

Class: S.Y.B.Tech(EnTC)

MA223

MAX. MARKS:50

END SEMESTER EXAMINATION

Time: 3Hrs

- N.B. 1 Read the instructions carefully.
 2. Use of non-programmable calculators are allowed.
 3. Answer Each Section SEPERATELY.

SECTION I

Q1. Solve ANY TWO subparts from the following. (10)

A. The velocity of the parachutist is given by the following function of time (5m)

B.

$$v(t) = \frac{gm}{c} \left(1 - e^{-(c/m)t} \right)$$

where v = velocity(m/s), g = the gravitational constant of 9.8 m/s^2 ,

m = mass of the parachutist = 68.1 kg , & c = the drag coefficient of 12.5 kg/s . The distance

through which the parachutist has fallen after a certain time t is given by $d = \int_0^t v(t) dt$, where

d is the distance in meters. Find out the distance travelled by the parachutist in first 12 seconds

C. by dividing the interval into 12 subintervals.

The concentration of total phosphorus (p in mg/m^3) & chlorophyll (c in mg/m^3) for each of the great Lakes is

	p	c
Lake superior	4.5	0.8
Lake Michigan	8.0	2.0
Lake Huron	5.5	1.2
Lake Erie West Basin	39.0	11.0
Lake Erie Central Basin	19.5	4.4
Lake Erie East Basin	17.5	3.8
Lake Ontario	21.0	5.5

Chlorophyll is a parameter that indicates how much plant life is suspended in the water. As such, it indicates how unclear & unsightly the water appears. Use the above data to determine a linear relationship to predict c as a function of p (i.e. $c = Ap + B$). Use this equation to predict the level of chlorophyll that can be expected if waste treatment is used to lower the phosphorus concentration of western Lake Erie to 15 mg/m^3 .

D. Using Runge-kutta method, solve $y'' = xy'^2 - y^2$ for $x = 0.2$ correct to 4 decimal places. Initial conditions are $x = 0, y = 1, y' = 0$.

Q 2. Solve ANY TWO subparts from the following. (10)

A. Find $y(0.5)$ using Euler's Modified method with $h = 0.25$, given that

$$\frac{dy}{dx} = 3x^2 + y, \quad y(0) = 4.$$

B. Find $y(1.1)$ using 2nd order Runge Kutta method by solving the equation

$$\frac{dy}{dx} = \sqrt{x^2 + y^2}, \quad y(1) = 2.$$

C. Use Simpson's 1/3 rule to integrate $f(x) = 0.2 + 25x - 200x^2 + 675x^3 - 900x^4 + 400x^5$ from $a=0$ to $b=0.8$. Also compare with exact value.

Q 3. Solve ANY THREE subparts from the following. (15)

A. A river is 45m wide. The depth d in meters at a distance x meters from one bank is given in the following data:

x	0	5	10	15	20	25	30	35	40	45
d	0	3	6	8	7	7	6	4	3	0

Find the cross-section of the river by Simpson's 3/8th Rule.

B. Perform 4 iterations of the Newton's method to find the smallest positive root of the equation $f(x) = x^3 - 5x + 1 = 0$

C. Use Trapezoidal rule to evaluate the vertical distance traveled by a rocket by dividing the interval $(0, 30)$ into 10 equal parts if the vertical velocity is given by

$$V = 10t^2 - 5t \quad \text{if } 0 \leq t \leq 10$$

$$V = 1000 - 5t \quad \text{if } 10 \leq t \leq 20$$

$$V = 2(t - 20)^2 + 45t \quad \text{if } 20 \leq t \leq 30$$

D. Define optimization & its classifications.

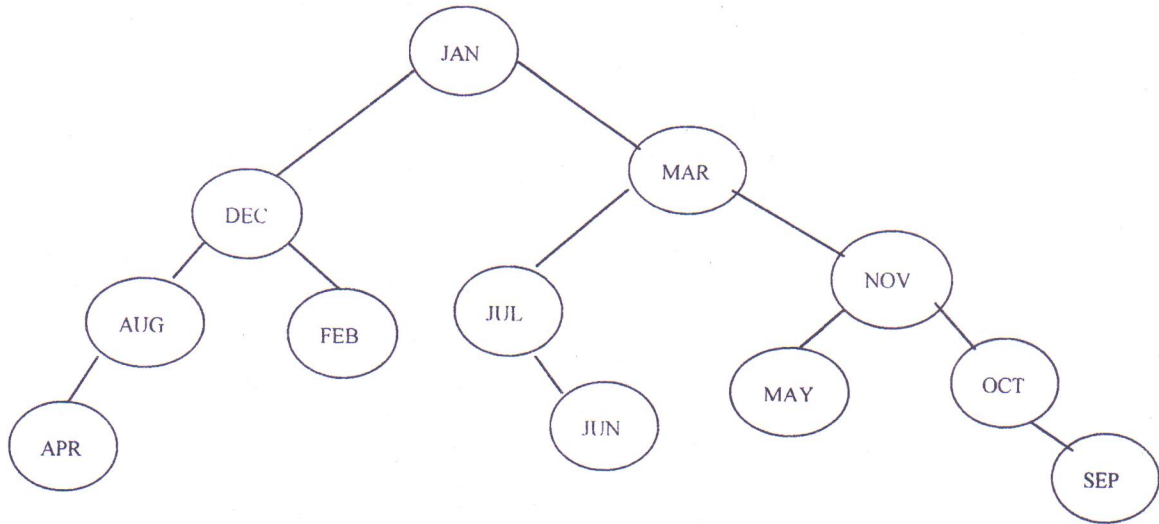
Section II

Q.5 Represent following expressions in the form of a tree. (6)

Precedence of operation is given by brackets and not necessarily be included in a binary tree. Traverse the tree in preorder and post order forms.

- 1) $(A-B)+C*(D/E)$
- 2) $(A+B*C) - ((D*E+F)/G)$

Q.6 a) Consider the following alphabetical binary search tree. Show the deletion of following nodes. Redraw the tree in each case. (3)



- 1) Deletion of root node
- 2) Deletion of MAR
- 3) Deletion of DEC

b) Calculate the value of following postfix expression (3)
 $623+ - 382/+*2^3+$ where * is the multiplication operator and ^ is the power operator.
 Show the runtime scenario of stack of operand.

c) Represent the following polynomial in a link list form (3)

$$10x^9 + 9x^7 + 5x^5 - 4x^3 + 2x + 8$$

OR

c) Represent two stacks using one single dimensional array such that space utilization is maximum. Show the Push and Pop operations on these stacks.