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Part III — BUSINESS MATHEMATICS

(English Version)

Time Allowed : 3 Hours]

[Maximum Marks : 200

Instruction : Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

SECTION - A

N. B. : i) Answer *all* the 40 questions.

ii) Choose and write the correct answer from the four choices given. 40 × 1 = 40

1. If $AB = BA = |A|I$ then the matrix B is

- | | |
|-----------------------|-------------------------|
| a) the inverse of A | b) the transpose of A |
| c) the adjoint of A | d) $2A$. |

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. |

[Turn over

23. The solution of $\frac{dp}{dt} = ke^{-t}$ (k is a constant) is

a) $c - \frac{k}{e^t} = p$

b) $p = ke^t + c$

c) $t = \log \frac{c-p}{k}$

d) $t = \log_c p.$

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 $\frac{d^2y}{dx^2} - 5 \frac{dy}{dx} + 6y = e^{5x}$ is

a) $\frac{e^{5x}}{6}$

b) $\frac{xe^{5x}}{2!}$

c) $6e^{5x}$

d) $\frac{e^{5x}}{25}$

26. $\Delta f(x) =$

a) $f(x+h)$

b) $f(x) - f(x+h)$

c) $f(x+h) - f(x)$

d) $f(x) - f(x-h)$

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.

32. The standard error of the sample mean is

- a) Type I error
- b) Type II error
- c) Standard deviation of the sampling distribution of the mean
- d) Variance of the sampling distribution of the mean

33. The Z value that is used to establish 95% confidence interval for the estimation of a population parameter is

- a) 1.28
- b) 1.65
- c) 1.96
- d) 2.58.

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. A decline in the sales of ice cream during November to March is associated with

- a) seasonal variation
- b) cyclical variation
- c) random variation
- d) secular trend.

38. Most frequently used index number formulae are

- a) weighted formulae
- b) unweighted formulae
- c) fixed weighted formulae
- d) none of these.

39. The range of correlation co-efficient is

- a) 0 to ∞
- b) $-\infty$ to ∞
- c) -1 to 1
- d) none of these.

40. The lines of regression intersect at the point

- a) (X, Y)
- b) (\bar{X}, \bar{Y})
- c) $(0, 0)$
- d) none of these.

[Turn over

SECTION - B

N. B. : Answer any ten questions.

10 × 6 = 60

41. Given $A = \begin{pmatrix} 1 & -1 & 1 \\ 2 & 1 & 1 \\ 3 & 1 & -1 \end{pmatrix}$. Verify that $|\text{Adj } A| = |A|^2$.

42. Find the rank of the matrix $\begin{pmatrix} -2 & 1 & 3 & 4 \\ 0 & 1 & 1 & 2 \\ 1 & 3 & 4 & 7 \end{pmatrix}$.

43. Find the equation of the parabola with focus $(1, -1)$ and directrix $x - y = 0$.

44. If $y = \frac{1-2x}{2+3x}$, find $\frac{Ey}{Ex}$. Obtain the values of η when $x = 0$ and $x = 2$.

45. The radius of a circular plate is increasing at the rate of 0.2 cm per second. At what rate is the area increasing when the radius of the plate is 25 cm?

46. Find the stationary points and the stationary values of the function $f(x) = 2x^3 + 3x^2 - 12x + 7$.

47. The elasticity of demand with respect to price p is $\frac{3-x}{x}$, $x < 3$. Find the demand

function and the revenue function when the price is 2 and the demand is 1.

48. Solve : $\frac{dy}{dx} + y \cot x = \text{cosec } x$.

49. Solve : $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 2e^{-3x}$.

50. From the following data find $f(3)$:

$x:$	1	2	3	4	5
$f(x):$	2	5	—	14	32

51. Fit a straight line to the following :

$$\sum x = 10, \sum y = 19, \sum x^2 = 30, \sum xy = 53 \text{ and } n = 5.$$

52. If the function $f(x)$ is defined by $f(x) = ce^{-x}$, $0 \leq x < \infty$, find the value of c .

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. Calculate the correlation co-efficient from the following data :

$$N = 25, \sum x = 125, \sum y = 100, \sum x^2 = 650, \sum y^2 = 436 \text{ and } \sum xy = 520.$$

[Turn over

55. Calculate the cost of living index by aggregate expenditure method :

Commodity	Quantity 2000	Price (Rs.)	
		2000	2003
A	100	8	12.00
B	25	6	7.50
C	10	5	5.25
D	20	48	52.00
E	65	15	16.50
F	30	19	27.00

SECTION - C

N. B. : Answer any ten questions.

10 × 10 = 100

56. Solve the equations $x + 2y + 5z = 23$, $3x + y + 4z = 26$, $6x + y + 7z = 47$ by determinant method.
57. In an economy of two industries P and Q , the following table gives the supply and demand positions in millions of rupees.

Producer	User		Final demand	Total output
	P	Q		
P	16	20	4	40
Q	8	40	32	80

Find the outputs when the final demand changes to

- 12 for P and 18 for Q and also
- 8 for P and 12 for Q .

58. Find the equation to the asymptotes of the hyperbola

$$8x^2 + 10xy - 3y^2 - 2x + 4y - 2 = 0.$$

59. Find the equation of the tangent and normal to the curve

$$y(x-2)(x-3) - x + 7 = 0 \text{ at the point where it cuts the } x\text{-axis.}$$

60. Use Euler's theorem to prove the following :

$$\text{If } z = e^{x^3+y^3} \text{ then prove that } x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y} = 3z \log z.$$

61. The demand for a commodity A is $q_1 = 240 - p_1^2 + 6p_2 - p_1 p_2$. Find the partial

elasticities when $\frac{Eq_1}{Ep_1}$ and $\frac{Eq_1}{Ep_2}$ when $p_1 = 5$ & $p_2 = 4$.

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

63. Under pure competition, the demand and supply laws for commodity are

$$p_d = 56 - x^2 \text{ and } p_s = 8 + \frac{x^2}{3}. \text{ Find the consumer's surplus and producer's}$$

surplus at the equilibrium price.

64. Solve : $\frac{dy}{dx} = \frac{y}{x} - \frac{y^2}{x^2}$.

[Turn over

65. Find the number of men getting wages between Rs. 30 and Rs. 35 from the following table :

Wages : x	20 - 30	30 - 40	40 - 50	50 - 60
No. of men : y	9	30	35	42

66. Ten coins are thrown simultaneously. Find the probability of getting at least 7 heads.
67. In a normal distribution 20% of the items are less than 100 and 30% are over 200. Find the mean and S.D. of the distribution.

Z	0.84	0.525
Area	0.3	0.2

68. The mean lifetime of 50 electric bulbs produced by a manufacturing company is estimated to be 825 hours with a standard deviation of 110 hours. If μ is the mean lifetime of all the bulbs produced by the company, test the hypothesis that $\mu = 900$ hours at 5% level of significance.
69. Solve the following using graphical method :

Maximize $Z = 3x_1 + 4x_2$

subject to the constraints $2x_1 + x_2 \leq 40$

$$2x_1 + 5x_2 \leq 180$$

$$x_1, x_2 \geq 0.$$

70. Compute (i) Laspeyre's, (ii) Paasche's and (iii) Fisher's index numbers from the following table :

Commodity	Price		Quantity	
	Base Year	Current Year	Base Year	Current Year
A	6	10	50	50
B	2	2	100	120
C	4	6	60	60
D	10	12	30	25

10. Compute the Laspeyres and the Fisher's index numbers for the following table:

Commodity	Price		Quantity	
	Base Year	Current Year	Base Year	Current Year
A	5	10	50	50
B	2	2	100	100
C	4	4	50	50
D	10	12	30	30

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