Model Question 2023 BBM
Second Semester/Business Mathematics- II

Full Marks: 100, Pass Marks: 50
Time:3 hrs

Candidates are required to give their answers in their own words as far as practicable.
Attempt all questions.
Brief Answer Questions:

Group "A" [10X2=20]

1. Write down the order and degree of differential equation: $\frac{d^2y}{dx^2}^2 - 2 \frac{dy}{dx}^3 + 3y = 0$

2. Find *Fx* and *Fy* when $F\ x,y\ = 3x^3y^3 + 2x^2y^2$

3. Solve the following difference equation: $Y_t = 3\ Y_{t-1}$ when $Y_0 = 3$.

4. Find the area of curve bounded by x-axis and ordinates of $y = 8x^2$ from $x_1 = 0\ and\ x_2 = 2$.

5. .If the marginal revenue MR=1 +10x - $3x^2$, find the total revenue function.

6. Solve the differential equation: $\frac{dy}{dt} = 2t^2$

7. Integrate: $\frac{x+6}{x-4}dx$

8. Find 7(A-B) where $A = \begin{matrix} 8 & 2 \\ 3 & 4 \end{matrix}$ $and\ B = \begin{matrix} 2 & -1 \\ 1 & -3 \end{matrix}$

9. Find the value of determinant: $\begin{matrix} 1 & 4 & 2 \\ 2 & 5 & 1 \\ 3 & 6 & 9 \end{matrix}$

10. Test whether Hawkins-Simon conditions is satisfied or not, A= $\begin{matrix} 1/2 & 1/3 \\ 2/7 & 2/3 \end{matrix}$

GROUP'B' [6X5=30]

Short Answer Question (Attempt any SIX questions)

11. Integrate the following:
    i) $\frac{1}{(x+logx)}dx$
    ii) $\int_0^1 \frac{2x+1}{5x+3} dx$

12. Solve the following differential equation: $\frac{dy}{dt} + \frac{2xy}{1+x^2} = \frac{4x^2}{1+x^2}$

13. Solve the following linear equations by using matrix method or determinant method:
    2x+3y-4z= -1,   3x-2y+2z=14   and   -10x+8y+z=6

14. Solve the difference equation $Y_{t-1} = 0.2Y_t +10$, given $Y_0 = 6$ and find Y_4.

15. A firm has the production function Q=$10L^{0.7}K^{0.3}$, where L and K represent the level of labour and capital respectively. Find out marginal product of labour and capital. Also verify that $L\frac{\delta Q}{\delta L} + K\frac{\delta Q}{\delta K} = Q$.

16. The marginal cost function of a firm be $x^2 + x + 2$ and fixed cost is Rs. 50, where x is the output. Find the total cost function and average cost function when x=10.

17. The demand function is Q=100-2P+0.3P_A+0.2Y, where P=6,P_A=10 and Y=500, find the price elasticity, cross-price elasticity and income elasticity of demand. What happened to demand when (i) P decreases by 10% (ii)P_A increases by 10% (iii) Y increases by 5%?

GROUP 'C'[3X10=30]

Long Answer Questions (Attempt any THREE questions)

18.. The demand and supply function under perfect competition are $Qd = 35 - 0.5P$ and $Qs = -4 + 0.8P$ respectively, where P and Q denote price and quantity respectively. It is given that price is Rs 37 in time period (t) = 0. The rate of adjustment of price when the market is out of equilibrium is $\frac{dp}{dt} = 0.25 \ Qd - Qs$, where $\frac{dp}{dt}$ denotes price in Rs. per week.

(a) Derive and solve the relevant differential equation to get the function for P in terms of t.
(b) What will be the price after 5 and 9 weeks?

19. Assume a Lagged Keynesian microeconomic national income model is $Y_t = C_t + I_t$, Where $C_t = 0.7Y_{t-1} + 100$, $I_t = 500$, where Y_t is total national income, C_t is consumption and I_t is investment.

(a) Solve for Y_t when $Y_0 =$ Rs 2400.
(b) Find the value of Y_5 and Y_{10}.

20. In an economy of two industries P and Q the following tables gives the supply and demand position in millions of rupees.

Producer	User		Final Demand	Total output
	X	Y		
X	150	250	100	500
Y	200	250	300	750

Determine the outputs (a) if the final demand changes to 120 for X and 180 for Y (b) if the final demand changes to 180 for X and 240 for y.

21. A factory produces two product P and Q, each of which processes by two machines X and Y. The total hours available on machine X and machine Y per week are 20 and 35 respectively. The time requirements and profit per unit for each product are listed below:

Machines	products	
	P	Q
X	1	2
Y	1	5
Profit (Rs)	10	30

(a) Find how many units of each of product should be manufactured to maximize profit?
(b) Calculate the maximum profit. (Using simplex method or Graphical method)

Comprehensive Answer Question

22. A joint function of a factory in terms of x and y is given by F(x,y) = $x^3 + xy^2 - 3x$, where x and y representing the output of two goods. Find the
(a) Stationary points.
(b) Saddle points.
(c) Maximum value.
(d) Minimum value.   (5+5+5+5=20)

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Attempt all questions.
Brief Answer Questions:

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Group "A"   [10X2=20]

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1. Find the area of curve bounded by x-axis and ordinates of $y = 4x^2$ from $x_1 = 1$ and $x_2 = 2$.

2. Solve the following difference equation: $Y_t = 2 Y_{t-1}$ when $Y_0 = 5$.

3. Find *Fx* and *Fy* when $F\ x, y = 5x^2y^3 + 3x^3y^2$

4. Integrate: $\frac{x+5}{x-1}dx$

5. Find $(A+B)^T$ where $A = \begin{matrix} 3 & -1 \\ 5 & -2 \end{matrix}$ and $B = \begin{matrix} 2 & -1 \\ 5 & -3 \end{matrix}$

6. Solve the differential equation: $\frac{dy}{dt} = 5ty$

7. Find the value of determinant: $\begin{matrix} 1 & 2 & 2 \\ 2 & 3 & 2 \\ 7 & 8 & 9 \end{matrix}$

8. Test whether Hawkins-Simon conditions is satisfied or not, A= $\begin{matrix} 1/2 & 1/4 \\ 2/5 & 2/3 \end{matrix}$

9...If the marginal revenue MR=10x - 5x^2, find the total revenue function.

10. Write down the order and degree of differential equation: $\frac{d^2y}{dx^2}^{\ 3} - \frac{dy}{dx}^{\ 4} + 4y = 0$

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GROUP'B'   [6X5=30]

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Short Answer Question (Attempt any SIX questions)

11. The annual rate of repair of washing machine is given by $\frac{dc}{dt} = 3t + 8.5$, where "t" is the age of machine in years $\frac{dc}{dt}$ is Rs. per year. Find total cost after 5 years.

12. The demand function is Q=100-2P+P$_A$+0.1Y, where P=10, P$_A$=12 and Y=1000, find the price elasticity, cross-price elasticity and income elasticity of demand. What happened to demand when (i) P decreases by 5% (ii)P$_A$ increases by 5% (iii) Y increases by 10%?

13. Solve the following differential equation: $\frac{dy}{dt} + \frac{y}{t} = \frac{5}{t}$, $given\ y\ 0 = 3$

14. Solve the difference equation: $Y_{t-1} = 0.8Y_t + 10$, given $Y_0 = 5$ and find Y_5.

15. A firm's unit capital and labour costs are 2 and 4 respectively. The production function is $Q = 6KL + 2L^2$, where L and K represent the labour and capital of the production function. If the total input costs are 200 units, what is the maximum possible output Q?

16. Solve the following linear equations (Using inverse matrix method or determinant method):

$$3x+4y+5z=18$$
$$2x-y+8z=13$$
$$5x-2y+7z=20$$

17. Integrate the following:

i) $\int \frac{1}{x(1+logx)} dx$

ii) $\int_0^1 \frac{3x+1}{5x+2} dx$

GROUP 'C' [3X10=30]

Long Answer Questions (Attempt any THREE questions)

18. In an economy of two industries P and Q the following tables gives the supply and demand position in millions of rupees.

Producer	User		Final Demand	Total output
	X	Y		
X	15	10	10	35
Y	20	30	15	65

Determine the outputs (a) if the final demand changes to 12 for X and 18 for Y (b) if the final demand changes to 18 for X and 44 for y.

19. A factory turns out two articles A and B, each of which processes by two machines M and N. The total hours available on machine M and machine N per month are 90 and 150 respectively. The time requirements and profit per unit for each product are listed below:

Machines	Articles	
	A	B
M	1	2
N	2	2
Profit (Rs)	10	15

(a) Find how many units of each of product should be manufactured to maximize profit?
(b) Calculate the maximum profit. (Using simplex method or Graphical method)

20. The demand and supply function under perfect competition are $Qd = 180 - 2P$ and $Qs = -25 + 5P$ respectively, where P and Q denote price and quantity, and price currently is Rs. 30. The rate of adjustment of price when the market is out of equilibrium is $\frac{dp}{dt} = 0.4\ Qd - Qs$, where $\frac{dp}{dt}$ denotes price in Rs. Per week.

(a) Derive and solve the relevant differential equation to get the function for P in terms of t.
(b) What will be the price after 7 and 10 weeks?

21. Assume a Lagged Keynesian microeconomic national income model is $Y_t = C_t + I_t$, Where $C_t = 0.7Y_{t-1}$ + 100 , $I_t = 500$, where Y_t is total national income, C_t is consumption and I_t is investment.
(a) Solve for Y_t when $Y_0 = $ Rs 2300.
(b) Find the value of Y_{10} and Y_{15}.

GROUP'D'   **[1X20=20]**

Comprehensive Answer Question

22. A joint function of a factory in terms of x and y is given by $F(x,y) = -x^3 + 2y^3 - 147x - 54y + 12$, where x and y representing the output of two goods. Find
(a) Stationary points.
(b) Saddle points.
(c) Maximum value.
(d) Minimum value.   (5+5+5+5=20)