

[Figure in the right margin indicates full marks. Split answering of any question is not recommended.]

Answer any 5 of the following questions.

1. a) Define Ordinary differential equation, Partial differential equation and Homogeneous differential equation. 5
- b) Solve the following differential equation 9
- (i) $(x^2 + y^2)dx - 2xydy = 0$ P-2(A)
- (ii) $(x + 2y - 3)dx - (2x + y - 3)dy = 0$ P-3(A)
- (iii) $(x^2 + y^2)dx + 2xydy = 0$ P-33(A)
2. a) State the necessary and sufficient condition for a differential equation $Mdx + Ndy = 0$ to be exact. 6
- b) Solve the differential equation 8
- (i) $(x^2 - 2xy + 3y^2)dx + (4y^3 + 6xy - x^2)dy = 0$ A.P-68
- (ii) $(x - 2e^y)dy + (y + x \sin x)dx = 0$
3. a) Define Integrating factor. 2
- b) Solve the linear differential equation: $\frac{dy}{dx} + Py = Q$, where P and Q are the function of x or constant 4
- c) Solve the following 8
- (i) $\frac{dy}{dx} + \frac{2}{x}y = \frac{y^3}{x^3}$ P-82
- (ii) $(D^2 - 4D + 4)y = x^2 + x + 1$ (m-2)^2 m=2,2
4. a) What do you understand by statistics? Discuss with example its importance. 4
- b) What do you mean by frequency distribution? Distinguish between variable and attribute. 6
- Marks obtained by 50 students of CSE 3rd semester in Mathematics are given below:
- 46, 38, 26, 51, 32, 41, 56, 33, 49, 10, 68, 34, 24, 35, 39, 50, 15, 40, 37, 21, 38, 43, 31, 29, 19, 44, 32, 55, 11, 34, 40, 36, 36, 39, 27, 44, 48, 19, 15, 36, 45, 48, 38, 19, 52, 22, 33, 39, 49, 45
- Present the data in the form of a frequency table using the class interval of 10 marks.
- What are the different methods of data collection? 10

- ✓ a) What is central tendency? What are the usual measures of central tendency?
- b) Find out the mean, median and mode from the following data:

| | |
|-------|----|
| 80-89 | 1 |
| 70-79 | 1 |
| 60-69 | 3 |
| 50-59 | 10 |
| 40-49 | 28 |
| 30-39 | 20 |
| 20-29 | 21 |
| 10-19 | 16 |

- c) What are the various measures of dispersion? Find the standard deviation of the following distribution

| | |
|-------|----|
| 5-10 | 5 |
| 10-15 | 12 |
| 15-20 | 19 |
| 20-25 | 21 |
| 25-30 | 18 |
| 30-35 | 15 |
| 35-40 | 7 |
| 40-45 | 5 |

$$\sqrt{\frac{1}{N} \sum f_i x_i^2 - \frac{(\sum f_i x_i)^2}{N}}$$

$$\frac{\sum h_i x_i^2}{\sum h_i}$$

$$\sqrt{\frac{\sum h_i (x_i - \bar{x})^2}{n}}$$

6. a) Explain the idea of correlation and regression. Fit the regression line of Y on X to the following data:

| | | | | | | |
|--------|-----|-----|-----|-----|----|-----|
| X: 10 | 12 | 15 | 22 | 24 | 28 | 32 |
| Y: 207 | 222 | 218 | 228 | 230 | 24 | 235 |

- b) Discuss the different techniques of sampling. What is pilot survey?
- c) What do you understand by the term "test of significance"? What are the different uses of "t" test?

$$r = \frac{\sum f_i x_i y_i}{\sqrt{\sum f_i x_i^2 \sum f_i y_i^2}}$$

$$\frac{\sum f_i x_i y_i}{\sqrt{\sum f_i x_i^2 \sum f_i y_i^2}}$$

[Figure in the right margin indicates full marks. Split answering of any question is not recommended]
 Answer any 5 of the following questions.

1. a) State the order of each differential equation and determine whether the differential equation under consideration is linear or nonlinear

(i) $\frac{d^4 y}{dx^4} + 3\left(\frac{d^2 y}{dx^2}\right)^2 + 5y = 0$ (ii) $\frac{d^2 y}{dx^2} + x \sin y = 0$ (iii) $\frac{d^3 y}{dx^3} + \frac{dy}{dx} + y \sin x = 0$

Form the differential equation of the following function:

$Ax^2 + By^2 = 1$

Solve the differential equation $\sin^{-1}\left(\frac{dy}{dx}\right) = x + y$

2. a) Define homogeneous differential equation with example

Solve the differential equation $\left(x \sin \frac{y}{x} - y \cos \frac{y}{x}\right) dx + x \cos \frac{y}{x} dy = 0$

Explain the integrating factor of a differential equation.

Solve the differential equation $y \log y dx + (x - \log y) dy = 0$

3. a) Write down the form of linear differential equation and Bernoulli's equation

Solve the differential equation $\frac{dy}{dx} + \frac{1}{x} \sin 2y = x^3 \cos^2 y$

Give the definition of auxiliary equation of a differential equation

Solve the differential equation $(D^2 - 2D + 1)y = x \sin x$

4. a) Discuss about statistics. Write down the functions of statistics.

b) Marks obtained by 3rd semester CSE students in Mathematics out of 70 are given below:

| Marks | No. of students |
|-------|-----------------|
| 20-25 | 05 |
| 25-30 | 10 |
| 30-35 | 15 |
| 35-40 | 20 |
| 40-45 | 08 |
| 45-50 | 04 |
| 50-55 | 02 |

Present the data by Histogram and frequency curve.

What are the usual measures of central tendency?

For two non-zero positive observations, prove that (i) $A > G > H$ (ii) $AH = G^2$ where
 A =Arithmetic mean, H =Harmonic mean, G =geometric mean

5. a) Write down the various methods of absolute measures of dispersion

b) Prove that the standard deviation is independent of change of origin but not of scale

c) Find out the coefficient of variation from the following frequency distribution

| Weights | No. of tomato |
|---------|---------------|
| 50-60 | 5 |
| 60-70 | 9 |
| 70-80 | 13 |
| 80-90 | 20 |
| 90-100 | 19 |
| 100-110 | 9 |
| 110-120 | 5 |

6. a) Explain the terms skewness and kurtosis.

A card is randomly drawn from a well shuffled pack. What is the probability that the card will be either an Ace or the Queen of diamond?

c) Write down some properties of correlation coefficient

d) Per week weight(in pounds) of a calf from its birth is given below:

| Age in week (x) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-----------------|------|------|------|------|------|------|------|------|-------|-------|
| Weight (g) | 52.5 | 58.7 | 65.0 | 70.2 | 75.4 | 81.1 | 87.2 | 95.5 | 102.2 | 108.0 |

Estimate the least square regression of weight on age and also estimate the weight when the age is 9.5 weeks.

[Figure in the right margin indicates full marks. Split answering of any question is not recommended]

Answer any 5 of the following questions.

1. a) Determine whether the differential equation under consideration is linear or nonlinear 4

$$(i) \frac{d^4 y}{dx^4} + 3 \left(\frac{d^2 y}{dx^2} \right)^5 + 5y = 0 \quad (ii) \frac{d^2 y}{dx^2} + y \sin x = 0 \quad (iii) \frac{d^2 y}{dx^2} + x \sin y = 0 \quad (iv) \frac{d^3 y}{dx^3} + 4 \frac{d^2 y}{dx^2} - 5 \frac{dy}{dx} + 3y = \sin^2 x$$
 - b) Form a differential equation of the function $y = Ae^{2x} + Be^x + C$ where A, B, C are arbitrary constants 4
 - c) Write down the methods for solving first order and first degree differential equation 2
 - d) Solve the differential equation $\sin^{-1} \left(\frac{dy}{dx} \right) = x + y$ 4
 2. a) Define homogeneous differential equation with examples 2
 - b) Solve the differential equation $\frac{y}{x} \cos \frac{y}{x} dx = \left(\frac{x}{y} \sin \frac{y}{x} + \cos \frac{y}{x} \right) dy$ 5
 - c) State the necessary and sufficient condition for a differential equation to be exact 2
 - d) Solve the differential equation $\frac{dy}{dx} + \frac{1}{x} \sin 2y = x^3 \cos^2 y$ 5
 3. a) Explain the auxiliary equation of a differential equation with examples 2
 - b) Solve the differential equation $\frac{d^2 y}{dx^2} - 4 \frac{dy}{dx} + 4y = x^2 e^{2x}$ 5
 - c) Find the solution of the differential equation $x^2 \frac{d^2 y}{dx^2} - 3x \frac{dy}{dx} + 4y = x + x^2 \log x$ 7
 4. a) Discuss about statistics with its application. 4
 - b) The frequency distribution below gives the cost of production of computers in different models: 8
- | Cost (Tk. Lac) | No. of Computers |
|----------------|------------------|
| 10-15 | 11 |
| 15-20 | 27 |
| 20-25 | 42 |
| 25-30 | 45 |
| 30-35 | 35 |
| 35-40 | 30 |
| 40-45 | 20 |
| 45-50 | 15 |
- Compute: (a) Mean (b) Median (c) Draw a histogram and locate the mode
5. a) Define skewness and kurtosis 2
 - b) A distribution of short term computer credit disbursement from 10 branches of a bank is given below- 5
- | Amount of credit: (Lac Tk.) | 0-5, | 5-10, | 10-15, | 15-20, | 20-25 |
|-----------------------------|------|-------|--------|--------|-------|
| No. of branches : | 01 | 02 | 04 | 02 | 01 |
- Calculate first four central moments, coefficients of skewness and kurtosis and thus comment on the shape and nature of the distribution.
- c) State and prove the additive law of probability for two events 3
 - d) A card is randomly drawn from a well shuffled pack. What is the probability that the card will be either an Ace or the queen of diamond 4
 6. a) Prove that the value of correlation coefficient lies between -1 and 1 4
 - b) Give the geometrical interpretation of regression coefficient 3
 - c) Distinguish between correlation and regression 3
 - d) Following marks were obtained out of 100 by 7 students of CSE in Physics and mathematics: 4

| | | | | | | | |
|---------------------------|----|----|----|----|----|----|----|
| Marks in Physics (x): | 70 | 66 | 68 | 71 | 69 | 65 | 67 |
| Marks in Mathematics (y): | 72 | 68 | 69 | 69 | 72 | 67 | 66 |

Compute the correlation coefficient