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+2 MODEL EXAMINATION

Business Mathematics

Time allowed: 3 Hrs]

[Max. Marks: 200

SECTION – A

Note: i) Answer all questions

ii) Each question carries one mark.

iii) Choose the most suitable answer from the given four alternatives.

40 x 1 = 40

1. The rank of an $n \times n$ matrix each of whose elements is 1 is
 a) 1 b) 2 c) n d) n^2
2. The rank of a zero matrix is
 a) 0 b) 1 c) -1 d) ∞
3. If $|A| = 0$ then $|\text{Adj } A|$ is
 a) 0 b) 1 c) -1 d) ± 1
4. 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) $\begin{pmatrix} 0 & 2 \\ 2 & 0 \end{pmatrix}$
5. If the mirror of a_{23} equals the cofactor of a_{23} in $|a_{ij}|$ then the minor of a_{23} is
 a) 1 b) 2 c) 0 d) 3
6. 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) $\frac{b^2}{2a}$
7. Eccentricity of the hyperbola $\frac{x^2}{4} - \frac{y^2}{5} = 1$ is
 a) $\frac{3}{2}$ b) $\frac{9}{4}$ c) $\frac{5}{4}$ d) 4
8. Equation of the directrix of $y^2 = -8x$ is
 a) $x + 2 = 0$ b) $x - 2 = 0$ c) $y + 2 = 0$ d) $y - 2 = 0$
9. If a is the length of the semi transverse axis of rectangular hyperbola $xy = c^2$ then the value of c^2 is
 a) a^2 b) $2a^2$ c) $\frac{a^2}{2}$ d) $\frac{a^2}{4}$
10. For cost function $C = \frac{1}{10}e^{2x}$, the marginal cost is
 a) $\frac{1}{10}$ b) $\frac{1}{5}e^{2x}$ c) $\frac{1}{10}e^{2x}$ d) $\frac{1}{10}e^x$

11. If 60 units of some product cost Rs. 1400 and 40 units cost Rs. 1200 to manufacture, then the variable cost per unit is
 a) Rs. 100 b) Rs.2600 c) Rs.10 d) Rs.5
12. For the function $y = 3x + 2$ 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
13. If $y = 2x^2 + 3x$, the instantaneous rate of change of y at $x = 4$ is
 a) 16 b) 19 c) 30 d) 4
14. The slope of the tangent to the curve $y = \cos t$, $x = \sin t$ at $t = \frac{\pi}{4}$ is
 a) 1 b) 0 c) $\frac{1}{\sqrt{2}}$ d) -1
15. If $u = \log(e^x + e^y)$ then $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y}$ is equal to
 a) $\frac{1}{e^x + e^y}$ b) $\frac{e^x}{e^x + e^y}$ c) 1 d) $e^x + e^y$
16. $f(x, y) = \frac{x^{1/2} + y^{1/2}}{x^{1/3} + y^{1/3}}$ is a homogeneous function of degree.
 a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{1}{6}$ d) $\frac{1}{5}$
17. The maximum value of $f(x) = \cos x$ is
 a) 0 b) $\frac{\sqrt{3}}{2}$ c) $\frac{1}{2}$ d) 1
18. If $R = 5000$ units/year, $C_1 = 20$ paise, $C_2 = \text{Rs. } 20$, then EOQ is
 a) 1000 b) 5000 c) 200 d) 100
19. The area bounded by $y = x$, y -axis and $y = 1$ is
 a) 1 b) $\frac{1}{2}$ c) $\log 2$ d) 2
20. $\int_{-3}^3 x dx$ is
 a) 0 b) 2 c) 1 d) -1
21. The area under the curve $x = g(y)$, the y -axis and the lines $y = c$ and $y = d$ is
 a) $\int_c^d y dy$ b) $\int_c^d x dy$ c) $\int_c^d y dx$ d) $\int_c^d x dx$
22. The degree and order of the differential equation $\frac{d^2 y}{dx^2} - 6 \sqrt{\frac{dy}{dx}} = 0$ are
 a) 2 and 1 b) 1 and 2 c) 2 and 2 d) 1 and 1
23. The solution of $x dx + y dy = 0$ is
 a) $x^2 + y^2 = c$ b) $\frac{x}{y} = c$ c) $x^2 - y^2$ d) $xy = c$
24. The integrating factor of $x \frac{dy}{dx} - y = e^x$ is

- a) $\log x$ b) e^{-x} c) $\frac{1}{x}$ d) $\frac{-1}{x}$
25. The complementary function of the differential equation $(D^2 - 2D + 1)y = e^{2x}$ is
 a) $Ae^x + Be^{-x}$ b) $A + Be^x$ c) $(Ax+B)e^x$ d) $A+Be^{-x}$
26. $E =$ a) $1 + \Delta$ b) $1 - \Delta$ c) $\nabla + 1$ d) $\Delta - 1$
27. The normal equations of fitting a straight line $y = ax + b$ are $10a + 5b = 15$ and $30a + 10b = 43$. The slope of the line of best fit is
 a) 1.2 b) 1.3 c) 13 d) 12
28. If $X \sim N(\mu, \sigma)$, the standard Normal variate is distributed as
 a) $N(0, 0)$ b) $N(1, 0)$ c) $N(0, 1)$ d) $N(1, 1)$
29. The mean and variance of a binomial distribution are
a) np, npq **b) pq, \sqrt{npq}** **c) np, npq** **d) np, nq**
30. The random variables X and 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 $X \sim N(8, 64)$, the standard normal variate Z will be
 a) $\frac{X - 64}{8}$ b) $\frac{X - 8}{64}$ c) $\frac{X - 8}{8}$ d) $\frac{X - 8}{\sqrt{8}}$
32. The critical region for Z at 1% level is
 a) $|Z| \leq 1.96$ b) $|Z| \geq 2.58$ c) $|Z| < 1.96$ d) $|Z| > 2.58$
33. The number of ways in which one can select 2 customers out of 10 customer is
 a) 90 b) 60 c) 45 d) 50
34. Which of the following statements is true?
 a) Point estimate gives a range of values.
 b) Sampling is done only to estimate a statistic.
 c) Sampling is done to estimate the population parameter .
 d) Sampling is not possible for an infinite population.
35. 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
36. A time series consists of
 a) two components b) three components c) four components d) none of these
37. An additive model of time series with the components T, S, C and I is
 a) $Y = T + S + C - 1$ b) $Y = T + S \times C + 1$ c) $Y = T + S + C + 1$ d) $Y = T + S + C \times 1$
38. Variation in the items produced in a factory may be due to
 a) Chance causes b) assignable causes c) both (a) and (b) d) neither (a) or (b)
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 interest at the point.

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

SECTION-B

Note: (i) Answer any Ten questions.

(ii) Question no 55. In compulsory and choose any nine questions from the following.

(iii) Each question carries six marks.

10x6=60

41. Verify $(AB)^{-1} = B^{-1} A^{-1}$, when $A = \begin{bmatrix} 3 & 1 \\ 2 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} -6 & 0 \\ 0 & 9 \end{bmatrix}$

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

43. Find the foci, latus rectum, vertices and directions of the following parabolas: $y^2 + 4x - 2y + 3 = 0$.

44. Find the marginal revenue for the revenue function $R(x) = 100x + \frac{x^2}{2}$, where $x = 10$.

45. For what values of x , is the rate of the increase of $x^3 - 5x^2 + 5x + 8$ is twice the rate of increase of x ?

46. Find the points of inflection of the curve $y = 2x^4 - 4x^3 + 3$.

47. The marginal cost function of manufacturing x units of a commodity is $3x^2 - 2x + 8$. If there is no fixed cost find the total cost and average cost functions.

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

49. Solve: $(1 - e^x) \sec^2 y \, dy + 3e^x \tan y \, dx = 0$.

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

X :	1	2	3	4	5
f(x):	2	5	-	14	32

51. Fit the line of best fit if $\Sigma x = 75$, $\Sigma y = 115$, $\Sigma x^2 = 1375$ $\Sigma xy = 1875$, and $n = 6$.

52. A continuous random variable has the following p.d.f $f(x) = kx^2$; $0 \leq x \leq 10 = 0$ otherwise. Determine k and evaluate (i) $P(-2 \leq x \leq 0.5)$ (ii) $P(x \leq 3)$

53. Out of 1000 TV viewers, 320 watched a particular programme. Find 95 % confidence limits, for TV Viewers who watched this programme.

54. Calculate the correlation coefficient from the following data:

X :	12	9	8	10	11	13	7
Y :	14	8	6	9	11	12	3

55. Obtain the trend values by the method of Semi Average.

Year	1987	1988	1989	1990	1991	1992	1993
Production (in tones)	90	110	130	150	100	150	200

SECTION-C

Note: (i) Answer any Ten questions.

(ii) Question No.70 is compulsory and choose any nine questions from the remaining.

(iii) Each question carries ten marks.

10x10=100

56. Solve by matrix method the equations $x-2y+3z=1$, $3x-y+4z=3$, $2x+y-2z=-1$.

67. Suppose the inter-relationship between the production of two industries P and Q in a year (in lakhs of rupees) is

Producer	User		Final Demand	Total Output
	P	Q		
P	15	10	10	35
Q	20	30	15	65

Find the outputs when the final demands changes to(i)12 for P and 18 for Q(ii)8 for P and 12 for Q

56. Solve by matrix method the equations $x-2y+3z=1$, $3x-y+4z=3$, $2x+y-2z=-1$.

58. Find the equations of the asymptotes of the hyperbola $2x^2 + 5xy + 2y^2 - 11x - 7y - 4 = 0$.

59. Find the elasticity of demand when the demand is $q = \frac{20}{p+1}$ and $p = 3$. Interpret the result.

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

61. A manufacturing company purchases 9000 parts of a machine for its annual requirements. Each part costs Rs. 20. The ordering cost per order is Rs. 15 and carrying charges are 15% of the average inventory per year.

Find (i) economic order quantity (ii) time between each order (iii) minimum average cost.

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

(i) the partial elasticities $\frac{Eq_1}{Ep_1}$, $\frac{Eq_1}{Ep_2}$

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

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 the quantity demanded $Q_d = 42 - 4p - 4 \frac{dp}{dt} + \frac{d^2p}{dt^2}$ and quantity supplied $Q_s = -6 + 8p$ where p is the price. Find the equilibrium price for market clearance.
65. Fit a straight line of the following data:
 X : 4 8 12 16 20 24
 Y : 7 9 13 17 21 25
66. A random variable X has the following probability distribution.
 Values of X , x : 0 1 2 3 4 5 6 7 8
 $p(x)$: a $3a$ $5a$ $7a$ $9a$ $11a$ $13a$ $15a$ $17a$
 (i) Determine the value of a (ii) Find $P(X < 3)$, $P(X > 3)$ and $P(0 < X < 5)$
67. The mean yield for one-acre plot is 663 kgs with a S.D. 32kgs. Assuming normal distribution, how many one-acre plot in a batch of 1000 plots would you expect to have yield (i) over 700kgs (ii) below 650kgs.
68. To test the conjecture of the management that 60 percent employees favour a new bonus scheme, a sample of 150 employees was drawn and their opinion was taken whether they favoured it or not. Only 55 employees out of 150 favoured the new bonus scheme Test the conjecture at 1% level of significance
69. Obtain the two regression equations for the following data:
 X : 4 5 6 8 11
 Y : 12 10 8 7 5
70. Calculate Fisher's Ideal Index from the following data and verify that it satisfies both Times Reversal and Factor Reversal test.

Commodity	Price		Quantity	
	1985	1986	1985	1986
A	8	20	50	60
B	2	6	15	10
C	1	2	20	25
D	2	5	10	8
E	1	5	40	30