Total no of printed pages: 5 *NB/XII/FBM/1*

2024

FUNDAMENTALS OF BUSINESS MATHEMATICS

Full marks: 80 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 28 questions. All questions are compulsory.
iii) Questions 1 to 10 carry 1 mark each.
iv) Questions 11 to 18 carry 2 marks each.
v) Questions 19 to 23 carry 4 marks each.
vi) Questions 24 to 26 carry 6 marks each.
vii) Questions 27 and 28 carry 8 marks each.
viii) Internal choice has been provided in 6 marks and 8 marks questions.

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

Choose the correct answer from the given alternatives in questions 1 to 10.

1. If $A=\{2,3,4\}$ and $B=\{3,5\}$, then $A \cup B$ will be _____. **1**

a) $\{3,5\}$ b) ϕ
c) $\{2,3,4,5\}$ d) $\{3\}$

2. If $A=\begin{vmatrix} 2 & 3 & 1 \\ 5 & 2 & 6 \\ 7 & 3 & 2 \end{vmatrix}$, then the value of $a_{21}+A_{21}$ *is* _____. **1**

a) 1 b) 2
c) 3 d) 0

3. Find the value of x and y if $\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix}=\begin{bmatrix} 0 & y-2 \\ 8 & 4 \end{bmatrix}$ is_____. **1**

a) $x=-\frac{1}{3}, y=7$ b) $y=-\frac{2}{3}, x=-\frac{1}{3}$
c) $y=7, x=-\frac{2}{3}$ d) Not possible to find.

4. If A and B are two matrices of order $3\times m$ and $3\times n$ respectively, then the order of the matrix $(5A-2B)$ is_____. **1**

a) $m\times 3$ b) 3×3
c) $m\times n$ d) $3\times n$

5. If the capitals of the partners are contributed for different lengths of time, then the partnership is called_____. **1**

a) Simple b) Compound
b) Working d) Sleeping.

6. If a bill of ` 5,000 is drawn on 01-05-1990 payable for 6 months, then the legal due date of the bill is _____. **1**

a) 1st October, 1990 b) 1st November, 1990
c) 4th October, 1990 d) 4th November, 1990.

7. Any fraction occurring in equated time of payment is to be ignored in favour of_____. **1**

a) Creditor b) Debtor
c) Lender d) Borrower.

8. The cost of ` 4,000 stock, 4% stock at 90 is_____. **1**

a) ` 3,500 b) ` 3,550
c) ` 3,600 d) ` 3,570.

9. The minimum value of $Z=3x+4y$ subject to constraints $x+y\le 4,\ x\ge 0,\ y\ge 0$, is _____. **1**

a) 12 b) 14
c) 16 d) None of the above.

10. A shopkeeper mixes two varieties of teas at ` 60 and ` 80 per kg. Then the ratio of the mixture will be_____ when the cost price of the mixture is ` 75. **1**

a) 3:1 b) 1:3
c) 2:3 d) 1:1.

11. Using set operation, find the HCF of the following 3 numbers 15, 40 and 80. **2**

12. Write the co-factor of elements of second column of the determinant **2**

$$\begin{vmatrix} 5 & 6 & 7 \\ 3 & 4 & 1 \\ -1 & -16 & 7 \end{vmatrix}$$

13. Evaluate $\begin{bmatrix} 3 \\ 5 \end{bmatrix}\begin{bmatrix} 7 & 8 \end{bmatrix}+\begin{bmatrix} 4 & 3 \\ 2 & 1 \end{bmatrix}$ **2**

14. Find the matrix B such that $AB = I_2$, where $A=\begin{bmatrix} 3 & -2 \\ 5 & 3 \end{bmatrix}$ **2**

15. Three partners A, B and C invested ` 16,000, ` 20,000 and ` 14,000 respectively in a business. How should they divide a profit of ` 2,500 in proportion of their capitals? **2**

16. The true discount on a bill due 18 months hence at 4% per annum is ` 30. Obtain the amount of the bill. **2**

17. How much will be realised from the sale of ` 6,000, 5% stock at $90\frac{1}{4}$, brokerage being $\frac{1}{4}\%$? **2**

18. Draw the graph of the inequation: $2x + y \geq 50$. **2**

19. In a class of 450 students, 180 study mathematics, 200 study computer and 50 study both the subjects. Obtain the number of students who study neither mathematics nor computer. **4**

20. If $A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$, find K so that $A^2 - 8A + KI_2$ **4**

21. A, B, C and D with capitals of ` 5,000, ` 4,000, ` 6,000 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 profits were ` 9,690. Find the share of each partner on the basis of average investment. **4**

22. Mr. X owes Mr. Y ` 5,000 payable 5 years hence. Mr. Y owes Mr. X ` 3,870 payable 18 months hence. If they want to settle their account by cash payment now, what sum should be paid and by whom, reckoning money at 5% per annum? **4**

23. Solve graphically the following LPP: **4**
Maximize $Z=-x_1+3x_2$
subject to constraints
$3x_1 + 6x_2 \leq 18$
$5x_1 + 2x_2 \leq 10$
$x_1, x_2 \geq 0$

24. **a)** It is given that the 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 savings (**Using Cramer's Rule**).

Or **6**

b) Food I has 5 units of vitamin A, 7 units of vitamin B and 2 units of vitamin C. Food II has 0,4 and 6 units respectively and Food III has 4,0,6 units respectively. Find by **determinant method** how much amount of the three foods will exactly be required if we need 39 units of A, 37 units of B and 66 units of C.

25.**a)** Gaurav purchased 3 pens, 2 bags and 1 instrument box and pay ` 41. From the same shop, Dheeraj purchases 2 pens, 1 bag and 2 instrument boxes and pays ` 29, while Ankur purchases 2 pens, 2 bags and 2 instrument boxes and pays ` 44. Translate the problem into a system of equations. Solve the system of equations by **matrix method** and hence find the cost of 1 pen, 1bag and 1instrument box.

Or **6**

b) Mr. Rao invested a total of ` 1,500 in three different savings account with annual rates of 5%, 2% and 1%. The total amount yield from this investment is ` 38. If he invested equal amounts in this 5% and 1% accounts, how much amount would be yield from each investment? **(using matrix algebra)**

26. **a)** Out of two stocks A and B at $136\frac{1}{2}$ and 125, the former paying $5\frac{1}{2}\%$ dividend and latter 5%, a person purchases ` 1,82,000 of the less profitable stock initially and then sells it to invest the proceeds in the other, paying $\frac{1}{8}\%$ brokerage on the stock sold. What is his gain in the return by the change in investment?

Or **6**

b) Having a certain sum to invest, a man puts half of it in 6% stock at 110 and the other half in 5% stock at par, the price in each case being inclusive of brokerage. If he had invested $\frac{3}{4}$ of it in the first and rest in the second, his annual income would have been ` 10 more. How much did he invest?

27.**a) i)**Determine whether the relation R in the set A of human beings in a village at a particular period given by R ={(m,n):m is a wife of n} is reflexive, symmetric or transitive.

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

Or **4+4=8**

b)i) Prove that the relation 'is a multiple of' on the set of all natural numbers are reflexive, and transitive but not symmetric.

ii) Let R be the set of real numbers and A=R-{3} and B=R-{1}
Let the function $f : A \to B$ be defined by $f(x) = \frac{x-1}{x-3}$, show that the function f is bijective.

28.**a)** A businessman openly declares 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 must he mix the two kinds so as to gain 10%?

Or **8**

b) Gold is valued at ` 560 per gram. An alloy of gold and silver weighs 1 kg and its value is ` 4,00,000. If the weights of gold and silver are interchanged, it would worth ` 3,00,000. Find the proportion of gold and silver in the alloy and also the price of silver per kg.

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