

First year Diploma in Operations Research Management
Paper - I - Business Mathematics

BB-8959

Con. 2320-08.

(3 Hours)

[Total Marks : 100

- N.B.** (1) Attempt any **five** questions.
 (2) **Figures** to the **right** indicate **full** marks.
 (3) **Necessary** explanations at **intermediate stages** must be given.
 (4) Use of **non-programmable Calculator, Statistical Tables** and **Log tables** is **permitted**.
 (5) Answers should be **brief** and to the **points**.
 (6) Assumptions, **required** in the questions, where **necessary** must be **explained**.

1. (a) 3 metal spheres whose radii are 3, 4 and 5 cm. melted and formed into one sphere. If volume of a sphere varies as the cube of its radius, find the radius of the new sphere. **10**
 (b) Solve for x, the equation **10**

$$\frac{\sqrt{x+2} + \sqrt{x-1}}{\sqrt{x+2} - \sqrt{x-1}} = 3$$

2. (a) Find the square root of **10**
 $12 + \sqrt{24} + \sqrt{56} + \sqrt{84}$
 (b) Solve for x and y : **10**
 $a^x = x^y$ and $a^y = x^x$.

3. (a) If a, b and c are any 3 consecutive positive integers, prove that— **10**
 $\log(1+ac) = 2 \log b$
 (b) Derive the equation of a common tangent to **10**
 $x^2 + y^2 = z$ and $y^2 = 8x$ and plot the graph.

4. (a) A contractor builds 3 types of houses. The raw materials needed are given in the form of a matrix A and the cost of buying and transporting each of the raw materials are also given in the form of a matrix B. Find AB and interpret the entries of (AB) **10**

$$A = \begin{matrix} \text{Type I} \\ \text{Type II} \\ \text{Type III} \end{matrix} \begin{bmatrix} \text{Cement} & \text{Wood} & \text{Steel} \\ 10 & 20 & 5 \\ 20 & 30 & 6 \\ 25 & 40 & 7 \end{bmatrix}, \quad B = \begin{matrix} \text{Cement} \\ \text{Wood} \\ \text{Steel} \end{matrix} \begin{bmatrix} \text{Purchase} & \text{Transport} \\ 15 & 1 \\ 10 & 2 \\ 20 & 3 \end{bmatrix}$$

- (b) A rectangular area of 1000 square feet is to be enclosed by a fence and then divided in the middle by another fence. **10**
 The fence drawn in the middle cost Rs. 0.70 per running foot and the other fence costs Rs. 2.00 per running foot.
 Find the minimum cost of fencing.
5. (a) Define (i) Consumer's surplus, and (ii) Producer's surplus. **10**
 (b) The demand function of the commodity is $p = 20 - 3x$ and the supply function is $p = 2x$ **10**
 Determine the equilibrium price and show that at this price,
 Consumer's surplus = 24
 and Producer's surplus = 16.

[TURN OVER

Con. 2320-BB-8959-08.

6. (a) Evaluate—

10

$$(i) \int \frac{dx}{x \sqrt{x^2 - a^2}} \quad (ii) \int \frac{dx}{(x+2)(x+1)} \quad \text{and} \quad (iii) \int \frac{dx}{2x^3 + 7x^2 + 8x + 3}$$

(b) If $Z = x^3 + 3x^2y + 6xy^2 - y^2$, show that when $x = 2, y = 3$,

10

$$\frac{d^2z}{dx^2} = 30, \quad \frac{d^2z}{dy^2} = 6, \quad \text{and} \quad \frac{d^2z}{dxdy} = 48.$$

7. (a) Find the sum of n terms of the following series :

10

$$(i) \frac{1}{2 \cdot 5} + \frac{1}{5 \cdot 8} + \frac{1}{8 \cdot 11} + \frac{1}{11 \cdot 14}$$

$$(ii) 2 \cdot 5 + 5 \cdot 8 + 8 \cdot 11 + 11 \cdot 14 + \dots$$

(b) A rectangular box with a square base and open top is to be made from 1200 square material. Find volume of the largest box that can be made.

10

8. (a) An Institute of Management uses aptitude test and group discussion for selecting candidates for its management course of those obtaining satisfactory grades in these tests and group discussion. 75% pass the management course examination while only 35% of those whose performance in aptitude test and group discussion was unsatisfactory, pass the management course examination. Can it be said that the aptitude test and group discussion are necessary before admission to the course.

10

(b) If

10

$$y = \frac{1}{3} - \frac{1}{2} \left(\frac{1}{3} \right)^2 + \frac{1}{3} \left(\frac{1}{3} \right)^3 - \frac{1}{4} \left(\frac{1}{3} \right)^4 + \dots$$

then find the sum of the following series :

$$y + \frac{y^2}{2!} + \frac{y^3}{3!} + \frac{y^4}{4!} + \dots$$