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**Part III — BUSINESS MATHEMATICS**

( English Version )

Time Allowed : 3 Hours ]

[ Maximum Marks : 200

**SECTION - A**

- N. B. :
- Answer all the 40 questions.
  - Each question carries one mark.
  - Choose and write the correct answer from the four choices given.
- 40 × 1 = 40

1. The adjoint of  $\begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix}$  is

a)  $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$

b)  $\begin{pmatrix} 0 & -2 \\ -2 & 0 \end{pmatrix}$

c)  $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

d)  $\begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix}$

2. For what value of K the matrix A where  $A = \begin{pmatrix} 2 & K \\ 3 & 5 \end{pmatrix}$  has no inverse ?

a)  $\frac{3}{10}$

b)  $\frac{10}{3}$

c) 3

d) 10.

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3. The rank of a zero matrix is

a) 0

b) 1

c) -1

d)  $\infty$ .

4. The equation  $AX = B$  can be solved by Cramer's rule only when

a)  $|A| = 0$

b)  $|A| \neq 0$

c)  $A = B$

d)  $A \neq B$ .

5. If  $T = \begin{matrix} & A & B \\ A & \begin{pmatrix} 0.7 & 0.3 \\ x & 0.8 \end{pmatrix} \end{matrix}$  is a transition probability matrix, then the value of  $x$  is

a) 0.3

b) 0.2

c) 0.8

d) 0.7.

6. The eccentricity of a parabola is

a) 1

b) 0

c) 2

d) -1.

7. Latus rectum of an ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  ( $a > b$ ) is

a)  $\frac{2a^2}{b}$

b)  $\frac{a^2}{2b}$

c)  $\frac{2b^2}{a}$

d)  $\frac{b^2}{a}$ .







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24. The integrating factor of  $x \frac{dy}{dx} - y = e^x$  is

a)  $\log x$

b)  $e^{-\frac{1}{x}}$

c)  $\frac{1}{x}$

d)  $-\frac{1}{x}$

25. The particular integral of the differential equation  $\frac{d^2 y}{dx^2} - 6 \frac{dy}{dx} + 9y = e^{3x}$  is

a)  $\frac{e^{3x}}{2!}$

b)  $\frac{x^2 e^{3x}}{2!}$

c)  $\frac{x e^{3x}}{2!}$

d)  $9 e^{3x}$

26.  $E =$

a)  $1 + \Delta$

b)  $1 - \Delta$

c)  $\nabla + 1$

d)  $\nabla - 1$

27. In a line of best fit  $y = 5.8(x - 1994) + 41.6$ , the value of  $y$  when  $x = 1997$  is

a) 50

b) 54

c) 59

d) 60

28. If the probability density function of a variable  $X$  is defined as  $f(x) = cx(2-x)$

$0 < x < 2$  then the value of  $c$  is

a)  $\frac{4}{3}$

b)  $\frac{6}{4}$

c)  $\frac{3}{4}$

d)  $\frac{3}{5}$



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34. Probability of rejecting the null hypothesis, when it is true, is

- a) Type I error
- b) Type II error
- c) Sampling error
- d) Standard error.

35. The number of ways in which one can select 2 customers out of 10 customers is

- a) 90
- b) 60
- c) 45
- d) 50.

36. A time series consists of

- a) two components
- b) three components
- c) four components
- d) none of these.

37. Index number is expressed

- a) in percentages
- b) in ratios
- c) in terms of absolute value
- d) all of these.

38. The weights used in Paasche's formula belong to

- a) the base period
- b) the current period
- c) any arbitrary chosen period
- d) none of these.

39. The range of correlation co-efficient is

- a) 0 to  $\infty$
- b)  $-\infty$  to  $\infty$



40. The lines of regression intersect at the point

a)  $(X, Y)$

b)  $(\bar{X}, \bar{Y})$

c)  $(0, 0)$

d) none of these.

### SECTION - B

N. B. : i) Answer any ten out of fifteen questions given.

ii) Each question carries six marks.

$10 \times 6 = 60$

41. Find the inverse of  $A = \begin{pmatrix} -1 & 2 & 1 \\ 0 & 2 & 3 \\ 1 & 1 & 4 \end{pmatrix}$ .

42. Find the rank of the matrix  $A = \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 3 & -2 & 1 \\ 2 & 0 & -3 & 2 \end{pmatrix}$ .

43. Find the equation of the ellipse, whose focus is  $(1, 2)$ , directrix is  $2x - 3y + 6 = 0$ , and eccentricity is  $\frac{2}{3}$ .

44. The cost function for the production of  $x$  units of an item is given by  $C = \frac{1}{10}x^3 - 4x^2 + 20x + 5$ . Find

i) the average cost

ii) the marginal cost

iii) the marginal average cost.

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45. A metal cylinder is heated and expands so that its radius increases at a rate of 0.4 cm per minute and its height increases at a rate of 0.3 cm per minute retaining its shape. Determine the rate of change of the surface area of the cylinder, when its radius is 20 cm and height is 40 cm.
46. Find EOQ for the data given below. Also verify that carrying cost is equal to ordering costs at EOQ :
- Monthly requirements    9000
- Ordering cost per unit    Rs. 200
- Carrying cost per unit    Rs. 3.60
47. Find the area of one loop of the curve  $y^2 = x^2(1 - x^2)$  between  $x = 0$  and  $x = 1$ .
48. The slope of a curve at any point is the reciprocal of twice the ordinate of the point. The curve also passes through the point (4,3). Find the equation of the curve.
49. Solve the differential equation  $\frac{dy}{dx} + y \cot x = 4x \operatorname{cosec} x$  if  $y = 0$  when  $x = \frac{\pi}{2}$ .
50. Find the missing term from the following data :

$x :$	0	5	10	15	20	25
$y :$	7	11	14	-	24	32

51. Fit a straight line for the following data:

$x :$	0	1	2	3	4
$y :$	1	1	3	4	6

52. Ten coins are thrown simultaneously. Find the probability of getting at least 7 heads .

53. A random sample of 500 apples was taken from large consignment and 45 of them were found to be bad. Find the limits at which the bad apples lie at 99% confidence level.

54. From the data given below, find the correlation co-efficient :

$X :$	46	54	56	56	58	60	62
$Y :$	36	40	44	54	42	58	54

55. Construct the cost of living index number for 2003 on the basis of 2000 from the following data using family budget method :

Items	Price		Weight
	2000	2003	
Food	200	280	30
Rent	100	200	20
Clothing	150	120	20
Fuel and lighting	50	100	10
Miscellaneous	100	200	20

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## SECTION - C

N. B. : i) Answer any *ten* questions out of *fifteen* questions given.

ii) Each question carries *ten* marks.

$10 \times 10 = 100$

56. Solve by Cramer's rule the equations  $2x + 2y - z - 1 = 0$ ,  $x + y - z = 0$ ,  
 $3x + 2y - 3z = 1$ .

57. In an economy there are two industries  $P$  and  $Q$  and the following table gives the supply and demand positions in crores of rupees :

Producer	User		Final demand	Total output
	P	Q		
P	10	25	15	50
Q	20	30	10	60

Determine the outputs when the final demand changes to 35 for  $P$  and 42 for  $Q$ .

58. Find the centre, vertices, eccentricity, foci and latus rectum and directrices of the ellipse

$$9x^2 + 16y^2 + 36x - 32y - 92 = 0.$$

59. Find the equation of the tangent and normal at the point  $(a \sec \theta, b \tan \theta)$  on the hyperbola  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

60. Investigate the maxima and minima of the function  $2x^3 + 3x^2 - 36x$

61. A demand for a quantity  $A$  is  $q_1 = 16 - 3p_1 - 2p_2^2$ . Find

i) the partial elasticities  $\frac{E q_1}{E p_1}$ ,  $\frac{E q_1}{E p_2}$

ii) the partial elasticities for  $p_1 = 2$  and  $p_2 = 1$

62. Evaluate :  $\int_{\pi/6}^{\pi/3} \frac{dx}{1 + \sqrt{\cot x}}$

63. The demand and supply functions under pure competition are  $p_d = 16 - x^2$  and  $p_s = 2x^2 + 4$ . Find the consumers' surplus and producers' surplus at the market equilibrium price.

64. Suppose that  $Q_d = 30 - 5p + 2 \frac{dp}{dt} + \frac{d^2p}{dt^2}$  and  $Q_s = 6 + 3p$ . Find the equilibrium price for market clearance. [Where  $Q_d =$  Quantity of demand,  $Q_s =$  Quantity of supply and  $p =$  Price]

65. From the following data, find the number of students whose height in between 80 cm and 90 cm :

<b>Height in cm <math>x</math> :</b>	40-60	60-80	80-100	100-120	120-140
<b>No. of students <math>y</math> :</b>	250	120	100	70	50

66. A continuous random variable has the following p.d.f. :

$$f(x) = kx^2 \quad 0 \leq x \leq 10$$

$$= 0 \quad \text{otherwise.}$$

Determine  $k$  and evaluate (i)  $p(0.2 \leq x \leq 0.5)$  (ii)  $p(x \leq 3)$ .

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67. The I.Q. (Intelligence Quotient) of a group of 1000 schoolchildren has mean 96 and the standard deviation 12. Assuming that the distribution of I.Q. among schoolchildren is normal, find approximately the number of schoolchildren having I.Q.

(i) less than 72, (ii) between 80 and 120.

[Given  $P(0 \leq z \leq 2) = 0.4772$ ,  $P(0 \leq z \leq 1.33) = 0.4082$ ]

68. The income distribution of the population of a village has a mean of Rs. 6,000 and a variance of Rs. 32,400. Could a sample of 64 persons with a mean income of Rs. 5,950 belong to this population?

(Test at both 5% and 1% levels of significance)

69. Solve graphically :

Minimize  $Z = 20x_1 + 40x_2$

subject to  $36x_1 + 6x_2 \geq 108$

$$3x_1 + 12x_2 \geq 36$$

$$20x_1 + 10x_2 \geq 100$$

$$x_1, x_2 \geq 0.$$

70. Calculate the seasonal indices by the method of Simple average for the following

data :

Year	I-quarter	II-quarter	III-quarter	IV-quarter
1985	65	60	61	63
1986	68	55	66	61
1987	68	60	63	67

