[M19 ST 1104]

I M. Tech I Semester (R19) Regular Examinations
ANALYTICAL& NUMERICAL METHODS FOR STRUCTURAL ENGINEERING
(STRUCTURAL ENGINEERING)
MODEL QUESTION PAPER

TIME: 3 Hrs. **Max. Marks: 75 M**

Answer **ONE Question** from **EACH UNIT**
All questions carry equal marks
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			CO	KL	M
		UNIT - I			
1.	a).	Using the Laplace transform method solve the Initial Bndary Value Problem (IBVP) described as PDE $\frac{\partial^2 u}{\partial t^2} = \frac{1}{c^2}\frac{\partial^2 u}{\partial t}$ - $\cos \omega t$; $0 \le x < \infty$, $0 \le t < \infty$. Also given bndary conditions areu(u_t (x,0) = u(x, 0) = 0.	CO1	K3	12
	b).	Write the Laplace transform of $\{\frac{1}{\sqrt{t}}\}$.	CO1	K2	3
		OR			
2.	a).	A string is stretched as fixed between two points (0, 0) & (l , 0). Motion is initiated by displacing the string in the form of $u = \lambda \sin(\frac{\prod x}{l})$ and released from rest at time $t = 0$. Find the displacement of any point on the string at any time t.	CO1	K3	12
	b).	State the heat conduction problem in semi – infinite rod.	CO1	K2	3
		UNIT - II			
3.	a).	Using the Frier transform method solve the solution of 2D Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$, is valid in the half - plane , y > 0 , is subjected to the condition U (x, 0) = 0 if x< 0, u (x, 0) = 1 if x > 0 and $\lim_{x^2+y^2 \to \infty} u(x, y) = 0$ in the half plane.	CO2	K3	12
	b).	Write the change of scale property of Frier transforms	CO2	K2	3
		OR			
4.	a).	Find the curves on which the functional $\int_0^1 (y_1{}^2 + 12xy)\, dx$ withy(0) = 0 and y(1) = 1 can be extremised.	CO2	K3	7
	b).	Show that the curve which extremises the functional $I = \int_0^{\frac{\pi}{4}} [(y'')^2 - y^2 + x^2] dx$ under the conditions	CO2	K3	8
		UNIT - III			
5.	a).	Verify that u(x) = x e^x is a solution of the Voltaerra Integral equation $u(x) = \sin x + 2\int_0^x \cos(x-t) u(t) dt$	CO3	K2	8

<table>
<tr><td></td><td>b).</td><td>Convert $\frac{d^2y}{dx^2} + xy = 1$, y(0) = 0, y(1) = 1 into an integral equation</td><td>CO3</td><td>K2</td><td>7</td></tr>
<tr><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td>6.</td><td>a).</td><td>Find the Eigen values and Eigen functions of the Integral Equation
$u(x) = \lambda \int_0^1 e^{x+t} u(t)dt$</td><td>CO3</td><td>K2</td><td>8</td></tr>
<tr><td></td><td>b).</td><td>Solve the homogenes Fredholm Integral equation of second kind
$u(x) = \lambda \int_0^{2\pi} \sin(x+t)u(t)dt$</td><td>CO3</td><td>K2</td><td>7</td></tr>
<tr><td></td><td></td><td>UNIT - IV</td><td></td><td></td><td></td></tr>
<tr><td>7.</td><td>a).</td><td>From the following table, estimate the number of students who obtain marks between 40 and 45.
<table>
<tr><td>Marks</td><td>30-40</td><td>40-50</td><td>50-60</td><td>60-70</td><td>70-80</td></tr>
<tr><td>No. of Students</td><td>31</td><td>42</td><td>51</td><td>35</td><td>31</td></tr>
</table></td><td>CO4</td><td>K2</td><td>7</td></tr>
<tr><td></td><td>b).</td><td>Find by Teylor's series method the value of y at x = 0.1 and x = 0.2 to five places of decimals from $\frac{dy}{dx} = x^2y - 1$, y(0) =1</td><td>CO4</td><td>K2</td><td>8</td></tr>
<tr><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td>8.</td><td>a).</td><td>A beam of length l, supported at n points carries a uniform load w per unit length. The bending moments $M_1, M_2, M_3, \ldots, M_n$ at the supports satisfy the Clapeyron's equation: $M_{r+2} + M_{r+1} + M_r = \frac{1}{2}wl^2$. If a beam weighing 30 kg is supported at its ends and at two other supports dividing the beam into three equal parts of 1 meter length, show that the bending moments at each of the two middle supports is 1 kg meter.</td><td>CO4</td><td>K3</td><td>8</td></tr>
<tr><td></td><td>b).</td><td>The deflection of Beam is given by the equation $\frac{d^4y}{dx^4} + 81y = \phi(x)$, where φ(x) is:
<table>
<tr><td>x</td><td>1/3</td><td>2/3</td><td>1</td></tr>
<tr><td>φ(x)</td><td>81</td><td>162</td><td>243</td></tr>
</table>
And bndary condition $y(0) = y^{1}(0) = y^{11}(1) = y^{111}(1) = 0$. Evaluate the deflection at the pivotal points of the beam using three sub intervals.</td><td>CO4</td><td>K3</td><td>7</td></tr>
<tr><td></td><td></td><td>UNIT - V</td><td></td><td></td><td></td></tr>
<tr><td>9.</td><td>a).</td><td>Given Values
<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>398</td><td>1492</td><td>2366</td><td>5202</td></tr>
</table>
Evaluate f(9) using Lagrange Formula</td><td>CO5</td><td>K2</td><td>8</td></tr>
<tr><td></td><td>b).</td><td>Use the Composite Trapezoidal Rule with m = n = 2 to evaluate the dble integral
$\int_0^{1/2}\int_0^{1/2} e^{x-y} dxdy$</td><td>CO5</td><td>K3</td><td>7</td></tr>
<tr><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
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10.	a).	integral $\int_0^1 \int_x^{2x} \left(x^2 + y^3\right) dydx$	CO5	K3	7
	b).	Apply New Marks Method with suitable example	CO5	K3	8

CO: Crse tcome
KL: Knowledge Level
M: Marks