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## [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	Μ
		UNIT - I			
1.	a).	Using the Laplace transform method solve the Initial Bndary Value Problem	CO1	K3	12
		$\partial^2 u = 1 \ \partial^2 u$			
		(IBVP) described as PDE $\frac{1}{\partial t^2} = \frac{1}{c^2} \frac{1}{\partial t} - \cos \omega t$ ; $0 \le x < \infty$ , $0 \le t < \infty$ . Also			
		given bndary conditions areu(			
		$u_{\mu}(\mathbf{x},0) = \mathbf{u}(\mathbf{x},0) = 0.$			
	b).	1	CO1	К2	3
	0).	Write the Laplace transform of $\{\frac{1}{\sqrt{t}}\}$ .			5
		OR			
2.	a).	A string is stretched as fixed between two points $(0, 0)$ & $(l, 0)$ . Motion is initiated	CO1	K3	12
		by displacing the string in the form of $y = 2 \sin(\prod x)$ and released from rest at time.			
		by displacing the string in the form of $u - x \sin(\frac{l}{l})$ and released from rest at time			
		t=0. Find the displacement of any point on the string at any time t.			
	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	CO2	K3	12
		$\partial^2 u = \partial^2 u$			
		$\frac{\partial x^2}{\partial x^2} + \frac{\partial y^2}{\partial y^2} = 0$ , 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.			
	b).	Write the change of scale property of Frier transforms	CO2	K2	3
		OR			
4.	a).	Find the survey on which the functional $\int_{1}^{1} (y^2 + 12yy) dy$ with $y(0) = 0$ and $y(1) = 1$	CO2	K3	7
		Find the curves of which the functional $\int_{0}^{0} (y_1 + 12xy) dx$ with $y(0) = 0$ and $y(1) = 1$			
		can be extremised.			
	b).	$\frac{\pi}{2}$	CO2	K3	8
	,	Show that the curve which extremises the functional $I = \int_0^4 [(y'')^2 - y^2 + x^2] dx$			
		under the conditions			
		UNIT - III			
5.	a).	Verify that $u(x) = x e^x$ is a solution of the Voltaerra Integral equation	CO3	K2	8
		$u(x) = \sin x + 2\int_{0}^{x} \cos(x - t)u(t)dt$			
		$\int_{0}^{1} u(x) - \sin x + 2 \int_{0}^{1} \cos(x - t) u(t) dt$			
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b).	Convert $\frac{d^2 y}{dx^2} + xy = 1$ , $y(0) = 0$ , $y(1) = 1$ into an integral equation						CO3	K2	7	
				OR						
a).	Find the Eigen values and Eigen functions of the Integral Equation $u(x) = \lambda \int_{0}^{1} e^{x+t} u(t) dt$					CO3	K2	8		
b).	Solve the homogenes Fredholm Integral equation of second kind $u(x) = \lambda \int_{0}^{2\pi} \sin(x+t)u(t)dt$						CO3	K2	7	
	UNIT - IV									
a).	From the following between 40 and 40	ing table, 45.	estimate the	e number o	f students w	ho obtain marl	ζS	CO4	K2	7
	Marks 30-	-40	40-50	50-60	60-70	70-80				
	No. of 31 Students		42	51	35	31				
b).	Find by Teylor's series method the value of y at $x = 0.1$ and $x = 0.2$ to five places						places	CO4	K2	8
of decimals from $\frac{dy}{dx} = x^2 y - 1$ , y(0) =1										
				OR						
a).	A beam of length <i>l</i> , supported at <i>n</i> points carries a uniform load <i>w</i> per unit length. The bending moments $M_1, M_2, M_3,, M_n$ 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.						CO4	К3	8	
b).	The deflection of Beam is given by the equation $\frac{d^4 y}{dx^4} + 81 y = \phi(x)$ , where $\phi(x)$ is: $\begin{array}{c c} \hline x & 1/3 & 2/3 & 1 \\ \hline \phi(x) & 81 & 162 & 243 \end{array}$ 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.						CO4	K3	7	
	UNIT - V									
a).	Given Values $x$ 5 $f(x)$ 150	7 398	11 1492	13 2366	17 5202			CO5	K2	8
1.)	Evaluate f(9) using Lagrange Formula							005	K2	7
b).	). Use the Composite Trapezoidal Rule with m = n = 2 to evaluate the dble integral $\int_{0}^{\frac{1}{2}} \int_{0}^{\frac{1}{2}} e^{x-y} dx dy$					ntegral		K3	/	
1				OR				1		
	b).         a).         b).         a).         b).         a).         b).	b). Convert $\frac{d^2 y}{dx^2} + x$ a). Find the Eigen v $u(x) = \lambda \int_{0}^{1} e^{x+t} u(x)$ b). Solve the homog $u(x) = \lambda \int_{0}^{2\pi} \sin(x)$ a). From the follow: between 40 and $\frac{1}{Marks}$ 30 No. of 31 Students b). Find by Teylor's of decimals from a). A beam of length length. The bend Clapeyron's equ supported at its e parts of 1 meter supports is 1 kg b). The deflection o $\frac{x}{1/3} \frac{1}{2}$ $\phi(x) = 81$ And bndary cond at the pivotal point a). Given Values $\frac{x}{1} \frac{5}{1}$ f(x) = 150 Evaluate f(9) usi b). Use the Compos $\frac{1}{2} \frac{1}{2} \frac{1}{2}}{\int_{0}^{2} e^{x-y} dx dy}$	b). Convert $\frac{d^2 y}{dx^2} + xy = 1$ , y( a). Find the Eigen values and $u(x) = \lambda \int_{0}^{1} e^{x+t} u(t) dt$ b). Solve the homogenes Free $u(x) = \lambda \int_{0}^{2\pi} \sin(x+t)u(t) dt$ a). From the following table, between 40 and 45. Marks 30-40 No. of 31 Students b). Find by Teylor's series m of decimals from $\frac{dy}{dx} = x^2$ a). A beam of length <i>l</i> , support length. The bending mom Clapeyron's equation: M <sub>r</sub> supported at its ends and a parts of 1 meter length, sh supports is 1 kg meter. b). The deflection of Beam is $\frac{x}{1/3} \frac{1/3}{2/3} \frac{1}{1}$ $\phi(x) 81 162 243$ And bndary condition y(0) at the pivotal points of the a). Given Values $\frac{x}{5} \frac{5}{7} \frac{7}{f(x)} \frac{150}{398}$ Evaluate $f(9)$ using Lagra b). Use the Composite Trapes $\frac{y'_2y'_2}{\int_{0}} \int_{0}^{1} e^{x-y} dx dy$	b). Convert $\frac{d^2 y}{dx^2} + xy = 1$ , $y(0) = 0$ , $y(1)$ a). Find the Eigen values and Eigen function $u(x) = \lambda \int_{0}^{1} e^{x+t} u(t) dt$ b). Solve the homogenes Fredholm Integration $u(x) = \lambda \int_{0}^{2\pi} \sin(x+t)u(t) dt$ a). From the following table, estimate the between 40 and 45. Marks 30-40 40-50 No. of 31 42 Students b). Find by Teylor's series method the varies of decimals from $\frac{dy}{dx} = x^2 y - 1$ , $y(0)$ a). A beam of length <i>l</i> , supported at <i>n</i> polength. The bending moments M <sub>1</sub> , M Clapeyron's equation: M <sub>r+2</sub> + M <sub>r+1</sub> + supported at its ends and at two other parts of 1 meter length, show that the supports is 1 kg meter. b). The deflection of Beam is given by the formulation of the beam using the provided of the parts of the beam using the provided points of the beam using $\frac{y_2y_2}{y_2}$ by $\frac{y}{y_2} = \frac{y_2y_2}{y_2} = \frac{y_2y_2}{y_2$	b). Convert $\frac{d^2 y}{dx^2} + xy = 1$ , $y(0) = 0$ , $y(1) = 1$ into an <b>OR</b> a). Find the Eigen values and Eigen functions of the $u(x) = \lambda \int_{0}^{1} e^{x+t} u(t) dt$ b). Solve the homogenes Fredholm Integral equation $u(x) = \lambda \int_{0}^{2\pi} \sin(x+t)u(t) dt$ <b>UNIT - IV</b> a). From the following table, estimate the number of between 40 and 45. Marks 30-40 40-50 50-60 No. of 31 42 51 Students b). Find by Teylor's series method the value of y at of decimals from $\frac{dy}{dx} = x^2 y - 1$ , $y(0) = 1$ <b>OR</b> a). A beam of length <i>l</i> , supported at <i>n</i> points carries length. The bending moments M <sub>1</sub> , M <sub>2</sub> , M <sub>3</sub> ,,M Clapeyron's equation: M <sub>r+2</sub> + M <sub>r+1</sub> + M <sub>r</sub> = $\frac{1}{2} wt$ supported at its ends and at two other supports d parts of 1 meter length, show that the bending m supports is 1 kg meter. b). The deflection of Beam is given by the equation $\frac{x  1/3  2/3  1}{q(x)  81  162  243}$ And bndary condition $y(0) = y^{-1}(0) = y^{11}(1) = 1$ at the pivotal points of the beam using three sub <b>UNIT - V</b> a). Given Values $x  5  7  11  13 \\ f(x)  150  398  1492  2366 \\ Evaluate f(9) using Lagrange Formula$ b). Use the Composite Trapezoidal Rule with m = n $\frac{1}{2} \frac{1}{2} \frac{1}{2$	b). Convert $\frac{d^2 y}{dx^2} + xy = 1$ , $y(0) = 0$ , $y(1) = 1$ into an integral equ <b>OR</b> a). Find the Eigen values and Eigen functions of the Integral Eq $u(x) = \lambda \int_{0}^{1} e^{x+t} u(t) dt$ b). Solve the homogenes Fredholm Integral equation of second I $u(x) = \lambda \int_{0}^{2\pi} \sin(x + t)u(t) dt$ <b>UNIT - IV</b> a). From the following table, estimate the number of students w between 40 and 45. Marks <u>30-40</u> <u>40-50</u> <u>50-60</u> <u>60-70</u> No. of <u>31</u> <u>42</u> <u>51</u> <u>35</u> Students b). Find by Teylor's series method the value of y at $x = 0.1$ and of decimals from $\frac{dy}{dx} = x^2 y - 1$ , $y(0) = 1$ <b>OR</b> a). A beam of length <i>l</i> , supported at <i>n</i> points carries a uniform Id length. The bending moments M <sub>1</sub> , M <sub>2</sub> , M <sub>3</sub> ,, M <sub>n</sub> at the supp Clapeyron's equation: $M_{r+2} + M_{r+1} + M_r = \frac{1}{2}wt^2$ . If a beam of supported at its ends and at two other supports dividing the b parts of 1 meter length, show that the bending moments at ea supports is 1 kg meter. b). The deflection of Beam is given by the equation $\frac{d^4 y}{dx^4} + 81 y = \frac{1}{\frac{x}{\phi(x)}} \frac{1/3}{81} \frac{1/2}{162} \frac{1}{243}}$ And bndary condition $y(0) = y^{-1}(0) = y^{11}(1) = y^{111}(1) = 0$ . If at the pivotal points of the beam using three sub intervals. <b>UNIT - V</b> a). Given Values $\frac{x}{x} \frac{5}{17} \frac{7}{11} \frac{13}{13} \frac{17}{17} \frac{1}{1} \frac{13}{13} \frac{17}{1} \frac{1}{1} 1$	b). Convert $\frac{d^2y}{dx^2} + xy = 1$ , $y(0) = 0$ , $y(1) = 1$ into an integral equation <b>OR</b> a). Find the Eigen values and Eigen functions of the Integral Equation $u(x) = \lambda \int_{0}^{1} e^{x+t}u(t)dt$ b). Solve the homogenes Fredholm Integral equation of second kind $u(x) = \lambda \int_{0}^{1} \sin(x+t)u(t)dt$ <b>UNIT - IV</b> a). From the following table, estimate the number of students who obtain mark between 40 and 45. Marks 30-40 40-50 50-60 60-70 70-80 No. of 31 42 51 35 31 Students b). Find by Teylor's series method the value of y at x = 0.1 and x = 0.2 to five of decimals from $\frac{dy}{dx} = x^2 y - 1$ , $y(0) = 1$ <b>OR</b> a). A beam of length <i>I</i> , supported at <i>n</i> points carries a uniform load <i>w</i> per unit length. The bending moments $M_1, M_2, M_3,, M_n$ at the supports satisfy the Clapeyron's equation: $M_{r+2} + M_{r+1} + M_r = \frac{1}{2}wt^4$ . If a beam weighing 30 k; supported at its ends and at two other supports dividing the beam into three parts of 1 meter length, show that the bending moments at each of the two supports is 1 kg meter. b). 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From the following table, estimate the number of students who obtain marks <b>b</b>). Find by Tcylor's series method the value of y at x = 0.1 and x = 0.2 to five places of decimals from <math>\frac{dy}{dx} = x^2 y - 1</math>, <math>y(0) = 1</math> <b>c</b> <b>a</b>). A beam of length <i>i</i>, supported at <i>n</i> points carries a uniform load <i>w</i> per unit length. The bending moments M<sub>1</sub>, M<sub>2</sub>, M<sub>3</sub>,, M<sub>at</sub> the supports satisfy the Clapeyron's equation: M<sub>1/2</sub> + M<sub>1/1</sub> + M<sub>1/2</sub> + M<sub>1/2</sub> + M<sub>1/2</sub> for the abeam 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. b). The deflection of Beam is given by the equation <math>\frac{d^4y}{dx^4} + 81y = \phi(x)</math>, where <math>\phi(x)</math> is: <math>\frac{x}{\frac{1}{9}(x)} \frac{1/3}{162} \frac{233}{12}</math> And budary condition <math>y(0) = y^{-1}(0) = y^{11}(1) = 0</math>. Evaluate the deflection at the pivotal points of the beam using three sub intervals. <b>b</b>). <b>c</b> <b>c</b> <b>c</b> <b>c</b> <b>c</b> <b>c</b> <b>c</b> <b>c</b></td></t<>	b).Convert $\frac{d^2 y}{dx^2} + xy = 1$ , $y(0) = 0$ , $y(1) = 1$ into an integral equationCO3ORa).Find the Eigen values and Eigen functions of the Integral Equation $u(x) = \lambda \int_{0}^{1} e^{xx} u(t) dt$ CO3UNIT - IVa).Solve the homogenes Fredholm Integral equation of second kind $u(x) = \lambda \int_{0}^{2\pi} e^{xx} u(t) dt$ UNIT - IVa).Solve the homogenes Fredholm Integral equation of second kind $u(x) = \lambda \int_{0}^{2\pi} e^{xx} u(t) dt$ UNIT - IVa).A).From the following table, estimate the number of students who obtain marks between 40 and 45.Marks 30-40 40-50 50-60 60-70 70-80No. of314251A3531b).Find by Teylor's series method the value of y at x = 0.1 and x = 0.2 to five places of decimals from $\frac{dy}{dx} = x^2 y - 1$ , $y(0) = 1$ ORa).A beam of length l, supported at n points carries a uniform load w per unit length. 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Evaluate the deflection at the pivotal points of the beam using three sub intervals. <b>b</b> ). <b>c</b> <b>c</b> <b>c</b> <b>c</b> <b>c</b> <b>c</b> <b>c</b> <b>c</b>



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10.	a).	1.2 x	CO5	K3	7
		integral $\int_{0}^{1} \int_{x}^{2x} (x^2 + y^3) dy dx$			
	b).	Apply New Marks Method with suitable example	CO5	K3	8

CO: Crse tcome KL: Knowledge Level M: Marks

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