ME/Sem I/CBCGS/NMCT/N-D 16 13/12/2016.
THER

Q.P. Code : 859400

Total Marks:80

(3hours)

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) Derive Newton-Raphson method and using it find the real root of the equation $x\sin x+\cos x=0$ correct up to 3 decimal place. 10

(b) Using predictor-corrector method, solve the differential equation,

dy/dx = x +y , with y(1) = 0. Find y(1.1) , y(1.2) 10

2 (a) Use bisection method to determine the root of $xe^{x}=2$. 10

(b) Fit a linear spline to the following data, 10

x	1	3	6	8
$f(x)$	4	5.5	7	9.5

Estimate the values at x = 2, 4, 7.

3 (a) Solve $\frac{d^2y}{dx^2}=y$ with $y(0)=0$, $y((1)=3$ by using Shooting method with step size $h=0.5$ 10

(b) A rocket is launched from the ground. It's acceleration a is registered during the first 80 seconds and is given in the table below:

t (sec)	0	10	20	30	40	50	60	70	80
a (m/s²)	30	31.63	33.34	35.47	37.75	40.33	43.25	46.69	50.67

Find the velocity at time t = 80sec. Justify the method used.

4 (a) Use Relaxation method to solve the following system, 10

$$9x - y + 2z = 9$$
$$x + 10y - 2z = 15$$
$$2x - 2y - 13z = -17$$

(b) Determine the constants a and b by the method of least square such that the equation $pv^a = b$ fits the following data. 10

p (kg/m^3)	105	42.7	25.3	16.7	13
v (litres)	2	4	6	8	10

5 (a) Using R-K method of order four, find $y(0.1)$ and $z(0.1)$ from the system of equations, 10

$$\frac{dy}{dx} = x + z, \quad \frac{dz}{dx} = x - y^2 \quad \text{given } y(0) = 2, \quad z(0) = 1$$

(b) Using Schmidt method, solve the equation $u_t = u_{xx}$ under the conditions $u(0,t) = 0, u(1,t) = 0, \quad u(x,0) = \sin \pi x, \; 0 \le x \le 1,$

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

6 (a) Using finite-difference scheme, solve the boundary value problem, 10

$$\frac{d^2y}{dx^2} + y + 2 = 0 \text{ with } y(0) = 0, \quad y((2) = 0 \text{ and step size } h = 0.5.$$

(b) Classify the equation $u_{tt} = 16u_{xx}$ and solve it up to $t = 1.25$ using finite difference. Given that $u(0,t) = 0, u(5,t) = 0, \quad u_t(x,0) = 0, \quad u(x,0) = x^2(5-x)$ (take $h = 1$). 10