

HIGHER SECONDARY SECOND YEAR
BUSINESS MATHS
MODEL QUESTION PAPER - 1

TIME: 2.30 HOURS

MARKS: 90

Part-1

Answer all the questions

I. Choose the correct answer: -

20 X 1 = 20

1. If $|\text{Adj}(A)| = 64$ then $|A^{-1}|$

- a) 8
b) $\frac{1}{8}$
c) 32
d) $\frac{1}{32}$

2. If $T = \begin{pmatrix} 0.7 & 0.3 \\ x & 0.8 \end{pmatrix}$ is a transition probability matrix, then the value of x is

- a) 0.3
b) 0.2
c) 2
d) 0.7

3. The eccentricity of a rectangular hyperbola is

- a) 1
b) 1.1
c) 2
d) $\sqrt{2}$

4. The centre of the hyperbola whose asymptotes are $x+y=0$ and $x-y=0$ is

- a) (0,0)
b) (1,0)
c) (0,1)
d) (1,1)

5. For the cost function $C = \frac{e^{-5x}}{10}$, the marginal cost is

- a) $\frac{-1}{10} e^{-5x}$
b) $\frac{-e^{-5x}}{2}$
c) $\frac{e^{-5x}}{10}$
d) $\frac{e^{-5x}}{2}$

Answer any seven questions. Question No.30 is compulsory

21. Find the adjoint of $\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} \begin{pmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{pmatrix}$

22. The cost function $y = \frac{1}{10}x^2 - 3x + 50$ for the production of x units. Find the number of units to be produced at which the cost is minimum.

23. Find the elasticity of the demand function $y = 4x - 8$ at $x = 6$.

24. Is the function $75 - 12x + 6x^2 - x^3$, a decreasing function?

25. Find the area enclosed by $\frac{x}{4} + \frac{y}{8} = 1$, x axis, $x = 0$ and $x = 4$.

26. Form the differential equation of $y = a \cos 3x + b \sin 3x$ where a and b are arbitrary constants.

27. Find the missing term from the following data

$$X : 1 \quad 2 \quad 3$$

$$Y : 7 \quad - \quad 13$$

28. If $p = 0.02$ and $n = 100$ where p denotes the probability of finding a defective item produced by a machine. Find the probability of finding at most 1 defective item.

$$(e^{-2} = 0.13534)$$

29. Find the point estimate of the mean of a population from the following sample taken from a population 21, 25, 20, 16, 12, 10, 17, 18, 13 and 11.

30. Find the correlation coefficient from the regression equation $x = 15.03 - 0.98y$ and $y = 14.72 - 0.93x$.

Part-3

7 x 3 = 21

Answer any of the seven questions. Question No.40 is compulsory.

31. Show that the equations $2x - y + z = 7$; $3x + y - 5z = 13$; $x + y + z = 5$ are consistent and have unique solution.

32. Find the equation of the ellipse whose eccentricity is $e = \frac{1}{2}$. One of the foci is $(-1, 1)$ and the corresponding directrix is $x - y + 3 = 0$.

33. Find the equations of the tangent and normal to the curve $xy = 9$ at $x = 4$.

34. If the production of a firm is given by $P = 3k^2L^2 - 2L^4 - k^4$, Prove that

$$L \frac{\partial P}{\partial L} + K \frac{\partial P}{\partial K} = 4P.$$

35. The marginal cost function is $MC = \frac{100}{x}$. Find the cost function $C(x)$ if $C(6) = 100$. Also find the average cost function.
36. A manufacturing company has found that the cost C of operating and maintaining the equipment is related to the length m of intervals between two overhauls by the equation $m^2 \frac{dC}{dm} + 2mc = 2$ and $c=4$ when $m=2$. Find the relationship between c and m .
37. Find $y(11)$ from the following data
- | | | | | |
|----|----|----|----|----|
| X: | 6 | 7 | 10 | 12 |
| Y: | 13 | 14 | 15 | 17 |
38. The mean of a binomial distribution is 4 and $3q+2p = \frac{11}{4}$ where p and q are respectively the probabilities of success and failures in each trial. Find the variance.
39. Find the trend values to the following data by the method of semi average

Year	1980	1981	1982	1983	1984	1985	1986
Sales	102	105	114	110	108	116	112

40. A random sample of size 50 with mean 67.9 is drawn from a normal population. If it is known that the standard error of the sample mean is $\sqrt{0.7}$. Find 95% confidence interval for the population mean.

Part-4

7x 5 = 35

Answer all the questions:-

41. (a) Find the equation of the hyperbola whose centre is (1,2). The distance between the directrices is $\frac{20}{3}$, the distance between the foci is 30 and the transverse axis is parallel to y-axis.

(Or)

- (b) Two products P and Q share the market currently with shares 70% and 30% each respectively. Each week some brand switching takes place. Of those who bought P the previous week, 80% buy it again whereas 20% switch over to Q. of those who bought Q the previous week, 40% buy it again whereas 60% switch over to P. Find their shares after two weeks. If the price war continues, when is the equilibrium reached?

42. (a). Prove that for the cost function $C = 100 + x + 2x^2$, where x is the output, the slope of AC curve $= \frac{1}{x}(MC - AC)$. [MC is the marginal cost and AC is the average cost]

(OR)

(b) Using Euler's theorem, prove that

$$x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 2 \cot u \text{ if } u = \sec^{-1} \left(\frac{x^2 + y^2}{x - y} \right).$$

43. (a) Suppose that $Q_d = 30 - 5P + 2 \frac{dP}{dt} + \frac{d^2 P}{dt^2}$ and $Q_s = 6 + 3P$. Find the equilibrium price for market clearance.

(Or)

(b) Using Gregory – Newton's formula, find y when $x=85$ from the following data

X	50	60	70	80	90	100
Y	184	204	226	250	276	304

44. (a) In a perfect competition the demand and supply curves of a commodity are given by $P_d = 40 - x^2$ and $P_s = 3x^2 + 8x + 8$. Find the consumer's surplus and producer's surplus at the market equilibrium price.

(Or)

(b) The mean score of 1000 students in an examination is 34 and S.D is 16.

(i) How many candidates can be expected to obtain marks between 30 and 60 assuming the normality of the distribution and

(ii) Determine the limit of the marks of central 70% of the candidates.

45. (a) The mean lifetime of 100 fluorescent light bulbs produced by a company is computed to be 1570 hours with a standard deviation of 120 hours. Test the hypothesis $\mu = 1600$ hours against the alternative hypothesis $\mu \neq 1600$ hours at 5% level of significance.

(Or)

(b) The following data shows the value of sample mean \bar{x} and the range R for ten samples of size 5 each calculate the values for central line and control limits for mean chart and range chart and determine whether the process is in control

Sample No	1	2	3	4	5	6	7	8	9	10
Mean \bar{x}	11.2	11.8	10.8	11.6	11.0	9.6	10.4	9.6	10.6	10.0
Range R	7	4	8	5	7	4	8	4	7	9

(Given for n=5, A2=0.577, D3=0, D4=2.115)

46. (a) Solve the equations $\frac{2}{x} + \frac{8}{y} + \frac{5}{z} = 5$, $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = -2$, $\frac{1}{x} + \frac{2}{y} + \frac{1}{z} = 2$ using matrix method

(Or)

(b) If $U = \log \left(\frac{1}{x^4 + y^4 + z^4} \right)$ then show that $x^3 \frac{\partial^2 u}{\partial y \partial z} = Y^3 \frac{\partial^2 u}{\partial z \partial x} = Z^3 \frac{\partial^2 u}{\partial x \partial y}$

(Or)

47. (a) Solve $(1 + e^{y/x}) dy + e^{y/x} \left(1 - \frac{y}{x}\right) dx = 0$ given that $x=1$, where $y=0$

(Or)

(b) Find the correlation coefficient for

X	46	54	56	56	55	60	62
Y	36	40	44	54	42	58	54

Will the coefficient be changed if each value in X is increased by 10 and each value in Y is decreased by 10?