tr><tr><td>y</td><td>4</td><td>3</td><td>6</td></tr></table> Use it to find y at x=1.5 , find $\frac{dy}{dx}$ at x = 0.5	x	0	1	2	y	4	3	6	(6)	CO3	L3				
x	0	1	2													
y	4	3	6													
	OR															
f)	Use Stirling's formula to find f(25) from the following data <table><tr><td>x</td><td>10</td><td>20</td><td>30</td><td>40</td></tr><tr><td>f(x)</td><td>1.1</td><td>2</td><td>4.4</td><td>7.9</td></tr></table>	x	10	20	30	40	f(x)	1.1	2	4.4	7.9	(6)	CO3	L3		
x	10	20	30	40												
f(x)	1.1	2	4.4	7.9												
Que. No.4																
a)	Use Euler's method to solve the equation $\frac{dy}{dx} = 1 + xy$, subject to the condition $y(0) = 1$ to find y for $x = 0 (0.1) 0.5$	(5)	CO3	L3												
	OR															

b)	Determine using Modified Euler's method the value of y when x= 0.1 given that $\frac{dy}{dx} = x^2 + y$ $y(0) = 1$, h=0.1	(5)	CO3	L3										
c)	Use Runge- Kutta method of fourth order to solve $\frac{dy}{dx} = \frac{1}{x+y}$, $y(0) = 1$ to find y at x = 0.2 taking h = 0.2.	(6)	CO3	L3										
	OR													
d)	<p>Solution of the equation $\frac{dy}{dx} = \frac{2-y^2}{5x}$ is tabulated as</p> <table border="1"> <tr> <td>x</td><td>4</td><td>4.1</td><td>4.2</td><td>4.3</td></tr> <tr> <td>y</td><td>1.0</td><td>1.0049</td><td>1.0097</td><td>1.0143</td></tr> </table> <p>Use Milne's predictor-corrector method to find y at x= 4.4</p>	x	4	4.1	4.2	4.3	y	1.0	1.0049	1.0097	1.0143	(6)	CO3	L3
x	4	4.1	4.2	4.3										
y	1.0	1.0049	1.0097	1.0143										
e)	Use trapezoidal rule to evaluate $\int_0^1 x e^{x^2} dx$ by taking h=0.1	(5)	CO5	L4										
	OR													
f)	Evaluate $\int_0^\pi \left[\frac{\sin^2 \theta}{5+4 \cos \theta} \right] d\theta$ By Simpson's $\left(\frac{3}{8}\right)^{th}$ rule, taking $h = \frac{\pi}{6}$.	(5)	CO5	L4										

Que. No.5 INDIVIDUAL_OR				
a)	Evaluate $\iint_R \frac{xy \, dx \, dy}{\sqrt{1-y^2}}$ over the positive quadrant of the circle $x^2 + y^2 = 1$.	(5)	CO2	L3
	OR			
b)	Evaluate by change of order $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y} \, dx \, dy$	(5)	CO2	L3
c)	Evaluate $\int_0^a \int_{y=x}^{\sqrt{a^2-x^2}} \frac{x \, dx \, dy}{\sqrt{x^2+y^2}}$	(5)	CO2	L3
	OR			
d)	Find the area outside the circle $x^2 + y^2 = a^2$ and inside the cardioid $r = a(1+\cos\theta)$	(5)	CO2	L3

e)	Evaluate $\int_0^1 \int_{y^2}^1 \int_0^{1-x} x \, dz \, dx \, dy$	(6)	CO5	L4
	OR			
f)	Find the volume of the cylinder $x^2 + y^2 = 2ax$ intercepted between the paraboloid $x^2 + y^2 = 2az$ & the XY plane	(6)	CO5	L4