

# NUMERICAL & STATISTICAL ANALYSIS

## QUESTION BANK

### ADVANCED LEARNER

- 1) State the characteristics of typical mathematical models of physical world. Explain with example.
- 2) Use zero- through third-order Taylor series expansions to predict  $f(3)$  for  $f(x) = 25x^3 - 6x^2 + 7x - 88$  using a base point at  $x = 1$ .
- 3) Find a positive root of the equation  $xe^x = 1$  using Method of False Position correct up to 2 decimal places.
- 4) From the following table, estimates the no. of students having marks less than 45.

Marks	Below 40	40-50	50-60	60-70	70-80
No. of Students	31	42	51	35	31

- 5) Solve the following equations by Gauss-Seidel Method

$$3x + 8y + 29z = 71$$

$$83x + 11y - 4z = 95$$

$$7x + 52y + 13z = 104$$

Perform 3 iterations.

- 6) Use Runge-Kutta method of second order to find  $y(0.1)$  and  $y(0.2)$  given that

$$\frac{dy}{dx} = y - x, \quad y(0) = 2$$

- 7) Fit regression equation of the type  $y = a + bx + cz$  for the following data:

y	4	5	3	2	6	7	8	9
x	18	22	15	10	30	32	35	42
z	2	3	1	1	3	4	4	5

- 8) A vegetable vendor stocks onions and potatoes at the beginning of the day. The demand for onion varies from 80kg to 140kg per day and the demand for potatoes varies from 90kg to 120 kg per day. He has enough space to stock only 200kg per day. He profit per kg of onions and potatoes is Rs. 2 and Rs. 3 respectively. Find the quantity of onion and potatoes he should stock so as to maximise his profit. Formulate the LPP and solve it graphically.

- 9) The p.d.f of continuous random variable X is given by

$$f(x) = \begin{cases} \frac{x+2}{18}, & -2 < X < 4 \\ 0 & \text{otherwise} \end{cases}$$

Find a)  $P(X < 1)$

b)  $P(-1 < X < 1)$

- 10) It is observed that 30% of the students appearing for a certain test are science graduates. If 5 students are randomly selected from this group, what is the probability that among them

- a) Two are science graduates
- b) No one is science graduate
- c) At least two are science graduates.

## SLOW LEARNER

- 1) Suppose that you have the task of measuring the lengths of a bridge and a rivet and come up with 9999 and 9 cm, respectively. If the true values are 10,000 and 10 cm, respectively, compute
  - a) The true error and
  - b) The true percent relative error for each case.
- 2) Explain the terms: i) Significant figures, ii) Accuracy, iii) Precision, iv) Truncation error, v) Round-off error.
- 3) Obtain root of the equation  $x^3 - 4x - 9 = 0$  correct up to 2 decimal places using Bisection method.
- 4) Using Lagrange's Interpolation formula, calculate the profit in the year 200 from the following data:

Year	1997	1999	2001	2002
profit	43	65	159	248

- 5) Solve the following equations by Gauss-Jordan Method

$$x_1 + x_2 + x_3 = 90$$

$$2x_1 + 3x_2 + 6x_3 = 370$$

$$3x_1 - 8x_2 - 4x_3 = -340$$

- 6) Given  $\frac{dy}{dx} - 1 = xy$  and  $y(0) = 1$ . obtain Taylor series for  $y(x)$  and compute  $y(0.1)$
- 7) Fit a regression line of  $y$  on  $x$  using least square method. Estimate  $y$  when  $x = 3$ .

x	1	2	3	4	5
y	14	13	9	5	2

- 8) A furniture dealer deals in tables and fans only. He has Rs. 5000 to invest and space to stock at most 50 pieces. A table cost Rs. 250 and fan Rs. 50. He can sell a table and a fan at profit of Rs. 50 and Rs. 15 respectively. How many tables and fans he should purchase to maximise his profit. Solve graphically.
- 9) The probability distribution function of discrete random variable  $X$  is given by

$X=x$	-2	-1	0	1	2
$P(X=x)$	0.1	0.15	0.2	0.15	0.4

- a)  $P(X \leq 0)$
  - b)  $P(X \geq -1)$
  - c)  $P(|X| \leq 1)$
  - d) Obtain p.m.f of  $y = x^2$ .
- 10) Find expected value and variance of  $x$ , if  $x$  denotes the number obtained on the uppermost face when a fair dice is thrown.

## ASSIGNMENT QUESTIONS

- 1) What is a mathematical model? With the help of a flowchart, explain the of solving an engineering problem.
- 2) The population of a town in decimal census is given below. Estimates the population for the year 1955 using Newton's Backward difference interpolation formula.

Year(x)	1921	1931	1941	1951	1961
Population(in thousands)	46	66	81	93	101

- 3) Evaluate  $\int_0^1 \frac{1}{x^2+1} dx$ , taking 4 equal sub-intervals by

- a) Trapezoidal rule
  - b) Simpson's 1/3<sup>rd</sup> rule.
- 4) Solve graphically following LPP  
Maximise  $z = 10x_1 + 15x_2$   
Subject to,

$$\begin{aligned}2x_1 + x_2 &\leq 26 \\2x_1 + 4x_2 &\leq 56 \\x_2 - x_1 &\leq 5 \\x_1, x_2 &\geq 0\end{aligned}$$

- 5) The monthly worldwide average number of air plane crashes of commercial airlines is 3.5. what is the probability that there will be
- a) At least two
  - b) Exactly 4 such accidents in the next month.

\*\*\*\*\*