MG–556 Seat No.________

First Year B. B. A. Examination

April / May – 2003

Business Mathematics

Time : Hours] [Total Marks :

Instructions : (i) Use of simple **calculator** is **only** allowed.
(ii) Graph papers will be supplied on request.

1 (a) (i) Define the following terms with example : Cartesian product of two sets, combination. **3**
(ii) Prove that there exist one and only one real number b such that $a \cdot b = 1 = b \cdot a$.

(b) If A, B and C are any three sets then using definition of subset prove that, **4**
$(A-B)\cup(B-A)=(A\cup B)-(A\cap B)$.

(c) A committee of six is to be formed from 6 students and 3 professors. In how many ways this can be done so that committee contains atleast 3 students ? **3**

(d) The daily cost of production for x number of units is $C(x)=2.5x+1500$ **4**
(i) If selling price is Rs. 4 per unit, then obtain break even point.
(ii) If selling price increased by Re. 1, then obtain new break even point.

OR

1 (a) (i) Define the following terms with example : Symmetric difference of two sets, proper subset. **3**
(ii) Prove that for every real number a, there exist one and only one real number '1' such that $a \cdot 1 = 1 \cdot a, \ \forall a \in R$.

(b) A class of 100 students appeared for F. Y. B.B.A. examination. Out of 100 students, 40 passed in Mathematics, 36 passed in Management, 60 passed in **4**

Accountancy. 8 students passed in Mathematics and Management, 17 passed in Management and Accountancy, 16 passed in Mathematics and Accountancy, 5 passed in all three subjects.

Find :

(i) How many students passed in exactly one subject ?

(ii) How many students passed in atleast two subjects ?

(c) Prove that, ${}^{n}C_{r} + {}^{n}C_{r-1} = {}^{n+1}C_{r}$. **3**

(d) The cost of producing x units is given by $C(x) = x^2 - 17x + 72$. **4**

(i) It selling price is Rs. 5 per unit then, what number of units should be produced to ensure no loss ?

(ii) If 40 units can be sold daily, then what price should be charged to guarantee no loss ?

2 (a) Define : **4**

(i) Skew Symmetric Matrix

(ii) Orthogonal Matrix

(iii) Upper triangular Matrix

(iv) Non-singular Matrix.

(b) If $A = \begin{bmatrix} 2 & 1 & 2 \\ 1 & 3 & -2 \\ 0 & -1 & 2 \end{bmatrix}_{3\times 3}$ then find, $A^2 - 6A + 2I$, **6**

where I is an identity Matrix of order 3.

Also, find $Adj\ A$.

(c) Find the equation of a straight line passing through the point (5, 7) and the sum of both intercepts on axes is 24. **4**

OR

2 (a) If $A = \begin{bmatrix} 6 & -5 \\ -3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 17 \\ 1 \end{bmatrix}$ then find a matrix X such that $AX = B$. **4**

(b) Solve the following equations using Cramer's rule : **6**

$$x + y + z = 3$$

$$2x - y + z = 2$$

$$x - 2y + 3z = 2.$$

(c) Find the equation of a straight line passing through the points (6, 5) and (10, 5). Also find an equation of a line parallel to this st. line and passing through the point $(-2, -5)$. **4**

3 (a) Evaluate : (any **two**) **4**

(i) $\lim_{x \to 0} \frac{\sqrt{1+x} - 1}{x}$

(ii) $\lim_{n \to \infty} \frac{6n^2 + 8n + 9}{(2n^2 - 5n + 6)}$

(iii) $\lim_{n \to \infty} \left(1 - \frac{6}{n}\right)^{\frac{3}{5}n}$

(iv) $\lim_{x \to 4} \frac{x^3 - 64}{x - 4}$.

(b) Differentiate the following functions w.r.t. x : (any **two**) **4**

(i) $y = \left(\frac{x+8}{3-x}\right)^{2/5}$

(ii) $y = \log(\log x)$

(iii) $y = 3^x x^3 3^3$.

(c) The total cost function of a commodity is given by $C(x) = 25x + 10{,}000$, where demand function of a firm is $x = 2500 - 5P$. Find the value of x (No. of units) at which the firm can expect the maximum profit. **3**

OR

3 (a) Evaluate : (any **two**) **4**

(i) $\lim_{x \to 0} \frac{6^{2x} - 2^{6x}}{5x}$

(ii) $\lim_{m \to 0} \left(1 - \frac{5m}{3}\right)^{\frac{30}{m}}$

(iii) $\lim_{x \to 1} \frac{x^3 - 2x^2 + 2x - 1}{x - 1}$

(iv) $\lim_{x \to 2} \frac{\sqrt{x+4} - \sqrt{6}}{x - 2}$.

(b) Differentiate the following functions w.r.t. x : (any **two**) **4**

(i) $y = 9^{x^3}$

(ii) $y = \log\left(\frac{x^2 - 6x + 10}{2x^2 + 5x - 6}\right)$

(iii) $y = (2x+3)(6x-1)(5-2x)$.

(c) Find the maximum and minimum values of the function $f(x) = \frac{2x^3}{3} + \frac{x^2}{2} - 6x + 8$. **3**

4 (a) Define the following terms : **2**

(i) Integration

(ii) Definite integration.

(b) Evaluate : (any **two**) **4**

(i) $\int \frac{\left(x^2+3x^2-2x+\sqrt[4]{x}+9\right)}{\sqrt{x}}\,dx$

(ii) $\int x^2\left(x^3-9\right)^9 dx$

(iii) $\int \frac{1}{x\log x}\,dx$

(iv) $\int \left(x^2+1\right)\log x\,dx$.

(c) Evaluate : (any **two**) **4**

(i) $\int_6^9 \frac{\sqrt{15-x}}{\sqrt{x}+\sqrt{15-x}}\,dx$

(ii) $\int \frac{x\,(x+1)}{(x+2)\,(2x+1)}\,dx$

(iii) $\int x^2 2^x dx$

(iv) $\int \frac{3x}{\sqrt{x^2+9}}\,dx$.

OR

4 (a) Evaluate : (any **two**) **3**

(i) $\int_0^3 (3-x)^{10}\cdot x\cdot dx$

(ii) $\int \frac{2x^5+1}{x^6+3x} \, dx$

(iii) $\int \frac{\left(x^4+2x^2+6x+10\right)}{\sqrt{x}} \, dx$.

(iv) $\int \left(x^3+3x^2+6x\right)^{\frac{1}{3}} \left(x^2+2x+2\right) dx \cdot$

(b) Evaluate : (any **two**) **4**

(i) $\int \log x \, dx$

(ii) $\int \frac{x\,(x+2)}{(x+1)\,(x-3)} dx$

(iii) $\int \left(\frac{e^{2x}-1}{e^{2x}+1}\right) dx$

(iv) $\int_{-1}^{1} \left(x^4+x^2+9\right) dx$.

(c) The Marginal Revenue of a commodity is given by $MR = 3x^2 - 6x + 25$. If the revenue of producing and selling 2 units is Rs. 50, then obtain average revenue for producing 4 units. **3**

5 (a) A producer produces two products A and B. It requires 20 minutes for the process of each unit of A and 15 minutes for that of B. The maximum available time for process is 150 minutes. A producer can earn a profit of Rs. 25 by selling one unit of A and Rs. 35 by selling one unit of B. Each unit of A requires 5 kg of raw material while that of B requires 4 kg of raw material. The total supply of Raw material is 850 kg only. **4**
Formulate the above problem as a linear programming problem.

(b) Solve the following problem by Graphical Method. **7**

Maximize $Z = 68x + 92y$

Such that

$$9x + 12y \le 108$$

$$20x + 15y \ge 180$$

$$25x + 10y \ge 150$$

Where $x, y \ge 0.$

OR

5 (a) Define the following terms : **2**

Slack variable and Surplus variable.

(b) Using Simplex Method, solve the following linear programming problem : **9**

Maximize $Z = 5x_1 + 7x_2$

S. t.

$$4x_1 + 5x_2 \le 200$$

$$3x_1 + 5x_2 \le 180$$

$$2x_1 + 3x_2 \le 165$$

Where $x_1,\ x_2 \ge 0.$

6 (a) For the following transportation problem, obtain initial basic feasible solution only by using NWCM, LCM and Vogel's approximation method : **6**

		Warehouse				
		W_1	W_2	W_3	W_4	Capacity
FACTORY	F_1	8	11	4	16	28
	F_2	18	8	13	3	10
	F_3	2	15	9	11	38
Requirement		12	26	16	22	

(b) Give the mathematical form of Assignment Problem and show that every assignment problem is a linear programming problem. **4**

OR

6 (a) Solve the following transportation problem obtain optimal basic feasible solution. Use NWCM to obtain initial basic feasible solution : **7**

From \ *To*	W_1	W_2	W_3	
F_1	16	20	12	200
F_2	14	8	18	120
F_3	26	24	16	130
	180	120	150	

(b) Suggest an optimal assignment policy for the given assignment problem : **3**

Jobs

Workers	*I*	*II*	*III*	*IV*
A	32	35	31	40
B	15	18	10	16
C	28	29	24	32
D	22	31	18	19