

3rd Sem.

6th set of paper

3rd sem

INDIAN MARITIME UNIVERSITY
(A CENTRAL UNIVERSITY, GOVERNMENT OF INDIA)
B.TECH (MARINE ENGINEERING)
DECEMBER 2014 / JANUARY END SEMESTER EXAMINATION
III SEMESTER
COMPUTATIONAL MATHEMATICS (T 2301 / T 1301)

Time : 0300 Hrs

Max Marks : 100

Date: 22-12-2014

Pass Marks : 50

PART- A (3 × 10 = 30 Marks)

Compulsory Questions

- 1) (a) Fit a straight line $y = a + bx$ to the following data by the method of least squares

x :	0	1	3	6	8
y :	1	3	2	5	4

- (b) The two regression equations are $3x + 2y = 12$ and $x + 3y = 11$. Find the two means \bar{x}, \bar{y} .
- (c) Express $\Delta^3 y_0$ in terms of functional values y_0, y_1, y_2, y_3 without forming the difference table.
- (d) Complete the right hand sides of the following equations representing distributive laws of Boolean functions:
$$x \vee (y \wedge z) =$$
$$x \wedge (y \vee z) =$$
- (e) Draw the circuit diagram for the Boolean function $(p_1 \vee p_2) \wedge (p_3 \vee p_4)$.
- (f) Find $f(x)$ in polynomial form when $\Delta f(x) = 3[x]^2 - 2[x] - 1$, where $[]$ represents a factorial function.
- (g) For the three given points $(x_0, y_0), (x_1, y_1)$ and (x_2, y_2) write down the Newton's divided difference interpolation formula for $f(x)$ with first and second order differences.
- (h) Solve the difference equation for $y_{n+2} - 4y_{n+1} + 4y_n = 0$.
- (i) Evaluate the integral $\int_0^1 (1+x^2)^{-1} dx$ using Simpson's (1/3)rd rule 4 equal sub-intervals.
- (j) Write an efficient algorithm to calculate the series of $\sin x$, include terms up to 0.0001.

PART-B (5 × 14 = 70 Mark)
Answer any five of the following

- 2) (a) Fit a second degree parabola $y = a + bx + cx^2$ to the following data, using least squares method

x :	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y :	1.1	1.3	1.6	2.0	2.7	3.4	4.1

- (b) The pressure and volume of a gas are related by the equation $pv^\gamma = k$, γ and k being constants. Fit this equation to the following set of observations:

$p(\text{kg/cm}^2)$:	0.5	1.0	1.5	2.0	2.5	3.0
$v(\text{liters})$:	1.62	1.00	0.75	0.62	0.52	0.46

(7+7)

- 3) (a) Calculate the rank correlation coefficient from the following data showing ranks of 10 students in two subjects :

Maths. :	3	8	9	2	7	10	4	6	1	5
Phys. :	5	9	10	1	8	7	3	4	2	6

- (b) The following results are obtained from records of age (x) and blood pressure (y) of a group of 10 people

$\bar{x} = 53, \bar{y} = 142, \sigma_x^2 = 130, \sigma_y^2 = 165$, and $\sum (x - \bar{x})(y - \bar{y}) = 1220$. Find the appropriate regression equation to estimate the blood pressure of a man of age is 45.

(7+7)

- 4) (a) Prove deductively $(a \wedge \bar{b}) \vee [(\bar{a} \wedge b) \vee (x \wedge y)] = a \vee b$.

- (b) Draw the circuit diagrams for

(i) $a \vee [b \wedge (a \vee c)] \vee (a \wedge c)$

(ii) $(p_1 \vee p_2 \vee p_3) \wedge (\bar{p}_1 \vee p_4) \vee (p_2 \wedge \bar{p}_3) \wedge (p_2 \vee p_3)$

(5+4+5)

- 5) (a) Prove that $\nabla y_{n+1} = h \left[1 + \frac{1}{2} \nabla + \frac{5}{12} \nabla^2 + \dots \right] y'_n$

where symbols have their usual meaning.

- (b) Using separation of symbols show that

$$u_0 + u_1 + u_2 + u_3 + \dots n\text{-terms} = nu_0 + \frac{n(n-1)}{2!} \Delta u_0 + \frac{n(n-1)(n-2)}{3!} \Delta^2 u_0 + \dots$$

and hence sum the series

$$2 \cdot 5 + 5 \cdot 8 + 8 \cdot 11 + 11 \cdot 14 + \dots n\text{-terms}$$

(5+4+5)

- 6) (a) Using Newton's forward interpolation formula calculate the function $y = f(x)$, at $x = 22$ from the following data set :

$x:$	20	25	30	35	40	45
$y:$	354	332	291	260	231	204

- (b) Construct a polynomial $y = f(x)$ from the following data set and hence find $f(3)$:

$x:$	0	1	2	4	5	6
$y:$	1	14	15	5	6	19

(7+7)

- 7) (a) The following data gives corresponding values of pressure (p) and specific volume (v) of a superheated steam :

$v:$	2	4	6	8	10
$p:$	105	47.2	25.3	16.7	13

Find the rate of change of (i) pressure with respect to volume at $v=2$ and (ii) volume with respect to pressure at $p=105$.

- (b) The velocity $v(ft/sec)$ of a particle at a distance $s(ft)$ from a fixed point on its path are given by :

$s(ft):$	0	10	20	30	40	50	60
$v(ft/sec):$	47	58	64	65	61	52	38

Use Simpson's (1/3)rd rule to estimate the time taken by the particle to travel 60 ft. (7+7)

- 8) (a) A plant is such that each of its seeds when one year old produces 8-fold and produces 18-fold when two or more years old. A seed is planted and as soon as a new seed is produced it is planted. Taking y_n to be the number of seeds produced at the end of the n-th year, show that $y_{n+1} = 8y_n + 18(y_1 + y_2 + \dots + y_{n-1})$. Hence show that $y_{n+2} - 9y_{n+1} - 10y_n = 0$ and find y_n .

- (b) Solve the difference equation $y_{x+2} - 3y_{x+1} + 2y_x = x^2 + 2x - 1$

(7+7)

- 9) (a) If $y = f(x)$ and y_n denotes $f(x_0 + nh)$, prove that, neglecting terms of the order of h^6 or higher,

$$\left(\frac{dy}{dx}\right)_{x_0} = \frac{3}{4h} \left[(y_1 - y_{-1}) - \frac{1}{5}(y_2 - y_{-2}) + \frac{1}{45}(y_3 - y_{-3}) \right].$$

- (b) Write an efficient algorithm for binary search problem and apply the same to find out how many checks you need to locate the number 13 from the list of pre-sorted numbers 0,2,3,5,6,7,9,11,12,13,15.

(8+6)
