11

Register No.

First Revision Examination - 2025

BUSINESS MATHEMATICS AND STATISTICS

Time : 3.00 Hrs Marks : 90

PART - A

Answer all the questions. Choose the correct answer. **20 x 1 = 20**

1. If $A = \begin{vmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{vmatrix}$ then $|2A|$ is equal to a) $4\cos 2\theta$ b) 4 c) 2 d) 1

2. The value of the determinant $\begin{vmatrix} 5 & 5^2 & 5^3 \\ 5^2 & 5^3 & 5^4 \\ 5^4 & 5^5 & 5^6 \end{vmatrix}$ is a) 5 b) 25 c) 0 d) 5^3

3. Thirteen guests has participated in a dinner. The number of handshakes happened in the dinner is a) 715 b) 78 c) 286 d) 13

4. The term containing x^3 in the expansion of $(x - 2y)^7$ is a) 3^{rd} b) 4^{th} d) 5^{th} d) 6^{th}

5. The minimum value of the objective function $z = x + 3y$ subject to the constraints $2x + y \geq 20$, $x + 2y \leq 20$, $x \geq 0$ and $y \geq 0$ is a) 10 b) 20 c) 0 d) 5

6. The objective of network analysis is to a) minimize total project cost b) minimize total project duration c) minimize production delays, interruption and conflicts d) all the above

7. From the following data, $N = 11$, $\Sigma x = 17$, $\Sigma y = 260$, $\Sigma x^2 = 1313$, $\Sigma y^2 = 6580$, $\Sigma xy = 2827$ the correlation coefficient is a) 0.3566 b) –0.3566 c) 0 d) 0.4566

8. If regression co-efficient of y on x is 2, then the regression co-efficient of x on y is a) $\leq \frac{1}{2}$ b) 2 c) $\geq \frac{1}{2}$ d) 1

9. If median = 45 and its coefficient is 0.25, then the mean deviation about median is a) 11.25 b) 180 c) 0.0056 d) 45

10. Probability that both events A and B occur is.....a) P(AUB) b) P(A ∩ B) c) P(A/B) d) P (A ∩ B)

11. The circle touches x-axis, y-axis and the line $x = 6$ then the length of the radius of the circle is.....a) 6 b) 3 c) 12 d) 4

12. The locus of the point 'p' which moves such that p is at equidistance from their coordinate axes is
a) $y = \frac{1}{x}$ b) $y = -x$ c) $y = x$ d) $y = -\frac{1}{x}$

13. $\sin\left(\cos^{-1}\frac{3}{5}\right)$ is.....a) $\frac{3}{5}$ b) $\frac{5}{3}$ c) $\frac{4}{5}$ d) $\frac{5}{4}$

14. The value of $\sec A \sin(270^\circ + A)$ is a) –1 b) $\cos^2 A$ c) $\sec^2 A$ d) 1

15. If $f(x) = \begin{cases} x^2 - 4x & \text{if } x \geq 2 \\ x + 2 & \text{if } x < 2 \end{cases}$, then f(5) is a) –1 b) 2 c) 5 d) 7

16. If $y = e^{2x}$, then $\frac{d^2y}{dx^2}$ at $x = 0$ is a) 4 b) 9 c) 2 d) 0

17. If demand and the cost function of a firm are $p = 2 - x$ and $C = -2x^2 + 2x + 7$ then its profit function is.....
a) $x^2 + 7$ b) $x^2 - 7$ c) $-x^2 + 7$ d) $-x^2 - 7$

18. If the average revenue of a certain firm is ₹50 and its elasticity of demand is 2, then their marginal revenue is
a) ₹50 b) ₹25 c) ₹100 d) ₹75

19. If a man received a total dividend of ₹25,000 at 10% dividend rate on a stock of face value ₹100, then the number of shares purchased a) 3500 b) 4500 c) 2500 d) 300

20. A invested some money in 10% stock at ₹96. If B wants to invest in an equally good 12% stock, he must purchase a stock worth of.....a) ₹80 b) ₹115.20 c) ₹120 d) ₹125.40

PART - B

Answer any seven(7) questions. Q.No.30 is compulsory. **7 x 2 = 14**

21. Prove that $\begin{vmatrix} \frac{1}{a} & bc & b+c \\ \frac{1}{b} & ca & c+a \\ \frac{1}{c} & ab & a+b \end{vmatrix} = 0$

22. From a class of 32 students, 4 students are to be chosen for a competition. In how many ways can this be done?

23. If the centre of the circle $x^2 + y^2 + 2x - 6y + 1 = 0$ lies on a straight line $ax + 2y + 2 = 0$, then find the value of 'a'.

24. Evaluate : $\cos\left(\sin^{-1}\frac{5}{13}\right)$

25. Find the marginal productivities of capital (k) and labour (L) if $P = 8L - 2K + 3K^2 - 2L^2 + 7KL$ when $K = 3$ and $L = 1$.

26. How much will be required to buy 125 of ₹25 shares at a discount of ₹7.

27. An automobile driver travels from plain to hill station 100 km distance at an average speed of 30km per hour. He then makes the return trip at average speed of 20km per hour what is his average speed over the entire distance (200 km)?

28. Calculate the coefficient of correlation from the data : $\Sigma x = 50$, $\Sigma y = -30$, $\Sigma x^2 = 290$, $\Sigma y^2 = 300$ $\Sigma xy = -115$, $N = 10$.

29. If a polygon has 44 diagonals, find the number of its sides.

30. Evaluate : $\lim_{n \to \infty} \frac{\Sigma n^2}{n^3}$

PART - C

Answer any seven (7) questions. Q.No.40 is compulsory **7 x 3 = 21**

31. The technology matrix of an economic system of two industries is $\begin{bmatrix} 0.8 & 0.2 \\ 0.9 & 0.7 \end{bmatrix}$ Test whether the system is viable as per Hawkins Simon conditions

32. Find the independent term of 'x' in the expansion of $\left(x^2 - \frac{2}{3x}\right)^9$

33. Find the angle between the straight lines $x^2 + 4xy + y^2 = 0$

34. Solve $\tan^{-1}(x+2) + \tan^{-1}(2-x) = \tan^{-1}\left(\frac{2}{3}\right)$

35. If $y = a\cos mx + b\sin mx$, then show that $y_2 + m^2 y = 0$

36. For a particular process, the cost function is given by $C = 56 - 8x + x^2$, where 'C' is cost per unit and x, the number of the cost and the corresponding number of units to be produced.

37. A person deposits ₹4,000 in the beginning of every year. If the rate of compound interest is 14% then, find the amount after 10 years. $[(1.14)^{10} = 3.707]$

38. Find the coefficient of correlation between x & y from the following two regression equations.
$4x - 5y + 33 = 0$, $20x - 9y - 107 = 0$

39. Construct a network diagram for the following situation. A < D, E ; B, D < F ; C < G and B < H

40. A bag contains 5 white and 3 black balls. Two balls are drawn at random one after the other without replacement. Find the probability that both balls drawn are black.

PART - D

Answer all the questions. **7 x 5 = 35**

41. In an economy there are two industries P_1 and P_2 and the following table gives the supply and the demand position in crores of rupees.

Production sector	Consumption sector P_1	Consumption sector P_2	Final demand	Gross output
P_1	10	25	15	50
P_2	20	30	10	60

Determine the outputs when the final demand changes to 35 for P_1 and 42 for P_2. **(OR)**

Verify the continuity of the function f(x) given by $f(x) = \begin{cases} 2 - x & \text{if } x < 2 \\ 2 + x & \text{if } x \geq 2 \end{cases}$ at $x = 2$.

42. By the principle of mathematical induction prove that $1.2 + 2.3 + 3.4 + \ldots + n(n+1) = \frac{n(n+1)(n+2)}{3}$, for all $n \in N$. **(OR)**

Find the vertex, focus, axis, directrix, and the length of latus rectum of the parabola $y^2 - 8y - 8x + 24 = 0$

43. Prove that $\cos 20^0 \cos 40^0 \cos 60^0 \cos 80^0 = \frac{1}{16}$ **(OR)**

The demand for a commodity 'x' is $q = 5 - 2p_1 + p_2 - p_1^2 p_2$. Find the partial elasticities $\frac{Eq}{Ep_1}$ and $\frac{Eq}{Ep_2}$ when $p_1 = 3$ and $p_2 = 7$

44. Sundar bought ₹4500, 12% of ₹10 shares at par. He sold them when the price rose to ₹23 and invested the proceeds in ₹25. Shares paying 10% per annum at ₹18. Find the change in his income. **(OR)**
A factory has 3 machines A_1, A_2, A_3 producing 1000, 2000, 3000. Screws per day respectively. A_1 produces 1% defectives, A_2 produces 1.5% and A_3 produces 2% defectives. A screw is chosen at random at the end of a day and found defective. What is the probability that it comes from machines A_1?

45. Calculate rank correlation coefficient of the following data.

Subject 1	40	46	54	60	70	80	82	85	87	90	95
Subject 2	45	46	50	43	40	75	55	72	65	42	70

(OR) Let $U = \log\left(\frac{x^4 + y^4}{x + y}\right)$. By using Euler's theorem show that $x \cdot \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 3$

46. Solve by matrix inversion method.
$3x - y + 2z = 13$;
$2x - y - z = 3$;
$x + 3y - 5z = -8$ **(OR)**
Find out the coefficient of mean deviation about median in the following series.

Age in year	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No. of person	20	25	32	40	42	35	10	8

Calculations have to be made correct to two places of decimals.

47. The following table gives the activities of a project and their duration in days.

Activity	1-2	1-3	2-3	2-4	3-4	3-5	4-5
Duration	5	8	6	7	5	4	8

Construct the network and calculate the earliest start time, earliest finish time, latest start time and latest finish time of each activity and determine the critical path of the project and duration to complete the project. **(OR)**
A cricket team of 11 players is to be formed from 16 players including 4 bowlers and 2 wicket-keepers. In how many different ways can a team be formed so that the team contains atleast 3 bowlers and atleast one wicket - keeper?