INDIAN MARITIME UNIVERSITY

(A CENTRAL UNIVERSITY, GOVT. OF INDIA)

End Semester Examination December 2018

B. Tech. (Marine Engineering)

Semester - III

Computational Mathematics (UG11T3301)

Date: 27-12-2018 Max Marks: 100

Time: 3 Hrs. Pass Marks: 50

PART – A (3 x10 = 30)

Compulsory Questions: (The symbols have their usual meanings.)

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(a) Derive the normal equations to fit a parabola $y = a + bx + cx^2$.

(b) Find the normal equations required to fit the curve $y = ax^b$ in given set of values of x and y.

(c) In Boolean algebra show that $[x \wedge (x' \vee y)] \vee [x' \wedge (x \vee y)] = y$.

(d) Use the shift operator E to derive the Newton's backward interpolation formula for the function $f(x_n + ph)$ where $p = (x - x_n)/h$.

(e) Find the real root of the equation $x^3 - 2x - 5 = 0$ by using Regula Falsi method up to two iterations.

(f) Find the missing term in the following table:

x	2	3	4	5	6
y	45.0	49.2	54.1	–	67.4

(g) Two lines of regression are given by $5y - 8x + 17 = 0$ and $2y - 5x + 14 = 0$. If $\sigma_y^2 = 16$, find (i) correlation coefficient between x and y and (ii) σx

(h) Prove the axiom $a \vee (b \wedge c) = (a \vee b) \wedge (a \vee c)$ of Boolean algebra by means of truth table.

(i) Evaluate the integral $\int_0^1 \frac{1}{1+x^2} dx$ using the Trapezoidal rule with 4 equal sub-intervals.

(j) Explain bubble short method with suitable example.

PART – B **(14 x 5 = 70)**

Answer any <u>FIVE</u> of the following questions

2(a) In a Boolean algebra, simplify the following:
(i) $x \vee y \wedge y \vee z \wedge y \vee z'$, (ii) $x \vee y \wedge [(x \wedge y') \vee y]'$. **[4+4]**

2(b) Draw the circuit diagrams for the Boolean function $f = [(p_1 \vee p_2) \vee (p_1 \vee p_3)] \wedge (p_1 \wedge p_2')$, then simplify the function and draw the diagram of simplified resulting circuit, **[6]**

3(a) Find the number of men getting wages below Rs. 15 from the following table:

Wages (in Rs.):	0 – 10	10 – 20	20 – 30	30 - 40
No. of Men :	9	30	35	42

[7]

3(b) Express the function $\frac{x^2+x-3}{x^3-2x^2-x+2}$ as sum of partial fractions by using Lagrange's interpolation formula. **[7]**

4(a) A rod is rotating in a plane. The following table gives the angle θ through which the rod has turned for different values of time t.

t (seconds)	0	0.2	0.4	0.6	0.8	1.0
θ (radians)	0	0.12	0.48	1.10	2.00	3.20

Find the angular velocity of rod, when $t = 0.2$ second. **[7]**

4(b) A river is 80 ft wide. The depth y (in feet) at a distance x ft from one 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 river. **[7]**

5(a) Find the real root of the equation $x^4 - x = 9$ by Newton Raphson Method correct to three decimal places. **[7]**

5(b) Write an algorithm to sum first n integers and draw its flow chart. **[7]**

6(a) Using Runge-Kutta method of fourth order, solve the differential equation $\frac{dy}{dx} = xy + y^2$ with $y(0) = 1$ at $x = 0.1, 0.2$. **[7]**

6(b) If three uncorrelated variables x_1, x_2 and x_3 have same variance, Find the correlation coefficient between $x_1 + x_2$ and $x_2 + x_3$. **[7]**

7(a) Apply Taylor series method to obtain approximate value of y at $x = 0.2$ for the differential equation $\frac{dy}{dx} = 2y + 3e^x$ with initial condition $y(0) = 0$. **[7]**

7(b) If V (km/hr) and R(kg/ton) are related by a relation of the type $R = a + bV^2$, Find by the method of least squares a and b with the help of following table: **[7]**

V	10	20	30	40	50
R	8	10	15	21	30

8(a) 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 and estimate the blood pressure of a man of age 45 years. **[7]**

8(b) Prove that $u_0 + u_1 x + u_2 x^2 + \ \ldots \infty = \frac{u_0}{1-x} + \frac{x\Delta u_0}{(1-x)^2} + \frac{x^2\Delta^2 u_0}{(1-x)^3} + \ \ldots \infty$. Hence sum the series $1.2 + 2.3x + 3.4x^2 + \cdots \infty$. **[7]**

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