

**2016**  
**FUNDAMENTALS OF BUSINESS MATHEMATICS**

Full marks : 100

Time : 3 hours

**General instructions:**

- i) Approximately 15 minutes is allotted to read the question paper and revise the answers.  
 ii) The question paper consists of 26 questions. All questions are compulsory.  
 iii) Marks are indicated against each question.  
 iv) Internal choice has been provided in some questions.

**N.B:** Check that all pages of the question paper is complete as indicated on the top left side.

1. Define a venn diagram. 1
2. Express Commutative Law. 1
3. Write the co factor of the determinant  $\begin{bmatrix} 5 & 6 \\ -3 & 2 \end{bmatrix}$  by taking second row. 1
4. Mention any two operational rules of matrices. 1
5. What is a compound partnership? 1
6. What is a dividend? 1
7. If the universal set  $U=\{1,2,3,4,5,6,7\}$  and sub set A ,B and C are given by  $A=\{1,3,5,6\}, B=\{4,5,6\}$  and  $C= \{2,4,6\}$  then verify that  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ . 4
8. Prove that  $(a + b + c)^2 > 3(ab + bc + ca)$  if a,b and c are unequal positive numbers. 4
9. If  $y = g(x) = \frac{ax-b}{cx-a}$  , prove that  $g(y) = x$ . 4
10. Prove without expanding  $\begin{vmatrix} 1 & a & a^2 - bc \\ 1 & b & b^2 - ca \\ 1 & c & c^2 - ab \end{vmatrix} = 0$  4

11. If  $A = \begin{bmatrix} 2 & 3 \\ 5 & 6 \\ 7 & 2 \end{bmatrix}$  and  $B = \begin{bmatrix} 3 & 1 \\ 5 & 2 \\ 9 & 3 \end{bmatrix}$

Find a matrix Y such that  $2A - 2Y = 4B$ .

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12. A manufacturer produces three products X, Y and Z which he sells in two markets A and B. Annual sales volumes are indicated as follows:

Markets	Products		
	X	Y	Z
A	8,000	9,000	7,000
B	6,000	8,000	5,000

If unit sales price of X, Y and Z are ` 2, ` 3 and ` 5 respectively, find the total revenue in each market with the help of matrix algebra.

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13. a. A and B starts a business with respective capitals of ` 80,000 and ` 50,000. They agreed to charge interest at 5% on capital. B gets a bonus of 5% on the turnover before profit are divided between them in the proportion of 3:2. The turnover during the year amounts to ` 2,00,000. If the gross profit is ` 35,000. Find the total share of A and B.

Or

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- b. P, Q and R are three partners of a firm. The total of their capital contribution is ` 10,000. P's capital is ` 800 more than that of Q and ` 1,200 more than that of R. The profit made is ` 4,000. How will they share the profits if the profits are proportionate to the capitals?

14. a. Mr. Atoka offers ` 305 cash for a book and Mr. Hituka offers ` 327 for the same book to be paid after 18 months. Which is the better offer and by how much money being reckoned at 6% per annum simple interest?

Or

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- b. The true discount and bankers discount on a bill due 8 months hence are ` 400 and ` 432 respectively. Find the amount of the bill and the rate of interest.

15. a. How much should a man invest in 10% stock at 120 to get an income of ` 2,000 a year?

Or

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- b. How much stock are to be sold to realize ` 43,960 by selling at a premium of ` 10 brokerage being  $\frac{1}{10}\%$  and stamp duty 3%?

16. a. Write any four advantages of linear programming. 4  
**Or**  
 b. Write any four limitations of linear programming.

17. a. A shopkeeper mixes two varieties of tea at ` 60 and ` 80 per kg. Find the ratio in which he should mix them so that cost price of the mixture is ` 75 per kg. 4  
**Or**  
 b. In a mixture of liquor and water there is 80% liquor. How much of liquor should be added in such a mixture of 65 liters to make the liquor 84% of the total?

18. a. For any three sets A, B and C, prove that  $(A \cap B) - C = (A - C) \cap (B - C)$  5  
**Or**  
 b. In an examination 80% of the candidates passed in Business Studies and 85% passed in Accountancy, while 75% passed in both. If 45 candidates failed in both the subjects, find the total number of candidates.

19. a. Three products P, Q and R are produced after being processed through three departments  $D_1, D_2$  and  $D_3$ . The following data are available

Product	Hours required for a unit produced		
	in $D_1$	in $D_2$	in $D_3$
P:	2	3	4
Q:	5	2	5
R:	3	1	3
Maximum time Available in hours	105	50	115

Find by Cramer's Rule the number of units produced for each product to have full utilization capacity.

- Or** 5  
 b. An amount of ` 10,000 is put into three investment at the rate of 10, 12 and 15 percent per annum. The combined income is ` 1,310 and the combined income of the first and second investment is ` 190 short of the income from the third. Find the investment in each using determinant method. (Cramer's Rule)
20. a. A, B and C enters into partnership, A contributing ` 11,400. They agreed to share profits and losses on pro-rata. A withdraws his capital after 3 months, B after 6 months and C after 10 months. At the end of the year, A gets  $\frac{1}{6}$ <sup>th</sup> of

the profit B gets  $\frac{1}{4}^{th}$  and C the balance .Find how much B and C contributed in the business.

**Or** **5**

- b. A and B jointly started a business unit with a capital of ` 25,000 and ` 17,000 respectively. They agreed to divide 40% of the profit equally between them. The remaining profit would be treated as interest on capital. If at the end of certain year the share of one partner exceeded that of the other by ` 1,120. Find the share of each partner.

21. a. A man finds that if he invests his money in 4% at 120 his income will be ` 90 more than what he would get by investing his money in 5% at 160. How much did he invest?

**Or** **5**

- b. How much  $4\frac{1}{2}\%$  stock at 90 can be purchased by selling ` 9,000, 4% stock at 80%? Find the profit or loss in this case.

22. a. Let R be a relation in  $N \times N$  which is defined by  $(a,b) R (x,y)$  if  $a+y=b+x$ , prove that R is an equivalence relation.

**Or** **6**

- b. Let  $A=\{1,2,3,4\}, B=\{a,b,c,d\}$ , decide whether or not the following are functions from A to B. If they are functions, find the range. If they are not, give reasons

- i)  $f_1 = \{(1,a),(2,b),(4,c)\}$
- ii)  $f_2 = \{(1,b),(4,d),(3,b),(4,c),(2,a)\}$
- iii)  $f_3 = \{(1,a),(2,b),(3,b),(4,c)\}$

23. a. In a certain country, there are 20 head post offices and 2,000 sub post offices. Each office has 1 cashier, 1 head clerk, 2 clerks. Each head post office in addition has 1 accountant, 1 clerk, 1 peon. The monthly salary of each of them is as follows; head clerk ` 8,000, accountant ` 7,000, cashier ` 5,000, clerk ` 4,000 and peon ` 3,000; using matrix algebra find:

- i) the total number of posts of each kind in all the offices taken together.
- ii) the total monthly salary bill of each kind of office separately.
- iii) the total monthly salary bill of all the offices taken together.

**Or** **6**

- b. Food X has 1 unit of vitamin A, 3 units of B and 5 units of C. Food Y has 2, 3 and 5 units respectively and food Z has 3 units of each of vitamin A and C none of B. We need 14 units of A, 9 units of B and 24 units of C. Find by matrix method how much amount of the three foods will exactly fulfill this requirement.

- 24.a.** The average due date of four bills was 10<sup>th</sup> June, three of the bills were payable as follows:  
 ₹ 418 on 29<sup>th</sup> April  
 ₹ 551 on 3<sup>rd</sup> June  
 ₹ 1,007 on 8<sup>th</sup> July  
 The 4<sup>th</sup> bill was for ₹ 323. What will be the due date?

**Or****6**

- b.** P holds a bill of exchange from Q for ₹ 4,800 payable 5 months hence Q holds a bill for ₹ 8,500 payable 3 months hence. They agreed to cancel both the bills and P pays ₹ 2,000 in cash to Q and gives a new bill payable 4 months hence determine the amounts of the new bill if the rate of discount is 4% per annum.

- 25.a.** Solve graphically the following LPP

$$\text{Maximize } Z = 3x_1 + 5x_2$$

Subject to the constraints

$$x_1 + x_2 \leq 3$$

$$4x_1 + 3x_2 \leq 12$$

$$x_1, x_2 \geq 0$$

**Or****6**

- b.** Solve graphically the following LPP

$$\text{Minimize } Z = 20x_1 + 10x_2$$

Subject to the constraints

$$x_1 + 2x_2 \leq 40$$

$$3x_1 + x_2 \geq 30$$

$$4x_1 + 3x_2 \geq 60$$

$$x_1, x_2 \geq 0$$

- 26.a.** A man buys 3 kinds of rice at ₹ 60 per kg, ₹ 80 per kg and ₹ 120 per kg respectively. He wants to mix them together so that mixture cost ₹ 90 per kg. In which proportion must he mix them?

**Or****6**

- b.** A shopkeeper wishes to mix tea at ₹ 80, ₹ 90, ₹ 110 and ₹ 120 per kg respectively. How must he mix them using the first two kinds in the proportion of 2:1 and last two in the proportion of 3:2 so that by selling the mixture at ₹ 100 per kg, he may earn  $\frac{1}{20}$ <sup>th</sup> of the receipts as his clear profits.

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