R – 130

Seat No.	

S.E. (Mechanical) (Semester – IV) Examination, 2012
NUMERICAL METHODS
Sub. Code : 43593

Day and Date : Wednesday, 21-11-2012 Total Marks : 100
Time : 2.30 p.m. to 5.30 p.m.

Instructions : *1) Attempt **any three** questions from each Section.*
*2) Figures to the **right** indicate **full** marks.*
*3) Use of Non-programmable calculator is **allowed**.*
*4) Make suitable assumptions **if** required and state them clearly.*

SECTION – I

1. a) Determine the drag coefficient C in Kg/s needed for a parachutist of mass m = 68.1 kg to have a velocity of 40 m/s after free falling for time t = 10 secs. The acceleration due to gravity is 9.8 m/s^2 The velocity of parachutist is given by

$V(t) = \frac{gm}{c}\left[1 - e^{-(c/m)t}\right]$ use method of false position. Drag coefficient lies in the range 12 kg/s to 16 kg/s. **10**

b) Carry out four iterations of the bisection method for the root of

$(2x + 1)^2 = 4 \cos \pi x$ lying in the interval $\left[\frac{1}{4}, \frac{1}{3}\right]$. **8**

ng system of equations by using triangularization method

18

10

26 **8**

asurement of electric resistance R of a copper bar at various
C are listed below

)	36	40	45	50
)	80	82	83	85

= a + bt by the method of least squares and find constants **8**

umel thermocouple gives the following output for rise in

0	10	20	30	40	50
.0	0.4	0.8	1.2	1.61	2.02

thermocouple for temperature of 45°C using Newton's Divided
olation. **8**

ve multiplication law of probability. **4**

ty that machine A will be performing an usual function in 5

$\frac{1}{4}$, while the probability that machine B will still be operating

e end of the same period is $\frac{1}{}$. Find the probability in the

b) For special security in a protected area, it was decided to put three lighting bulbs on each pole. If each bulb has a probability p of burning out in the first 100 hours of service, calculate the probability that at least one of them is still good after 100 hours. If p = 0.3 how many bulbs would be needed on each pole to ensure 99% safety so that at least one is good after 100 hours ? **8**

SECTION – II

5. a) A rocket is launched from the ground. Its acceleration is registered during the first 80 seconds and is given in the table below. Using Simpson's $\frac{1}{3}^{rd}$ rule, find the velocity of the rocket at t = 80 secs. **8**

t secs	0	10	20	30	40	50	60	70	80
f cm/sec^2	30	31.63	33.34	35.47	37.75	40.33	43.25	46.69	50.67

b) The table below gives the result of an observation. θ is the observed temperature in degree centigrade of a vessel of cooling water, t is the time in minutes from the beginning of observations.

t	1	3	5	7	9
θ	85.3	74.5	67.0	60.5	54.3

Find the approximate rate of cooling at t = 3 and 3.5. **8**

6. a) Solve the system of ordinary differential equations by Runge Kutta fourth order

eigen value and the corresponding eigen vectors of

ɔy power method. Assume initial eigen vectors as $\begin{bmatrix}1\\0\\0\end{bmatrix}$. **8**

$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(x, 0) = \sin \pi x,\ 0 \le x \le 1$;
ɹsing Crank Nicolson method carryout computations for two

$k = \frac{1}{36}$. **16**

ɔasic steps involved in finite element method. **8**

dinates X_i and X_j and the nodal values of ϕ_i and ϕ_j for several are given below. Evaluate ϕ at the given value of x. The x ntimeters, and ϕ_i and ϕ_j are in degree celsius. **10**

X_j	ϕ_i	ϕ_j
1.5	60	43
4.5	27	33
7.5	63	51
3.0	0	–15
3.0	60	67