

Time : 3 Hours]

[Total Marks : 80
[Min. Passing Marks : 24

Attempt any five questions. Selecting one question from each unit.
 All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.
 Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.
 (Mentioned in form No. 205)

1. _____ NIL _____

2. _____ NIL _____

UNIT - I

1 (a) Find the missing term in the following table

$x \rightarrow$	0	1	2	3	4
$y \rightarrow$	1	3	9	-	81

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(b) Find the form of the function given by the following table

$x \rightarrow$	0	1	2	3	4	5
$y \rightarrow$	-5	1	9	25	55	105

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(c) The area A of a circle of diameter d is given for the following values

$d \rightarrow$	80	85	90	95	100
$A \rightarrow$	5026	5674	6362	7088	7854

Calculate the area of circle of diameter 105.

8

OR



- (a) Using Stirling formula to find $f(35)$ from the table

$x \rightarrow$	20	30	40	50
$y \rightarrow$	512	439	346	243

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- (b) Using Lagrange's interpolation formula, find the value of y for $x=9.5$ from table

$x \rightarrow$	7	8	9	10
$y \rightarrow$	3	1	1	9

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UNIT - II

- 2 (a) Find $f'(1.5)$ using following data

$x \rightarrow$	1.5	2	2.5	3	3.5	4
$y \rightarrow$	3.375	7	13.625	24	38.875	59

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- (b) Using Euler's modified method, obtain a solution of

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$$\frac{dy}{dx} = x + \sqrt{y}, y(0) = 1 \text{ for the range } 0 \leq x \leq 0.4 \text{ in steps of } 0.2.$$

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OR

- 2 (a) Using Simpson's " $\frac{1}{3}$ " rule, integrate, $\int_1^{1.04} f(x) dx$ from following data

$x \rightarrow$	1	1.01	1.02	1.03	1.04
$f(x) \rightarrow$	3.953	4.066	4.182	4.300	4.421

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- (b) Apply fourth order Runge-Kutta method to

$$\frac{dy}{dx} = 3x + \frac{1}{2}y, y(0) = 1$$

to determine $y(0.1)$ correct to four decimal places.

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UNIT - III

- 3 (a) Derive the result of generating function for Bessel function $J_n(x)$. 8
- (b) For Legendre's function, show that
- (i) $P_n(1) = 1$
- (ii) $P_n(-x) = (-1)^n P_n(x)$ 8

OR

- 3 (a) For Bessel function, show that
- $$\left[J_{\frac{1}{2}}(x) \right]^2 + \left[J_{\frac{3}{2}}(x) \right]^2 = \frac{2}{\pi x}$$
- (b) State and prove orthogonal properties of Legendre's function. 8

UNIT - IV

- 4 (a) There are 3 true coins and 1 false coin with 'head' on both sides. A coin is chosen at random and tossed 4 times. If 'head' occurs all the 4 times, what is the probability that the false coin has been chosen and used? 8
- (b) Fit a binomial distribution for given data :
- | | | | | | | | |
|-----------------|---|----|----|----|---|---|---|
| $x \rightarrow$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| $f \rightarrow$ | 5 | 18 | 28 | 12 | 7 | 6 | 4 |
- 8

OR

- 4 (a) Two cards are drawn at random with replacement from a box which contains 4 cards numbered 1, 1, 2 and 2. If X denotes the sum of the numbers shown on the two cards, find the expected value of X. 8
- (b) Compute the coefficient of correlation between x and y, using the following data :
- | | | | | | | |
|-----------------|---|----|----|----|----|----|
| $x \rightarrow$ | 1 | 3 | 5 | 7 | 8 | 10 |
| $y \rightarrow$ | 8 | 12 | 15 | 17 | 18 | 20 |
- 8



UNIT - V

- 5 (a) Find the extremals of functional

$$\int_0^{\pi/2} [(y''')^2 - (y')^2 + (x)^2] dx;$$

given that $y(0)=1, y'(0)=0,$

$$y(\pi/2)=0, y'(\pi/2)=-1$$

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- (b) Find the curve through two points (x_1, y_1) and (x_2, y_2) which when rotated about the x axis, gives minimum surface area.

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OR

- 5 (a) Derive Euler's equation.

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- (b) Find the extremals of functional

$$\int_0^{\pi/2} [(y')^2 + (z')^2 + 2yz] dx;$$

given that $y(0)=0, y(\pi/2)=1$

$$z(0)=0, z(\pi/2)=-1$$

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