2017
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 universal set. **1**

2. Define binary relation. **1**

3. What is meant by injective function? **1**

4. What is a partnership deed? **1**

5. What is meant by bill of exchange after date? **1**

6. What is meant by cum-div-price? **1**

7. Suppose N, Z and R are the set of natural numbers, set of integers and set of real numbers respectively. Find $(N \cap Z) \cup R$ and $Z - (R - Z)$. **4**

8. Let R be the relation 'is less than' from A= {2, 4, 6} to B= {1, 5, 7}
   i) Write down the Cartesian product corresponding to R.
   ii) Write down the domain and range of R.
   iii) Find R^{-1}
   iv) Find domain (R^{-1}) and range (R^{-1}) **4**

9. Let $A=\{-2,-1,0,1,3,5\}$, $B=\{-2,0,7,10,28\}$ and the function $f:A \to B$ defined by $f(x)= x^2+x-2$, $x \in A$, find the range of f. Is f an onto function? **4**

10. Prove that $\begin{vmatrix} 0 & -2 & -3 \\ 2 & 0 & -5 \\ 3 & 5 & 0 \end{vmatrix} = 0$ by using properties of determinants. **4**

11. Show that $\begin{bmatrix} 3 & 4 \\ -2 & -3 \end{bmatrix}$ is an involuntory matrix.   **4**

12. If $A = \begin{bmatrix} 5 & 7 \\ 6 & 3 \end{bmatrix}$, prove that $A\,(\text{adj } A) = |A|.I$ **4**

13. **a.** A starts a business with capitals of `12,000. After 4 months he is joined by B who brings in `16,000 and at the end of another 3 months C joins with `20,000. The year's profit is `9,300. Divide it between the partners on the basis of average investment.

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Or   **4**
</div>

    b. In a business A, B and C makes a profit of `20,000 at the end of a year. If the capital of A: capital of B=2:3 and capital of B: capital of C =2:5. Find their profits.

14. **a.** A bill for `700 was payable 60 days after sight. It was accepted on 20th May, 1984 and discounted on 28th May, 1984. How much did the banker pay to the holder of the bill, if the rate of interest was 5% per annum?

<div align="center">

Or   **4**
</div>

    b. Mr. Sohan brought a television for `30,000 and sold it for `32,000 on credit for 6 months. What is his gain percent, if the rate of interest is 5% per annum?

15. **a.** A man invest `40,000 in 9% stock at 80. Find his income.

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Or   **4**
</div>

    b. How much 4% stock at 120 can be purchased by investing `48,000? What will be the income?

16. **a.** Graph the following system of inequations: $\begin{aligned} 2x + y &\le 20 \\ x + 3y &\le 15 \\ x, y &\ge 0 \end{aligned}$

and also name the geometric figure.

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Or   **4**
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    b. Verify that the solution set of the following linear constrains is a null set:
$$-x + y \ge 2$$
$$+3x - 5y \ge 15$$
$$x, y \ge 0$$

17. **a.** A dealer mixes tea costing ` 8 per kg with tea costing ` 7 per kg and sells the mixture at ` 8 per kg and earns a profit of 7½ % on his sale price. In what proportion does he mix them?

<div align="center">Or</div>   **4**

    b. Two grades of motor oil A and B are mixed in the ratio of 5:2 to make 84 gallons of grade C. When half of C has been sold, a further quantity of A is added to realize the ratio of A to B in the resulting mixture to 13:3. Find the quantity of A last added.

18. **a.** A, B, C and D, with capitals of ` 5,000, ` 4000, ` 16,000 and ` 9,000 respectively commence a joint business on 1/7/62. A brings further capital of ` 5,000 on 1/11/62 and B brings in ` 3,000 on 1/12/62. C withdraws ` 2,000 of his capital on 1/2/63 and D withdraws ` 4,000 on 1/3/63. The annual profit were ` 9,690. Find the share of each partner.

<div align="center">Or</div>   **5**

    b. A ,B and C started a business, A putting in ` 2,000 and they agreed to share the profits on prorata:

         A withdraws his capital after 3 months, B after 5 months and C after 6 months. At the end of the year A got as his share $\frac{1}{3}rd$ of the total profit and B received $\frac{1}{4}^{th}$ of the total profit and C the remaining profit. Find the contribution of B and C in the business.

19. **a.** A dealer brought goods of the following amounts on the stated date, two months being allowed in each case for payments:
` 2,500 on March 10$^{th}$, ` 2,680 on April 25th, ` 4,300 on May 4$^{th}$ and ` 3,000 on June 22nd, he paid ` 7,000 on June 20th. On what date would the balance amount be an equitable settlement of his account?

<div align="center">Or</div>   **5**

    b. One dealer offers to sell a television on the following conditions;
` 5,000 cash down and ` 200 per month for 10 months following.
Another offers the following conditions;
` 4,000 cash down and ` 250 per month for 9 months following .
which offer is cheaper to the customer and by how much if money is worth 6% per annum? Take the date of cash payment as zero date.

20. **a.** A man sold $4\frac{1}{2}$% stock of ` 7,000 at 104 and purchased 5% stock with sale proceeds. As a result, his yearly income increased by ` 140. What was the market price of 5% stock?

<div align="center">Or</div>   **5**

b. A man sells ₹ 15,000 stock at 98 and invested the proceeds in 5% stock at 147. Find the change of his income.(Assume that income of former is tax free and latter is subjected to a tax of 7%.)

21. **a.** Out of 300 students in a college, 30 students speak all the three languages English, German and Spanish, 60 speaks English and German, 90 speak German and Spanish,75 speaks English and Spanish , 36 speak English only, 15 speak German only and 24 speaks Spanish only. How many do not speak any of the three languages (use algebra of sets)?

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Or   **5**

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b. In a survey of 200 students, it was found that 50 students study Accountancy, 60 study Law, 40 study Mathematics and 20 study all the three subjects, 30 study Accountancy and Law, 35 study Law and Mathematics and 25 study Accountancy and Mathematics. Apply the principle of venn diagram to find the number of students who study only Accountancy.

22. **a.** It is given that consumption (C) and saving (S) are functions of income (Y). Also Y=C+S. If an economy may be described as

$$C=100+0.4Y$$
$$S= 50+0.3Y$$

find the equilibrium income, consumption and saving by using Cramer's Rule.

<div align="center">

Or   **6**

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b. Food I has 5 units of A, 7 units of B and 2 units of C ,Food II has 0, 4 and 6 units respectively and Food III has 4, 0 and 6 units respectively and accordingly we need a total of 39 units of A, 37 units of B and 66 units of C . Find by determinant method, how much amount of the three foods will meet this requirement?

23. **a.** A trust fund has ₹ 80,000, that is to be invested in two different types of bonds. The first bond pays 4% interest per year and the second bond pays 5% interest per year. Determine how to divide ₹ 80,000 between two types of bonds so as the trust can obtain an annual interest of ₹ 3,500 by using matrix multiplication.

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Or   **6**

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b. A shop owner sells 10 table fans, 15 ceiling fans and 5 pedestal fans in a week. The selling price of a table fan is ₹ 1,000, that of ceiling fan is ₹ 1,200 and of pedestal fan is ₹ 2,000. The cost price of the owner is ₹ 800 for 1 table fan, ₹ 900 for 1 ceiling fan and ₹ 1,500 for 1 pedestal fan. Calculate the weekly profit of the shop.

24. **a.** If $X=\begin{bmatrix} 2 & 5 \\ -6 & -1 \end{bmatrix}$, $Y=\begin{bmatrix} 4 \\ 5 \end{bmatrix}$ and $Z=\begin{bmatrix} 4 \\ 2 \end{bmatrix}$, find a matrix A such that
$XA=2Y-3Z$.

<div align="center">**Or**</div>   **6**

    b. Using matrix method, solve the system of equations
$5x + 7y + 2 = 0$
$4x + 6y + 3 = 0$

25. **a.** A small scale manufacturer has production facilities for producing two different products P and Q. Each of the product needs three different operations: grinding, assembling and testing, product P needs 1, 3 and 4 minutes per grinding, assembling and testing respectively. The production run calls for at least 40 minutes of grinding time, at least 30 minutes of assembling time and at least 60 minutes of testing time. If product P cost ` 20 and product Q cost ` 10 to manufacturer, using graphic method, determine the number of units of each product the firm should produce in order to minimize the cost operations.

<div align="center">**Or**</div>   **6**

    b. Solve graphically the following LPP
Minimize $Z=5x_1 + 5x_2$
Subject to the constraints
$2x_1 + x_2 \geq 40$
$x_1 + 2x_2 \geq 50$
$x_1 + x_2 \geq 35$
$x_1, x_2 \geq 0$

26. **a.** Gold valued at ` 250 per gram. An alloy of gold and silver weights 1kg and its value is ` 1,50,000. If the weight of gold and silver are interchanged, it would worth ` 1,10,000. Find the proportion of gold and silver in the alloy.

<div align="center">**Or**</div>   **6**

    b. A businessman openly declare to retail his goods at a profit of 5%, but he adulterates them by adding $\frac{1}{5}^{th}$ of their weight of an inferior article which costs him $\frac{3}{4}^{th}$ of the price of the better .How much percent profit does he make? Also, in what proportion he must mixed the two kinds so as to gain 10%?

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