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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. $40 \times 1 = 40$
- 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.

3. The rank of a zero matrix is

a) 0

b) 1

c) - 1

d) ∞

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 |A| = 0 then |Adj A| is

a) 0

b)

c) - 1

d) ± 1 .

6. The eccentricity of a parabola is

2)

b)

c) 2

d) -1

7. The parabola $x^2 + 16y = 0$ is completely

a) above x-axis

b) below x-axis

c) left of y-axis

d) right of y-axis.

- 8. The length of latus rectum of $4x^2 + 9y^2 = 36$ is
 - a) $\frac{4}{3}$

b) $\frac{8}{3}$

c) $\frac{4}{9}$

- d) $\frac{8}{9}$
- 9. Eccentricity of the rectangular hyperbola is
 - a) 2

b) $\frac{1}{2}$

c) √2

- d) $\frac{1}{\sqrt{2}}$
- 10. For the cost function $C = \frac{1}{10}e^{2x}$, the marginal cost is
 - a) $\frac{1}{10}$

b) $\frac{1}{5}e^{2x}$

 $c) \quad \frac{1}{10}e^{2x}$

- d) $\frac{1}{10}e^x$.
- 11. For the function y = 3x + 2, the average rate of change of y when x increases from

1.5 to 1.6, is

a) 1

b) 0.5

c) 0.6

- d) 3.
- 12. The average fixed cost of the function $C = 2x^3 3x^2 + 4x + 8$ is
 - a) $\frac{2}{x}$

 $\frac{4}{x}$

c) $\frac{-3}{x}$

d) $\frac{8}{r}$.

13.	The slope of the	tangent at (2,8) on	the curve	$y = x^3$ is
		0		4	The state of the s

a) 3

b) 12

c) 6

d) 8.

14. For the curve $y = 1 + ax - x^2$, the tangent at (1, -2) is parallel to x-axis. The value of a is

a) -2

b) 2

c) 1

d). -1

15. The maximum value of $f(x) = \cos x$ is

a) 0

b) $\frac{\sqrt{3}}{2}$

c) $\frac{1}{2}$

1) 1.

16. If $u = x^y (x > 0)$ then $\frac{\partial u}{\partial y}$

a) $x^y \log x$

b) $\log x$

c) $y^x \log x$

d) $\log y^x$.

17. If the marginal revenue is Rs. 25 and the elasticity of demand with respect to price is 2, then the average revenue is

a) Rs. 50

b) Rs. 25

c) Rs. 27

d) Rs. 12.50.

18. If R = 5000 units/year, $c_1 = 20$ paise, $c_3 = \text{Rs. } 20$, then E.O.Q. is

a) 1000

b) 5000

c) 200

d) 100.

- $19. \int_{-\pi/2}^{\pi/2} \cos x \, dx \text{ is}$
 - a) 2

b) -2

c) - 1

- d) 1.
- 20. The area bounded by the demand curve xy = 1, x-axis, x = 1 and x = 2 is
 - a) log 2

b) $\log \frac{1}{2}$

c) 2 log 2

- d) $\frac{1}{2} \log 2$.
- 21. If the marginal cost function MC = 2 4x, then the cost function is
 - a) $2x 2x^2 + k$

b) $2-4x^2$

c) $\frac{2}{x} - 4$

- d) $2x 4x^2$.
- 22. The order and degree of the differential equation $\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{\frac{2}{3}} = \frac{d^2y}{dx^2}$ are
 - a) 3 and 2

b) 2 and 3

c) 3 and 3

d) 2 and 2.

23. The solution of $\frac{\mathrm{d}p}{\mathrm{d}t} = ke^{-t}$ (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.

28. The mean and variance of a binomial distribution are

a) np, npq

b) pq, npq

c) np, \sqrt{npq}

d) np, nq.

29. The standard deviation of a Poisson variate is 2. The mean of the Poisson variate

is

a) 2

0) 4

c) $\sqrt{2}$

d) $\frac{1}{\sqrt{2}}$

30. The random variables X & Y are independent if

a) E(XY) = 1

- b) E(XY) = 0
- c) E(XY) = E(X)E(Y)
- d) E(X+Y)=E(X)+E(Y).

31. If a random variable X has the following probability distribution

	To What	CAN	2		
X:	- 1	-2	1	2	
	12	1	1	1 1	
P(x):	3	6	6	3	

then the expected value of X is

a) $\frac{3}{2}$

b) $\frac{1}{6}$

c) $\frac{1}{2}$

d) $\frac{1}{3}$

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32.	The	e standard error of the	sample mean is	ard a 14 construit one debut with the
	a)	Type I error		
	b)	Type II error	.00	
	c)	Standard deviation of	of the sampling distr	ribution of the mean
	d)	Variance of the samp	oling distribution of	the mean.
33.	The	Z value that is used t	o establish 95% cor	nfidence interval for the estimation of
	a po	opulation parameter is	ijo	res V 2 - Coelida book at lotters out? Dis-
	a)	1.28	b)	1.65
	c)	1.96	d)	2.58.
34.	Prol	pability of rejecting the	e null hypothesis wh	nen it is true, is
	a)	Type I error	b)	Type II error
V	c)	Sampling error	d)	Standard error.
35.	The	number of ways in wh	nich one can select 2	2 customers out of 10 customers is
	a)	90	b)	60
	۵)	AE.		

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) -∞ to ∞

c) - 1 to

d) none of these.

40. The lines of regression intersect at the point

a) (X, Y)

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

c) (0,0)

d) none of these.

SECTION - B

N. B.: Answer any ten questions.

 $10 \times 6 = 60$

- 41. Given $A = \begin{pmatrix} 1 & -1 & 1 \\ 2 & 1 & 1 \\ 3 & 1 & -1 \end{pmatrix}$. Verify that $|Adj A| = |A|^2$.
- 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: $\frac{dy}{dx} + y \cot x = \csc x$.

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
			06		0
f(x):	2	5	_	14	32

51. Fit a straight line to the following:

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

- 52. If the function f(x) is defined by $f(x) = ce^{-x}$, $0 \le x < \infty$, 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-efficent from the following data:

$$N = 25$$
, $\Sigma x = 125$, $\Sigma y = 100$, $\Sigma x^2 = 650$, $\Sigma y^2 = 436$ and $\Sigma xy = 520$.

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

Commoditu	Quantity	Price	(Rs.)
Commodity	2000	2000	2003
A	100	8	12.00
В .	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.

 $10 \times 10 = 100$

- 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.

10	Use	er		
Producer	P	9	Final demand	Total output
P	16	20	4	40
g	8	40	32	80

Find the outputs when the final demand changes to

- i) 12 for P and 18 for Q and also
- ii) 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 at the point where it cuts the x-axis.
- 60. Use Euler's theorem to prove the following:

If
$$z = e^{x^3 + y^3}$$
 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 $p_d = 56 x^2 \text{ and } p_s = 8 + \frac{x^2}{3}.$ Find the consumer's surplus and producer's surplus at the equilibrium price.
- 64. Solve: $\frac{dy}{dx} = \frac{y}{x} \frac{y^2}{x^2}.$

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
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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 μ = 900 hours at 5% level of significance.
- 69. Solve the following using graphical method:

Maximize
$$Z = 3x_1 + 4x_2$$

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

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

$$x_1, x_2 \ge 0.$$

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

	P	rice	Quar	ntity
Commodity	Base Year	Current Year	Base Year	Current Year
A	6	10	50	50
В	2	2	100	120
С	4	6	60	60
D	10	12	30	25
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