COMMON HALF YEARLY EXAMINATION - 2022

Standard XII Reg No. | | | | | | |

BUSINESS MATHEMATICS AND STATISTICS

Time: 3.00 hours ***Marks: 90***

Part - I

I Choose the correct answer **20 x 1 = 20**

1. The rank of the matrix $\begin{pmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 4 & 9 \end{pmatrix}$ is
   a) 0 b) 1 c) 2 d) 3
2. Cramer's Rule is applicable only to get an unique solution when
   a) $\Delta_z \neq 0$ b) $\Delta_x \neq 0$ c) $\Delta \neq 0$ d) $\Delta_y \neq 0$
3. $\int \sqrt{e^x}\, dx$ is
   a) $\sqrt{e^x} + c$ b) $2\sqrt{e^x} + c$ c) $\frac{1}{2}\sqrt{e^x} + c$ d) $\frac{1}{2\sqrt{e^x}} + c$
4. $\Gamma\left(\frac{3}{2}\right)$ a) $\sqrt{\pi}$ b) $\frac{\sqrt{\pi}}{2}$ c) $2\sqrt{\pi}$ d) $\frac{3}{2}$
5. The order and degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^{3/2} - \sqrt{\left(\frac{dy}{dx}\right)} - 4 = 0$ are respectively
   a) 2 and 6 b) 3 and 6 c) 1 and 4 d) 2 and 4
6. The general equation of $\frac{dy}{dx} = \cos x$ is
   a) $y = \sin x + 1$ b) $y = \sin x - 2$
   c) $y = \cos x + c$, c is an arbitrary constant
   d) $y = \sin x + c$, c is an arbitrary constant
7. The profit of a function p(x) is maximum when
   a) MC – MR = 0 b) MC = 0 c) MR = 0 d) MC + MR = 0
8. The area bounded by the parabola $y^2 = 4x$ bounded by its latus rectum is
   a) $\frac{16}{3}$ sq.units b) $\frac{8}{3}$ sq.units c) $\frac{72}{3}$ sq.units d) $\frac{1}{3}$ sq.units
9. If $f(x) = x^2 + 2x + 2$ and the interval of differencing is unity then $\Delta f(x)$
   a) 2x – 3 b) 2x + 3 c) x + 3 d) x – 3
10. If h = 1, then $\Delta(x^2)$ =
    a) 2x b) 2x – 1 c) 2x + 1 d) 1
11. $\int_{-\infty}^{\infty} f(x)\, dx$ is always equal to
    a) zero b) one c) E(X) d) f(x) + 1
12. If X is a random variable then Var(ax + b) =
    a) b^2 var(x) b) a^2 var(x) c) a^2 var(x) + b d) b^2 var(x) + a
13. In a Binomial Distribution, the probability of success is twice as that of failure. then out of 4 trials, the probability of no success is
    a) $\frac{16}{81}$ b) $\frac{1}{16}$ c) $\frac{2}{27}$ d) $\frac{1}{81}$

14. In a parametric distribution the Mean is equal to Variance is
    a) Binomial b) Normal c) Poisson d) all the above
15. Type II error is
    a) accept H_0 when it is wrong b) accept H_0 when it is true
    c) reject H_0 when it is true d) reject H_0 when it is false
16. A _____ is one where each item in the universe has an equal chance of known opportunity of being selected.
    a) parameter b) random sample c) statistic d) entire data
17. The component of a Time series attached to long term variation is trended as
    a) cyclic variation b) secular variations
    c) irregular variation d) seasonal variations
18. A typical control charts consists of
    a) CL, UCL b) CL, LCL c) CL, LCL, UCL d) UCL, LCL
19. The Transportation problem is said to be unbalanced if
    a) Total Supply ≠ Total Demand b) Total Supply = Total Demand
    c) m = n d) m + n – 1
20. North-west corner refers to _____.
    a) top left corner b) top right corner
    c) bottom right corner d) bottom left corner

Part - II

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

21. Find rank of the matrix $\begin{pmatrix} 1 & 2 & -1 & 3 \\ 2 & 4 & 1 & -2 \\ 3 & 6 & 3 & -7 \end{pmatrix}$
22. Find the Revenue Function and the Demand Function of the Marginal Revenue for x unit is $MR = 10 + 3x - x^2$
23. Find the differential equation of $x^2 + y^2 = a^2$
24. Given $U_0 = 1$, $U_1 = 11$, $U_2 = 21$, $U_3 = 28$ and $U_4 = 29$, find $\Delta^4 U_0$
25. Find the expected value for the random variable of an unbiased die.
26. The mean of the binomial distribution is 20 and standard deviation is 4. Find the parameters of the distribution.
27. Define Parameter.
28. Fit a Trend line by Method of Semi-averages for the given data.

Year	2000	2001	2002	2003	2004	2005	2006
Production	105	115	120	100	110	125	135

29. Given the following Pay-off matrix (in Rupees) for 3 strategies and two states of nature.

Strategy	States of Nature	
	E_1	E_2
S_1	40	60
S_2	10	–20
S_3	-40	150

Select a strategy using Maximum Rule.

30. Evaluate : $\int \frac{1}{\sqrt{x}} dx$

Part - III

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

31. Solve by using Cramer's Rule : $2x + 3y = 7$; $3x + 5y = 9$

32. Evaluate : $\int_2^5 \frac{\sqrt{x}}{\sqrt{x} + \sqrt{7 - x}} dx$

33. Using integration find area of circle whose center is at origin and radius a units.

34. Evaluate : $\Delta\left[\frac{1}{(x+1)(x+2)}\right]$ by taking '1' as interval of differentiating.

35. The time to failure in Thousands of hours of an important piece of electronic equipment used in a manufactured DVD player has density function

$$f(x) = \begin{cases} 3e^{-3x} & , x > 0 \\ 0 & , \text{otherwise} \end{cases}$$. Find expected life of the piece of equipment.

36. Mention the properties of Poisson Distribution.

37. The standard deviation of a sample of size 50 is 63. Determine standard error whose population standard deviation is 6?

38. You are given below the value of Sample Mean $\bar{X}$ and range (R) for ten samples of size 5 each. Draw Mean chart and given the following control chart constraint for: $n = 5, A_2 = 0.58, D_3 = 0, D_4 = 2.115$

Sample Number	1	2	3	4	5	6	7	8	9	10
$\bar{X}$	43	49	37	44	45	37	51	46	43	47
R	5	6	5	7	7	4	8	6	4	6

39. Obtain the initial solution for the problem.

		Destination			Supply
	1	2	7	4	5
Sources	2	3	3	1	8
	3	5	4	7	7
	4	1	6	2	14
Demand		7	9	18	

40. Solve : $(3D^2 + D - 14)\, y = 13e^{2x}$

Part - IV

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

41. a) Two types of soaps A and B are in the market. Their present market shares are 15% for A and 85% for B. Of those who bought A the previous year, 65% continue to buy it again while 35% switch over to B. Of those who bought B the previous year 55% buy it again and 45% switch over to A. find their market shares after one year and when is the equilibrium reached. ***(OR)***

b) Evaluate the integral as a limit of a sum $\int_1^2 x^2\, dx$

42. a) Under perfect competition for a commodity the demand and supply laws are $P_d = \frac{8}{x+1} - 2$ and $P_s = \frac{x+3}{2}$ respectively. Find Consumer's and Producer's surplus. ***(OR)***

b) If X is a Normal Variate with Mean 30 and SD 5. Find the probabilities that
i) $26 \le x \le 40$ ii) $x > 45$

43. a) Suppose that Quantity demand $Q_d = 13 - 6p + 2\frac{dp}{dt} + \frac{d^2p}{dt^2}$ and quantity supplied $Q_s = -3 + 2p$ where p is the price. Find equilibrium price market clearance. ***(OR)***

b) Solve the differential equation $\frac{dy}{dx} = \frac{x-y}{x+y}$

44. a) Using Lagrange's Interpolation Formula, find y(10) from the table.

x	5	6	9	11
y	12	13	14	16

(OR)

b) A continuous random variable X has the following probability function.

Value of X = x	0	1	2	3	4	5	6	7
P(x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

i) Find k ii) Evaluate $p(x < 6)$, $p(x \geq 6)$ and $p(0 < x < 5)$

iii) If $p(X \leq x) > \frac{1}{2}$, then find Minimum value of x.

45. a) Find value of f(x) when x = 32 from the following table.

x	30	35	40	45	50
f(x)	15.9	14.9	14.1	13.3	12.5

(OR)

b) Let X be a continuous random variable with probability density function

$f(x) = \begin{cases} \frac{3}{x^4}, & x \geq 1 \\ 0, & \text{otherwise} \end{cases}$. Find mean and variance of X.

46. a) Derive Mean and Variance of Binomial distribution. ***(OR)***

b) A sample of 100 measurements at breaking strength of cotton thread gave a mean of 7.4 and standard deviation of 1.2 gms. Find 95% confidence limits for the mean breaking strength of cotton thread.

47. a) Construct Laspeyre, Paasche's and Fisher's price index number for the data. Comment on the Result.

Commodities	Base Year		Current Year	
	Price	Qty	Price	Quantity
Rice	15	5	16	8
Wheat	10	6	18	9
Rent	8	7	15	8
Fuel	9	5	12	6
Transport	11	4	11	7
Miscellaneous	16	6	15	10

(OR)

b) Consider the following transportation problem. Determine the initial basic feasible solution by VAM (Vogel's Approximation Method)

Destination / Supply	D_1	D_2	D_3	D_4	Availability
O_1	5	8	3	6	30
O_2	4	5	7	4	50
O_3	6	2	4	6	20
Requirement	30	40	20	10	

*****