ME/SemI/MECH THERMAL/CBCS/NMCT/11-12-2017

QP CODE : 26111

(3 hours) Total Marks:80

N.B.: 1. Answer any **four** questions.
2. Figures to the right indicate full marks.
3. Use of **scientific calculator** is permitted.
4. Assume **suitable data** if necessary with justification.

1. a) Find the real root of the equation $x\log_{10}x = 1.2$ by Bisection method correct up to four decimal places. 10

b) Use the Gauss- Seidel method to solve the following system,

$$-5x + 12z = 80; \quad 4x - y - z = -2; \quad 6x + 8y - 2z = 45.$$

If necessary, make sure to rearrange the equations to achieve convergence. 10

2. a) Determine the linear spline valid in the interval $[x_{i-1}, x_i]$ for the following data,

x	6.2	6.5	7.1	8.5
$y(x) = xln(x)$	11.3122	12.1667	13.9167	18.1905

Also find $y(6.1)$, $y(6.6)$ *and* $y(7.5)$. 10

b) Using R-K 4th order method, solve the differential equations

$$\frac{dy}{dx} = 1 + xz, \qquad \frac{dz}{dx} = -xy$$

for $x = 0.3$ with step size $h = 0.3$. $y(0) = 0$, $z(0) = 1$. 10

3. a) Using Shooting method, solve the boundary value problem,

$\frac{d^2y}{dx^2} = y$, $y(0) = 0$ *and* $y(1) = 1.17$ with the step size $h = 0.5$. 10

b) The velocity v of a car which starts from rest, is given by the table below: 10

$t\ (min)$	2	4	6	8	10	12	14	16	18	20
$v(km/min)$	10	18	25	29	32	20	11	5	2	0

Estimate the distance covered in 20 minutes. Justify for the method used.

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4. a) Given the values: 10

x	5	7	11	13	17
$y=f(x)$	150	392	1452	2366	5202

Evaluate $f(9)$, using Newton's divided difference formula.

b) The latent heat of vaporization of steam l, is given in the following table at different temperatures t: 10

t	40	50	60	70	80	90	100	110
l	1069.1	1063.6	1058.2	1052.7	1049.3	1041.8	1036.3	1030.8

For this range temperature, a relation of the form $l = a + bt$ is known to fit the data. Find the values of a and b by the method of least square.

5. a) Using predictor-corrector method, find $y(0.2) and\ y(0.4)$ 10

$$\frac{dy}{dx} = y + e^x, y(0) = 0$$

b) Using Schmidt method, solve the equation $u_t = u_{xx}$ under the conditions

$u(0,t), u(1,t) = 0,\ u(x,0) = sin\pi x,\ 0 \le x \le 1$

up to $t = 0.1$ (Take $h = 0.2, \alpha = 0.5$) 10

6. a) Using finite-difference scheme, solve the boundary value problem,

$$\frac{d^2y}{dx^2} = x + y$$

with the boundary conditions $y(0) = y(1) = 0$ and step size $h = 0.25$. 10

b) Classify the equation $u_{xx} + u_{yy} = xy$. Write the finite difference scheme and corresponding algebraic equations to solve it. Given that $0 < x < 1,\ \ 0 < y < 1,$

$u(0,y) = 0, u(x,0) = 0,\ \ u(1,y) = 200,\ \ u(x,1) = 200$ and $h = \frac{1}{3}$. 10