B.COM. (PROGRAMME) CBCS (2019)
SEMESTER II, PAPER 2.3
BUSINESS MATHEMATICS AND STATISTICS

1. A manufacturer is engaged in the production of three products P, Q and R, which are sold in three different markets X, Y and Z. The annual sales of these products in these markets are given below:

Products

Markets	P	Q	R
X	1200	500	1000
Y	800	1700	600
Z	500	2200	900

You are required to find:

(*i*) The total revenue from each market, if these products are sold at Rs. 50, Rs. 30 and Rs. 40 respectively.

(*ii*) The gross profit from each market, if the cost of producing these products is Rs. 40, Rs. 25 and Rs. 30 respectively. 7

[**Hint :** *Refer* Example 10 of Chapter 2]

Or

An amount of Rs. 5,000 is put into three investments at the rates of interest of 6%, 7% and 8% p.a. respectively. The total annual income is Rs. 358. The combined income from the first two investments is Rs. 70 more than the income from third. Find the amount of each investment by using Cramer's rule. 7

[**Hint :** *Refer* Example 25 of Chapter 2 and Example 27 of Chapter 1]

2. (*a*) If the total cost function is given by $C = a + bx + cx^2$ where x is the quantity of output, show that:

$$\frac{d}{dx}(AC) = \frac{1}{x}(MC\text{-}AC)$$

Where MC and AC are marginal cost and average cost. 5

[**Hint :** *Refer* Example 16 of Chapter 5]

(*b*) A monopolist has a demand curve $x = 219 - 3p$ and average cost $AC = 8 + \left(\frac{x}{75}\right)$ where p is the price per *kg* and x*i* the number of kg of output. *Determine* the output *at* which the maximum profit can be earned and the amount of maximum profit. 5

[**Hint :** *Refer* Example 55 of Chapter 5]

Or

(*a*) If the demand law is $x = \frac{20}{(p+1)}$, find the elasticity of demand in terms of p and its value when $p = 3$. 5

[**Hint :** *Refer* Example 21 of Chapter 5]

(*b*) A piece of machinery costs Rs. 15,000. The total cost of operation from the time of purchase upto a time t is given by the function $30t^2 + 20t$. If the machine is sold as scrap after t years, the resale value is given by the function $8520 - 50t^2$. Find the optimum time for the replacement of the machine. 5

[**Hint :** *Refer* Example 64 of Chapter 5]

3. (*a*) A person deposited Rs. 20,000 in a bank at 5% compounded annually. After 5 years, the rate of interest was increased to 6% and after 4 more years, the rate was further increased to 7%. The money was withdrawn at the end of 12 years. Find the amount.

[**Hint :** *Refer* Example 13 of Chapter 6]

(*b*) A debt of Rs. 20,000 due 3 years hence and another of Rs. 50,000 due 6 years hence are to be paid off by a single payment 4 years hence. If the rate of interest is 6% compounded semi-annually, how much is this payment?

[**Hint :** *Refer* Example 33 of Chapter 6]

Or

(*a*) A banker credits the fixed deposit account of a deposit @ 12% p.a. compounded quarterly. Find out the effective rate of interest that is allowed by the bank.

[**Hint :** *Refer* Example 20 of Chapter 6]

(*b*) An item is being depreciated in such a way that the value of the item at the end of any year is 90% of the value at the beginning of the year. The cost of the machine is Rs. 40,000. Find the value of machine after 5 years and depreciation amount for the fifth year.

[**Hint :** *Refer* Example 45 of Chapter 6]

Part B

(Business Statistics)

4. (*a*) Explain the relationship between Mean, Median and Mode in a normal distribution. 2

[**Hint :** *Refer* Para 8.19 of Chapter 8]

(*b*) The median of a few number of observations is given as 48. The six items whose values are 33, 38, 45, 49, 53 and 59 were added to given series. What will be the new median? 2

[**Hint :** *Refer* Para 8.9 of Chapter 8]

(*c*) Find the average rate of increase in population which in the first decade increased by 20%, in the second by 30% and in the third by 40%. 6

[**Hint :** *Refer* Example 72 of Chapter 8]

Or

(*a*) What is the formula of empirical mode method? Find out the median for an asymmetrical distribution with mode and mean equal to 26.6 and 28.1 respectively. 3

[**Hint :** *Refer* Example 56 of Chapter 8]

(*b*) The mean salary paid to all the employees in a certain company was Rs. 600. The mean monthly salary paid to male and female employees was Rs. 620 and Rs. 520 respectively. Find the percentage of male and female employees in the company. 7

[**Hint :** *Refer* Example 23 of Chapter 8]

5. (*a*) What is the relationship between Q.D., M.D. and S.D.? 2

[**Hint :** *Refer* Para 9.16 of Chapter 9]

(*b*) The mean weight of 150 students is 60 kg. The mean weight of boys is 70 kg with a S.D. of 10 kg. For the girls, the mean weight is 55 kg and the S.D. is 15 kg. Find the number of boys and girls and the combined S.D. 8

[**Hint :** *Refer* Example 31 of Chapter 9]

Or

(*a*) Find:

(*i*) the range that contains the middle 50% of the items

(*ii*) Quartile Deviation

(*iii*) Coefficient of Q.D., from the following data:

X	11-20	21-30	31-40	41-50	51-60
F	4	8	20	12	6

[**Hint :** *Refer* Example 6 of Chapter 9]

(*b*) The coefficients of two series are 40% and 60%. The S.D. are 20 and 16 respectively. What are their arithmetic means? 2

[**Hint :** *Refer* Example 38 of Chapter 9]

6. (*a*) What is coefficient of determination and what is its use? 2

[**Hint :** *Refer* Theoretical concepts of Chapter 10]

(*b*) Is it true that a correlation coefficient $r = 0.8$ indicates a relationship twice as close as $r = 0.4$? 2

[**Hint :** *Refer* Theoretical concepts of Chapter 10]

(*c*) Calculate the correlation coefficient from the following results:

$N = 10$, $\Sigma X = 350$, $\Sigma Y = 310$,

$\Sigma(X - 35)^2 = 162$, $\Sigma(Y - 31)^2 = 222$,

$\Sigma(X-35)(Y-31) = 92$.

Also, find the regression line of Y on X. 6

[**Hint :** *Refer* Example 22 of Chapter 10 and Example 2(*iii*) of Chapter 11]

Or

(*a*) Write down the properties of regression coefficients. 2

[**Hint :** *Refer* Para 11.8 of Chapter 11]

(*b*) The Rank Correlation Coefficient between marks obtained by some students in Statistics and Accountancy is found to be 0.8. If the total of squares of rank differences is 33, find the number of students. 6

[**Hint :** *Refer* Example 28 of Chapter 10]

(*c*) Differentiate between correlation and regression. 2

[**Hint :** *Refer* Para 11.6 of Chapter 11]

7. (*a*) Distinguish between seasonal and cyclical fluctuations with suitable examples. 4

[**Hint :** *Refer* Para 13.5 of Chapter 13]

(*b*) Fit a straight line trend by the method of least squares to the following data and estimate sales for 2018 :

Year	2009	2010	2011	2012	2013	2014	2015	2016
Profits (Rs. Cr.)	80	90	92	83	94	99	92	104

6

[**Hint :** *Refer* Example 6 of Chapter 13]

Or

(*a*) What is Time Series Analysis ? What is its utility in business world? 3

[**Hint :** *Refer* Paras 13.1 & 13.4 of Chapter 13]

(*b*) Find the trend values by using 3 yearly moving average method for the following data:

Year	*Sales (in Rs. '000)*
2006	40
2007	42
2008	40
2009	44
2010	49
2011	46
2012	42
2013	44
2014	44
2015	50

7

[**Hint :** *Refer* Example 1 of Chapter 13]

8. (*a*) What is the difference between fixed base and chain, base index? 2

[**Hint :** *Refer* Paras 12.12 and 12.13 of Chapter 12]

(*b*) Find index number for the three years taking average Price as base by using Price Relative Method :

Year	*Price Per Quintal (Rs.)*		
	A	*B*	*C*
2015	3	5	8
2016	5	4	6
2017	7	6	7

6

[**Hint :** *Refer* Example 2 of Chapter 12]

(*c*) What are the main considerations while selecting base year to construct index ? 2

[**Hint :** *Refer* Para 12.5(*ii*) of Chapter 12]

Or

(*a*) What are the various tests of adequacy of index numbers? 3

[**Hint :** *Refer* Para 12.10 of Chapter 12]

(*b*) Given the following data, show that Fisher's Ideal Index satisfies the Time Reversal Test and Factor Reversal Test:

Commodity	*2016*		*2017*	
	Price	*Expenditure*	*Price*	*Expenditure*
A	8	80	10	120
B	10	120	12	96
C	5	40	5	50
D	4	56	3	60
E	20	100	25	150

[**Hint :** *Refer* Example 21 of Chapter 12]