CODE: 17CD54101

M. Tech I Year I Semester Supplementary Examinations, May 2018

COMPUTATIONAL METHODS
(CAD/CAM)

Time : 3 hours Max Marks : 60

Answer all **five** units. (5 x 12 = 60 Marks)

UNIT-I

1. Apply Gauss-Seidel iteration method to solve the equations $10x–2y–z–w = 3$, $–2x+10y–z–w = 15$, $–x–y+10z–2w = 27$, $–x–y–2z+10w = –9$. Carryout five iterations.

OR

2. Solve the system of linear equations $10x–2y–3z=205$, $–2x+10y–2z=154$, $–2x–y+10z=120$ using Relaxation method.

UNIT-II

3. The velocity v (km/min) of a moped which starts from rests is given at fixed intervals of time t (min) as follows:

t	2	4	6	8	10	12	14	16	18	20
v	10	18	25	29	32	20	11	5	2	0

Estimate approximately the distance covered in 20 minutes using

(a) Trapezoidal rule,

(b) Simpson's rule.

OR

4. Solve the partial differential equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square with sides $x = y = 0$, $x = y = 3$ with $u = 0$ on the boundary and mesh length is unity.

UNIT-III

5. (a) Find the maximum and minimum values of $f(x) = 3x^4 – 2x^3 – 6x^2 + 6x + 1$ in the interval (0, 2).

(b) Show that the rectangular solid of maximum volume that can be inscribed in a sphere is a cube.

OR

6. (a) The deflection of a beam is governed by the equation $\frac{d^4y}{dx^4} + 81y = \phi(x)$, where $\phi(x)$ is given by the following table

x	1/3	2/3	1
$\phi(x)$	81	162	243

and boundary conditions $y(0) = y'(0) = y''(1) = y'''(1) = 0$. Determine the deflexion at the pivotal points of the beam.

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UNIT-IV

7. Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ in $0 < x < 5$, $t \geq 0$ given that $u(x, 0)=20$, $u(0, t) = 0$, $u(5, t) = 100$. Compute u for the time step with h = 1 using Crank-Nicholson method.

OR

8. The transverse displacement u of a point at a distance x from one end and at any time t of a vibrating string satisfying the equation $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}$, with boundary conditions u = 0 at x = 0, t > 0 and u = 0 at x = 4, t > 0 and initial conditions u = x(4 – x) and $\frac{\partial u}{\partial t} = 0$ at t = 0, $0 \leq x \leq 4$. Solve this equation numerically for one half period of vibration, taking h = 1 and k = 0.5.

UNIT-V

9. The following are data on the drying time of a certain varnish and the amount of an additive that is intended to reduce the drying time.

Amount of Varnish additive (grams) x	0	1	2	3	4	5	6	7	8
Drying time (hours) y	12.0	10.5	10.0	8.0	7.0	8.0	7.5	8.5	9.0

(a) Derive the normal equations for fitting a parabolic equation.

(b) Fit a parabolic equation by the method of least squares

(c) Use the result of (b) to predict the drying time of the varnish when 6.5 grams of the additive is used

OR

10. The following are the data on the percentage of the high performance radial tires made by a certain manufacturer that are still usable after having been driven for the given number of miles

Miles driven (thousands) x	1	2	5	10	20	30	40	50
Percentage usable y	98.2	91.7	81.3	64.0	36.4	32.6	17.1	11.3

(a) Plot log y_i versus x_i to verify that it is reasonable to assume that the relationship is exponential

(b) Fit an exponential curve by applying the method of least squares to the data points (x_i, y_i)

(c) Use the result of (b) to estimate the percentage of the manufacturer's high-performance radial tires that will last at least 25,000 miles.

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