

Sr. No. of Question Paper : 692
 Unique Paper Code : 52411202
 Name of the Paper : Business Mathematics and Statistics
 Name of the Course : B.Com.(P.)
 Semester : CBCS
 Duration : 3 hours
 Maximum Marks : 75 Marks

Roll No.....

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt all questions.
3. Marks are indicated against each question.
4. Simple Calculator is allowed.
5. Answers may be written either in English or in Hindi; but the same medium should be used throughout the paper.

Part-A: Business Mathematics

- 1(a) A manufacturer produces three products X, Y and Z which he sells in three markets I, II and III. Monthly sales and sale prices are given as follows:

Market	Items Sold			Sale Price (Rs.)		
	X	Y	Z	X	Y	Z
I	10000	15000	20000	4.00	6.00	8.00
II	20000	28000	30000	5.00	5.60	7.40
III	30000	35000	40000	4.60	6.20	8.40

The cost per item for three products X, Y and Z are Rs. 3.60, Rs. 5.00 and Rs. 6.80 respectively. Find by matrix algebra the total profit of the manufacturer. (3)

- 1(b) In an engineering workshop there are 10 machines for drilling, 8 machines for turning and 7 machines for grinding. Three types of brackets are made. Type I brackets require 0 minutes for drilling, 5 minutes for turning and 4 minutes for grinding. The corresponding times for Type II and III brackets are 3, 3, 2 and 3, 2, 2 minutes respectively. How many brackets of each type should be produced per hour so that all the machines remain fully occupied during an hour? Solve by matrix algebra. (4)

Or

- 1(a) Product 1 uses 3 units of material, 9 units of labour and 12 units of capital. Product 2 uses 6, 9 and 15 units respectively and product 3 uses 9, 0 and 9 units respectively. 33 units of material, 27 units of labour and 60 units of capital are available. Find how many units of the three products could be produced making use of the available material, labour and capital. (3)

- 1(b) Mr. X has invested Rs. 35000, that he had divided into three investments. Part of the money is invested in a savings account with an annual return of 6%, partly in 7% annual yield bonds and the remainder in business. In 2021, when he lost 6% of the money that he invested in the business, his net income from all the three investments is Rs.660. If he invested Rs. 3,000 more in the business than in the savings account, how much was invested in each. Use matrix algebra. (4)

- 2(a) The total cost function of a firm is:

$$C(x) = 0.001x^3 - 0.06x^2 + 12x + 4000 \text{ where } x \text{ is the output. Determine:}$$

- i. the average cost

- ii. the marginal cost
 iii. the value of x for which average cost and marginal cost are equal. (5)
- 2(b) The supply of a certain good is given by $x = a\sqrt{p-b}$, where x is quantity supplied, p (which is greater than b) is price and a and b are positive constants. Find the expression for the elasticity of supply as a function of price and, by using calculus, show that the elasticity decreases as price increases and becomes unity at the price equal to $2b$. (5)
- Or
- 2(a) If the total cost function is given by $C(x) = a + bx + cx^2$ where x is the quantity of output, show that $d/dx (AC) = 1/x (MC - AC)$ where MC and AC are marginal cost and average cost. (5)
- 2(b) A TV manufacturer produces x sets per week at a total cost of $(x^2 + 78x + 2000)$. He is a monopolist and the demand function for his product is $x = (600 - p)/8$ when the price is Rs p per set. Show that maximum profit is obtained when 29 sets are produced per week. (5)
- 3(a) A sum of money is put at compounded interest for two years at 20% p.a. It would fetch Rs. 9,640 more, if the interest was payable half yearly than if it was payable yearly. Find the sum. (4)
- 3(b) A debt of Rs 10,000 which is due 5 years from now and Rs 10,000 due 10 years from now is to be repaid by a payment of Rs 4,000 in 2 years, a payment of Rs 8,000 in 4 years and a final payment at the end of 6 years. If the rate of interest is 7% compounded annually, find the value of the final payment. (4)
- Or
- 3(a) Find the effective rate equivalent to the nominal rate 6% converted i) monthly ii) quarterly. (4)
- 3(b) A machine costing Rs. 1,00,000 depreciates at a constant rate of 8%. What is the depreciation charge for the 8th year? If the estimated useful life of the machine is 10 years, determine its scrap value. (4)

Part-B: Business Statistics

- 4(a) Distinguish between mathematical and positional averages. (5)
- 4(b) Following are the scores of 2 batsmen Anil and Sunil in 8 innings of a cricket series:
- | | | | | | | | | |
|-------|----|-----|----|----|----|----|----|----|
| Anil | 12 | 115 | 76 | 42 | 7 | 19 | 49 | 80 |
| Sunil | 47 | 12 | 76 | 73 | 24 | 51 | 63 | 54 |
- (i) Which of the two is a more consistent batsman? (6)
- (ii) If Anil doubles his score in each innings of the next series and Sunil increases his score by 50 in each innings, how will their relative consistency be affected? (4)
- Or
- 4(a) Explain the difference between absolute and relative measures of dispersion. Also state the relationship between quartile deviation, mean deviation and standard deviation. (4)
- 4(b) A sample of 90 items has mean 55 and standard deviation 3. Another sample of 110 items has mean 60 and standard deviation 2. Find the combined mean and standard deviation of the 200 items. (5)

- 4(c) For 500 small scale industrial units, the return on investment ranged from 0 to 30%, no unit sustaining any loss. 5% of industrial units had return exceeding 0% but not exceeding 5%. 15% of units had return exceeding 5% but not exceeding 10%. Median and upper quartile rates of return were 15% and 20% respectively. The upper most layer of return exceeding 25% was earned by 50 units. Present this information in the form of a frequency distribution and find the modal rate of return. (6)
- 5(a) Explain the properties of regression coefficients. (5)
- 5(b) Calculate Karl Pearson's coefficient of correlation from the following data. Also calculate the probable error and state whether the correlation coefficient is significant or not. (10)

Weight (in Kgs)	Age (in Years)			Total
	40-50	50-60	60-70	
60-70	8	12	12	32
70-80	14	20	24	58
80-90	10	14	20	44
Total	32	46	56	134

Or

- 5(a) Differentiate between correlation and regression. (5)
- 5(b) The following data relates to advertising expenditure and sales revenue of a firm:
- | | | | | | |
|-------------------------------------|----|----|----|----|----|
| Advertising expenditure (Rs. lakhs) | 1 | 2 | 3 | 4 | 5 |
| Sales revenue (Rs. lakhs) | 10 | 20 | 30 | 50 | 40 |
- (i) Obtain the two regression equations.
- (ii) Estimate the likely sales revenue when the advertising expenditure is Rs. 7 lakhs.
- (iii) What should be the advertising expenditure if the firm wants to attain sales target of Rs. 90 lakhs?
- (iv) Calculate the coefficient of correlation. (10)

- 6(a) Why is Fisher's Index considered 'Ideal'? (2)
- 6(b) Construct Fisher's Ideal Index from the following data and show that it satisfies both Time Reversal Test and Factor Reversal Test. (4)

Commodities	Base Year		Current Year	
	Price	Quantity	p_1q_1	q_1
A	2	8	24	6
B	5	10	30	5
C	4	14	50	10
D	2	19	26	13

Or

- 6(a) Explain the practical utility of Cost of Living Index. (8)

(4)

- 6(b) The sub-group indices of a consumer price index number for the employees of an industrial centre for a particular year (with base 2010 = 100) were:

Food	200
Clothing	130
Fuel & lighting	120
House rent	150
Miscellaneous	140

The weights are given as 60, 8, 7, 10 and 15 respectively. It is proposed to fix dearness allowance in such a way so as to compensate fully the rise in the prices of food and house rent. What should be the dearness allowance expressed as a percentage of wages? (6)

- 7(a) Compare the moving averages method and the method of least squares, for determining trend values, in terms of their relative merits and limitations. (4)
- 7(b) Obtain trend values using four yearly moving averages from the following data:

Year	Sales (Lakh Rs.)
2010	200
2011	120
2012	280
2013	240
2014	160
2015	320
2016	360
2017	400
2018	320
2019	360
2020	360

Or

- 7 Given below are the figures of production (in thousand quintals) of a sugar factory:

Year	2014	2015	2016	2017	2018	2019	2020
Production (thousand quintals)	77	88	94	85	91	98	90

Fit a straight line trend to the data by the method of least squares and tabulate the trend values. Eliminate the trend using additive model. What components of the time series are thus left over? Also calculate the monthly increase in the production of sugar and the expected production for the year 2024. (10)