

- 1.3** A survey conducted to identify the favourite leisure activity of a group of students has shown the following results:

Activity	Outdoor Games	Video Games	Watching TV
Probability	0.35	0.25	x

The value of x is:

- (1) 0.6 (2) 0.5 (3) 0.4 (4) 0.25 (03 marks)
- 1.4** A person deposited Rs.100 million in a bank account at **XYZ Bank** at an interest rate of 10% compounded annually. The total amount available in his account after 3 years is:
(to the nearest integer)
- (1) Rs.133 Million. (2) Rs.131 Million. (3) Rs.109 Million. (4) Rs.107 Million.
(03 marks)
- 1.5** If the Total Cost (TC) function of a firm is given by $TC = q^3 - 10q^2 + 25q + 10$, the Marginal Cost (MC) function of the firm would be:
- (1) $MC = 3q^2 - 20q + 35$. (2) $MC = 3q^2 - 20q + 25$.
(3) $MC = 3q^2 + 20q - 25$. (4) $MC = q^2 - 10q + 1$. (03 marks)
- 1.6** A company manufactures **product Z** and the cost of the **product Z** is Rs.2,400/- per unit. The company keeps a profit margin of 20% on cost. The selling price of the **product Z** is:
- (1) Rs.480/- (2) Rs.2,880/- (3) Rs.3,000/- (4) Rs.3,480/-
(03 marks)

- 1.7** A company wants to identify the relationship between the number sold of a new model of a car and the amount of money spent on advertising. The information on the cost incurred on advertising (x) (in Rs. million) and the number of cars sold (y) for 15 years are summarized below:

$$\sum x = 177 \quad \sum y = 679 \quad \sum x^2 = 2,576 \quad \sum y^2 = 39,771 \quad \sum xy = 9,915 \quad n = 15$$

Based on the above data,

The correlation coefficient between (x) and (y) is:

- (1) 0.91 (2) -0.91 (3) 0.19 (4) -0.19
(03 marks)

- 1.8 The following table shows index numbers for the last five years considering year 2013 as the base year:

Year	2013	2014	2015	2016	2017
Index number	100 %	90 %	103.2 %	112.5 %	130 %

If the base year is changed to year 2014, the index number for the year 2017 would be:
(to the nearest integer)

- (1) 144 % (2) 117 % (3) 107 % (4) 90 %
(03 marks)

- 1.9 The following table shows the probability distribution of number of road accidents per day in a rural area:

No. of road accidents (x)	0	1	2	3	4
Probability (P)	0.45	0.22	0.19	0.08	0.06

The expected value $[E(x)]$ of number of road accidents is:

- (1) 1 (2) 1.08 (3) 1.53 (4) 1.6 (03 marks)

- 1.10 A student wishes to invest in a fund to buy a new Laptop for his higher studies after 2 years. The expected value of a Laptop after 2 years is Rs.75,000/-. He expects to deposit at the end of each quarter for two years. The fund is created in a bank which pays an annual interest of 12% compounded quarterly. The amount to be deposited to the fund at the end of each quarter by the student is (to the nearest integer):

- (1) Rs.7,715/- (2) Rs.10,500/- (3) Rs.9,375/- (4) Rs.8,434/-
(03 marks)

Use the following information to answer question No. 1.11 to 1.13. Write the answers in your answer booklet with the number assigned to the question.

Premarathne has borrowed Rs.200,000/- from a money lender and he wishes to settle it in 3 years.

- 1.11 **Calculate** the amount being paid as the interest at the end of 3 years, if he had borrowed the amount at the simple interest rate of 12% per annum. (02 marks)
- 1.12 **Calculate** the amount being paid as the interest at the end of 3 years, if he had borrowed the amount at the interest rate of 12% per annum compounded annually. (02 marks)
- 1.13 **Calculate** the amount that he should pay after 3 years to settle the loan in full, if he had borrowed the amount at the interest rate of 12% per annum, compounded quarterly. (02 marks)

State whether each of the following statements is **True** or **False**. Write the answer (True/False) in your answer booklet with the number assigned to the question.

- 1.14 Mean and standard deviation are the parameters of normal distribution. (02 marks)
- 1.15 At the profit maximization point, the total revenue equals the total cost. (02 marks)
- (Total 40 marks)

End of Section A

SECTION B

Four (04) compulsory questions
(Total 40 marks)

Question 02

- (a) A firm has the following cost function.

$$C_{(x)} = x^2 - 90x + 4,800$$

Where x is the number of units produced and $C_{(x)}$ is the total cost in rupees million.

The firm has found that it needs to produce 60 units to break-even.

You are required to:

- (i) **Calculate** the total cost at the break-even point. (03 marks)
- (ii) **Calculate** the selling price per unit at the break-even point. (02 marks)
- (b) You are given the following Total Revenue (TR) Function and Total Cost (TC) Function for a period:

$$TR \rightarrow R_{(x)} = 36x - 4x^2$$

$$TC \rightarrow C_{(x)} = 24x - 3x^2 + 1,200$$

You are required to:

- (i) **Identify** the Profit Function. (02 marks)
- (ii) **Calculate** the quantity at which the profit is maximized. (03 marks)
- (Total 10 marks)

Question 03

- (a) Two groups of candidates contest for an election for Board of Directors. Probability of winning the election by 1st and 2nd group are 0.6 and 0.4 respectively.

If the 1st group wins the election, the probability of starting a new project is 0.8 and if the 2nd group wins the election, the probability of starting a new project is 0.4

You are required to:

- (i) **Draw** a tree diagram to represent above data. (03 marks)
- (ii) **Calculate** the probability that the new project will start after the election. (03 marks)

- (b) The following table summarizes the results of all the driving tests taken at a Test Centre during the first week of September 2017:

	Male	Female	Total
Pass	32	43	75
Fail	8	15	23
Total	40	58	98

If a person is chosen at random on the same week,

You are required to:

- (i) **Calculate** the probability that the chosen person passes the driving test. (02 marks)
- (ii) **Calculate** the probability that the chosen person fails the driving test is a female. (02 marks)
- (Total 10 marks)

Question 04

The following table shows the amount of money spent annually on research activities and the annual income for the last six years of a biscuits manufacturing company:

Year	2012	2013	2014	2015	2016	2017
Expenses for Research (x) (in rupees million)	2	3	5	4	10	6
Annual Income (y) (in rupees million)	20	25	35	30	40	30

It is given that $\sum x = 30$ $\sum y = 180$ $\sum x^2 = 190$ and $\sum xy = 990$

You are required to:

- (a) **Identify** the regression line for the annual income using the least square regression given by $y = a + bx$ using the above information. (07 marks)
- (b) **Compute** the expected annual income, if the company has spent Rs.7 million for a particular year for research activities. (03 marks)
- (Total 10 marks)

Question 05

- (a) Marks obtained by 7 students for one of their assignments are as follows:

60, 92, 84, 66, 54, 37, 62

You are required to:

Calculate the following:

- (i) Mean. (02 marks)
- (ii) Standard Deviation of the marks. (04 marks)

- (b) The table below gives the quarterly sales income (in Rs.'000) of the **product X** from the year 2015 to 2017:

Year	Quarter	Quarterly Sales (Rs.'000)	Moving Average
2015	1	20	
	2	30	
	3	40	37.25
	4	59	-- (a) --
			-- (b) --
2016	1	39	-- (c) --
	2	43	-- (d) --
	3	62	-- (e) --
	4	81	-- (f) --
			-- (g) --
2017	1	52	-- (h) --
	2	65	
	3	75	
	4	94	

You are required to:

Calculate the quarterly moving averages of the above table to fill the given blanks from (a) to (h) using additive model.

(04 marks)

(Total 10 marks)

End of Section B

SECTION C

One (01) compulsory question

(Total 20 marks)

Question 06

- (A) A company sells 04 products **P, Q, R** and **S**. Sales revenue generated during the last year from each product is as follows:

Product	Rs. (Million)
P	40
Q	45
R	50
S	35

You are required to:

Calculate the sales revenue from each product in degrees using the above data, to draw the pie chart. (You are not required to draw the pie chart)

(04 marks)

- (B) The following table shows prices and quantities of three items of a Hardware Dealer for the years 2016 and 2017:

Item	Price per Unit (Rs.)		Quantity	
	2016 (P ₀)	2017 (P ₁)	2016 (q ₀)	2017 (q ₁)
A	850	1,150	1,100	980
B	600	610	500	500
C	450	350	1,400	1,650

Consider the year 2016 as the base year.

You are required to:

Calculate the base weighted aggregate price index (Laspeyre's Price Index) for the year 2017.

(05 marks)

- (C) The following simultaneous equations are provided:

$$4x + 2y = 40$$

$$2x + 5y = 60$$

You are required to:

Calculate the values for x and y .

(05 marks)

- (D) A company wants to evaluate the profitability of a new project. The initial investment of the project is Rs.500,000/-. The life time of the project is 3 years and the cost of capital (discount rate) of the company is 10 %.

The expected cash inflows from the project for next 3 years are as follows:

Year	1	2	3
Cash inflow (Rs.)	150,000	220,000	260,000

You are required to:

- (i) **Compute** the Net Present Value (NPV) of the project. (04 marks)

- (ii) **State** whether the company should invest in this project. (02 marks)

(Total 20 marks)

End of Section C

ACTION VERB CHECK LIST

Knowledge Process	Verb List	Verb Definitions
Level 01 Comprehension Recall & explain important information	Define	Describe exactly the nature, scope, or meaning.
	Draw	Produce (a picture or diagram).
	Identify	Recognize, establish or select after consideration.
	List	Write the connected items one below the other.
	Relate	To establish logical or causal connections.
	State	Express something definitely or clearly.
	Calculate/Compute	Make a mathematical computation
	Discuss	Examine in detail by argument showing different aspects, for the purpose of arriving at a conclusion.
	Explain	Make a clear description in detail revealing relevant facts.
	Interpret	Present in an understandable terms.
	Recognize	To show validity or otherwise, using knowledge or contextual experience.
	Record	Enter relevant entries in detail.
Summarize	Give a brief statement of the main points (in facts or figures).	

Knowledge Process	Verb List	Verb Definitions
Level 02 Application Use knowledge in a setting other than the one in which it was learned / Solve closed-ended problems	Apply	Put to practical use.
	Assess	Determine the value, nature, ability, or quality.
	Demonstrate	Prove, especially with examples.
	Graph	Represent by means of a graph.
	Prepare	Make ready for a particular purpose.
	Prioritize	Arrange or do in order of importance.
	Reconcile	Make consistent with another.
	Solve	To find a solution through calculations and/or explanation.

Knowledge Process	Verb List	Verb Definitions
Level 03 Analysis Draw relations among ideas and compare and contrast / Solve open-ended problems.	Analyze	Examine in detail in order to determine the solution or outcome.
	Compare	Examine for the purpose of discovering similarities.
	Contrast	Examine in order to show unlikeness or differences.
	Differentiate	Constitute a difference that distinguishes something.
	Outline	Make a summary of significant features.

FORMULAE SHEETS

Mathematical Fundamentals:

Quadratic equation:

The solutions of a quadratic equation, $ax^2 + bx + c = 0$ is given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Arithmetic sequence:

The sum of first n terms of an AP:

$$S = \frac{n}{2} \{ 2a + (n - 1)d \}$$

Geometric sequence:

The sum of first n terms of a GP:

$$S = a \frac{\{r^n - 1\}}{\{r - 1\}} \quad \text{if } r > 1$$

$$S = a \frac{\{1 - r^n\}}{\{1 - r\}} \quad \text{if } r < 1$$

$$S = na \quad \text{Otherwise } r = 1$$

Quantitative Finance:

Simple interest:

$$S = X (1 + nr)$$

Compound Interest:

$$S = X \{1 + r\}^n$$

Discounting:

$$\text{Present Value} = \text{Future Value} \times \frac{1}{(1+r)^n}$$

Repayment of mortgage:

$$A = \frac{SR^n(R - 1)}{\{R^n - 1\}}$$

Internal Rate of Return:

$$IRR = \frac{[N_1 r_2 - N_2 r_1]}{[N_1 - N_2]} \%$$

Or

$$IRR = a\% + \frac{NPV_A}{[NPV_A - NPV_B]} (b - a)\%$$

Numerical Descriptive Measures:

Mean \bar{x} :

For ungrouped data: $\frac{\sum x}{n}$

For grouped data: $\frac{\sum fx}{\sum f}$

Standard deviation σ :

For ungrouped data:

$$\sqrt{\frac{\sum (x - \bar{x})^2}{n}} \quad \text{or} \quad \sqrt{\frac{\sum x^2}{n} - \bar{x}^2}$$

For grouped data:

$$\sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}} \quad \text{or} \quad \sqrt{\frac{\sum fx^2}{\sum f} - \bar{x}^2}$$

Coefficient of variation (CV):

$$\frac{\text{Standard deviation}}{\text{Mean}} = \frac{\sigma}{\bar{x}} \times 100$$

Comparing Two Quantitative Variables:

Pearson's Product Moment Correlation.

Correlation coefficient (r):

$$\frac{[n \sum xy - \sum x \sum y]}{\sqrt{\{[n \sum x^2 - (\sum x)^2] \times [n \sum y^2 - (\sum y)^2]\}}}$$

Regression coefficients (a and b):

$$b = \frac{[n \sum xy - \sum x \sum y]}{[n \sum x^2 - (\sum x)^2]}$$

$$a = \bar{y} - b\bar{x}$$

FORMULAE SHEETS

(Continued)

Comparison over time with Economic variables

Index Numbers:

$$\text{Price Relative} = \frac{p_1}{p_0} \times 100$$

$$\text{Quantity Relative} = \frac{q_1}{q_0} \times 100$$

$$\text{Value Relative} = \frac{v_1}{v_0} \times 100$$

$$\text{Simple aggregate price index} = \frac{\sum p_1}{\sum p_0} \times 100$$

$$\text{Simple aggregate quantity index} = \frac{\sum q_1}{\sum q_0} \times 100$$

$$\text{Average price relative} = \frac{1}{n} \sum \frac{p_1}{p_0} \times 100$$

$$\text{Average quantity relative} = \frac{1}{n} \sum \frac{q_1}{q_0} \times 100$$

Weighted aggregate indices

1) Base-weighted / Laspeyre's:

$$\text{Price index} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$$

$$\text{Quantity index} = \frac{\sum q_1 p_0}{\sum q_0 p_0} \times 100$$

2) Current-weighted / Paasche's:

$$\text{Price index} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$$

$$\text{Quantity index} = \frac{\sum q_1 p_1}{\sum q_0 p_1} \times 100$$

3) Using standard weights

$$\text{Price index} = \frac{\sum p_1 w}{\sum p_0 w} \times 100$$

$$\text{Quantity index} = \frac{\sum q_1 w}{\sum q_0 w} \times 100$$

Weighted average of relatives

$$\text{Price index} = \frac{\sum [w \times I_p]}{\sum w} \times 100$$

$$\text{Quantity index} = \frac{\sum [w \times I_q]}{\sum w} \times 100$$

Time Series:

Additive model

$$Y = T + S + C + R$$

Multiplicative Model

$$Y = T \times S \times C \times R$$

Sets and Probability

U - Union; $A \cup B$ defines all elements in A plus all elements in B, no element being counted twice.

\cap - Intersection; $A \cap B$ defines all elements included in both A and B.

P (A) - Probability of event A

P (A/B) - Probability of event A, given B

General rules:

$$P (A \cup B) = P (A) + P (B) - P (A \cap B)$$

$$P (A/B) = \frac{P(A \cap B)}{P(B)}$$

Expectation and Variance of a discrete random variable:

$$E(X) = \sum (\text{probability} \times \text{pay off}) = \sum p \times x$$

$$VAR(X) = \sum px^2 - (\sum px)^2$$

Normal Distribution:

$$Z = \frac{x - \mu}{\sigma}$$