

INDIAN MARITIME UNIVERSITY
(A Central University, Govt. of India)
DEPARTMENT OF MARINE ENGINEERING
TERM END EXAMINATION – December 2015

Sub Code: UG11T2301/ UG11T1301
Sub Name: Computational Mathematics
Semester : 3rd

Time : 0300 Hrs
Max Marks : 100
Pass Marks : 50

PART- A (3 × 10 = 30 Marks)
Compulsory Question

- 1) (a) Show that $\nabla^2 = h^2 D^2 - h^3 D^3 + \frac{7}{12} h^4 D^4 - \dots$ where ∇ is the backward difference operator and h is the unit of differencing.
- (b) Use appropriate regression equation to find the constants in $y = a + bx$ when $\bar{x} = 53, \bar{y} = 142, \sigma_x^2 = 130, n = 10$ and $\sum (x - \bar{x})(y - \bar{y}) = 1220$.
- (c) Write down the normal equations of the least square fitting for the parabola $y = a + bx + cx^2$.
- (d) What is the difference between weighted and non-weighted binary codes?
- (e) Demonstrate by means of truth table the validity of the following Boolean algebra $x \cdot (y + x) = (x \cdot y) + (x \cdot z)$
- (f) Express the polynomial $3x^4 - 4x^3 + 6x^2 + 2x + 1$ into factorial functions.
- (g) Use the shifting operator E to derive the Newton's forward interpolation formula for the function $f(x_0 + ph)$ where $p = (x - x_0)/h$.
- (h) Solve the difference equation for $y_{n+2} - y_{n+1} - y_n = 0, n > 0$.
- (i) Evaluate the integral $\int_{1.2}^{1.6} (x + x^{-1}) dx$ using Simpson's (1/3) rd rule with 4 equal sub-intervals.
- (j) Draw a binary search tree for the following numbers: 3,7,2,5,9,1,6.

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 : | 2.0 | 4.0 | 6.0 | 8.0 | 10.0 |
| y : | 3.07 | 12.85 | 31.47 | 57.38 | 91.29 |
- (b) Find the power fit $y = ax^m$, for the data
- | | | | | | |
|-----|-----|---|-----|---|------|
| x : | 1 | 2 | 3 | 4 | 5 |
| y : | 0.5 | 2 | 4.5 | 8 | 12.5 |
- (7+7)
- 3) (a) $y_0 + y_8 = 1.9243, y_1 + y_7 = 1.9590, y_2 + y_6 = 1.9823$ and $y_3 + y_5 = 1.9956$, find y_4 .

- (b) If three uncorrelated variables x_1, x_2, x_3 have the same variances, find the correlation Coefficient between $x_1 + x_2$ and $x_2 + x_3$. (7+7)

- 4) (a) A simple example of error detecting code is parity check. What is parity bit? Write down the parity bit of the following messages.

Message	Odd Parity bit	Even Parity bit	Message	Odd Parity bit	Even Parity bit
0 0 0 0			1 0 0 0		
0 0 0 1			1 0 0 1		
0 0 1 0			1 0 1 0		
0 0 1 1			1 0 1 1		
0 1 0 0			1 1 0 0		
0 1 0 1			1 1 0 1		
0 1 1 0			1 1 1 0		
0 1 1 1			1 1 1 1		

- (b) In Boolean algebra show that

(i) $(x + y + z + w)' = x'y'z'w'$

(ii) $x(x + z) = x$ (7+3+4)

- 5) (a) Draw the logical diagram for the three input NAND Gate and give the corresponding truth table
 (b) Design an efficient algorithm for finding the sum of first n Fibonacci numbers. (6+8)
- 6) (a) Show that Newton's divided difference interpolation formula reduces to Newton's forward interpolation formula for equally spaced x – values.
 (b) Use Lagrange's interpolation formula to express the function

$$\frac{x^2 + 6x - 1}{(x - 1)(x + 1)(x - 4)(x - 6)} \text{ as a sum of partial fractions.} \quad (7+7)$$

- 7) (a) Find $y'(0)$ and $y''(0)$ for the following data table :

x :	0	1	2	3	4	5
y :	4	8	15	7	6	2

- (b) A river is 80 feet wide. The depth, 'y' (in feet) of the river at a distance 'x' feet from one of the bank is given by the following table

x :	0	10	20	30	40	50	60	70	80
y :	0	4	7	9	12	15	14	8	3

Find approximately the area of the cross section of the river. (7+7)

- 8) (a) Find the complete solution for $u_{n+2} + u_n = \cos(n/2)$
 (b) Solve the difference equation $y_{x+2} - 5y_{x+1} + 6y_x = 4^x(x^2 - x + 5)$. (6+8)