Seat No. | | | | | | |

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CAI1321

Numerical Methods Application in Civil Engineering (New) (1050)

P. Pages : 3

Time : Three Hours **Max. Marks : 100**

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any two** questions from each unit. Figures to right indicate full marks.
5. Use of non-programmable calculator is allowed. Assume suitable data if necessary.

UNIT - I

1. a) What do you mean by errors and approximations ? Explain different types of errors in numerical computation ? **5**

b) Solve the following system of simultaneous linear Algebraic equation using Elimination method. **5**

$$2.0x + 1.0y - 0.1z + 1.0t = 2.7$$
$$0.4x + 0.5y + 4.0z - 8.5t = 21.9$$
$$0.3x - 1.0y + 1.0z + 5.2t = -3.9$$
$$1.0x + 0.2y + 2.5z - 1.0t = 9.9$$

2. A box open at top is made from a rectangular piece of plywood measuring 6 x 8 m by removing squares pieces from corner. What will be size of square piece removed if the volume of box is to be $20m^3$. Use Newton Raphson method. **10**

3. What do you mean by solution of Non-linear Algebraic and transcendental equations ? Find the positive root of $x^4 - x^3 - 2x^2 - 6x - 4 = 0$ by bisection method. **10**

UNIT - II

4. A company making cold drinks has 2 bottling plants located at towns T_1 & T_2. Each plant produces 3 drinks A, B and C and their production capacity per day is shown in table given below. The marketing department of the company forecasts a demand of 80,000 bottles of A, 22,000 bottles of B and 40,000 bottles of C during the month of June. The operating costs per day of plants at T_1 & T_2 are Rs. 6000 and Rs. 4000 respectively. Find (graphically) The number of days for which each plant must be run in June so as to minimize the operating costs while meeting the market demand. **10**

Cold drinks	Plant at	
	T_1	T_2
A	6,000	2,000
B	1,000	2,500
C	3,000	3,000

5. What is linear programming problem ? What are its application in civil engineering ? Write down the steps required to solve given LPP by using simplex method with help of example for maximization ? **10**

6. Using Big-M method solve the given LPP for minimisation. **10**

Minimize $z = 2x_1 + x_2$

Subject to $3x_1 + x_2 = 3$

$4x_1 + 3x_2 \geq 6,$

$x_1 + 2x_2 \leq 3$

$x_1, x_2 \geq 0$

UNIT - III

7. a) Write an algorithm for fitting a parabola for a given data. **5**

b) The following data gives corresponding values of x and y. Obtain an equation of the form $y = ax + bx^2$. **5**

x	1.1	2.0	3.2	4.0	5.5	6.3
y	5.3	14.2	30.1	43.8	77.3	97.8

8. From the table given below find sin 52° by using Newton's forward interpolation formula. Also estimate the error. **10**

x	45°	50°	55°	60°
y = sin x	0.7071	0.7660	0.8192	0.8660

9. The mode of a certain frequency curve y = f(x) is very nearer to x = 9 and the values of the frequency density f(x) for x = 8.9, 9, 9.3 are respectively 0.3, 0.35 and 0.25 Calculate the approximate value of the mode. **10**

UNIT - IV

10. a) What do you mean by Numerical differentiation ? **3**

b) The elevation above a datum line of seven points of a road are given below. Find the gradient of the road at the middle point. **7**

x	0	300	600	900	1200	1500	1800
y	135	149	157	183	201	205	193

11. Evaluate $\int_0^2 \frac{x^2+2x+1}{1+(x+1)^4}\,dx$ by Gaussion 3 - point formula. **10**

12. A curve passes through the points (1, 2), (1.5, 2.4), (2.0, 2.7) (2.5, 2.8) , (3,3), (3.5, 2.6) and (4.0, 2.1). Obtain the area bounded by the curve, the x - axis and x = 1 and x = 4. Also find the volume of solid of revolution got by revolving this area about the x-axis. **10**

UNIT - V

13. Find $y(0\cdot1)$, $y(0\cdot2)$, $y(0\cdot3)$ from $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$ by using Runga-Kutta method and hence obtain $y(0\cdot4)$ using Adam's method. **10**

14. Solve $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square mesh with sides x = 0, y = 0, x = 3, y = 3 with u = 0 on the boundary and mesh length 1 unit. **10**

15. Write down Algorithm and flowchart for modified Euler's method. **10**

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