Time: 3hrs.

General Instructions:
1. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer type questions of 2 marks each.
4. Section C has 6 Short Answer type questions of 3 marks each.
5. Section D has 4 Long Answer type questions of 5 marks each.
6. Section E has 3 case based studies of 4 marks each.

Section - A

1. The objective function of an LPP is
   a) A constraint   b) a function to be optimised   c) functions   d) objective functions

2. If calculated value $|t| < t_v(\alpha)$, then null hypothesis is
   a) rejected   b) can't be determined   c) accepted   d) neither accepted nor rejected

3. For testing the significance of difference between the means of two independent samples, the degree of freedom (v) is taken as
   a) $n_1 + n_2 + 2$ b) $n_1 - n_2 - 2$ c) $n_1 + n_2 - 2$ d) $n_1 - n_2 + 2$

4. The present value of a perpetuity of Rs. R payable at the end of each payment period, when the money is worth i per period is given by
   a) Ri b) $R + \frac{R}{i}$ c) $\frac{R}{i}$ d) $R - Ri$

5. Using flat rate method, the EMI to repay a loan of Rs. 20,000 in 2½ years at an interest rate of 8% p.a. is
   a) Rs. 700   b) Rs. 800   c) Rs. 900   d) Rs. 1000

6. In an LPP, if objective function has $Z = ax + by$ has the same maximum value on two corner points of the feasible region, then the number of points at which Z_{Max} occurs is
   a) 0   b) 2   c) finite   d) infinite

7. Value of $\int \frac{(x+1)(x+\log x)^2}{x} dx$ is
   a) $\frac{(x+\log x)^3}{3} + C$ b) $\frac{(x+\log x)^2}{3} + C$ c) $\frac{(x+\log x)}{3} + C$ c) none

8. $\int (x-1)e^{-x} dx$ is equal to
   a) $(x-2)e^{-x} + C$ b) $x\, e^{-x} + C$ c) $-x\, e^{-x} + C$ d) $(x+1)e^{-x} + C$

9. Value of $\int_0^4 (x + e^{2x}) dx$ is
   a) $\frac{15 + e^8}{2}$ b) $\frac{15 - e^8}{2}$ c) $\frac{e^8 - 15}{2}$ d) $\frac{-e^8 - 15}{2}$

Assertion (A) : When price of a product increases, people prefer to buy less of that product.

Reason (R) : The law of demand states that the demand for a product is inversely related to its price.

20. **Assertion (A) :** A machine costing Rs. 40,000 (originally) has a final scrap value of Rs. 10,000. If annual depreciation is Rs. 5000, then the estimated useful life of machine is 6 years.

Reason (R) : Value of depreciable assets at the end of its useful life is called the scrap value.

Section – B

21. The feasible region for an LPP is shown in the figure. Find minimum value of $Z = 11x + 7y$
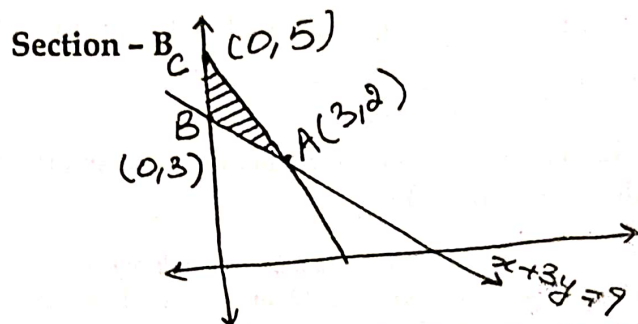
22. Assume an investment's starting at Rs. 20,000 grows to Rs. 50,000 in 3 years. Calculate CAGR. [use $(2.5)^{1/3} = 1.355$]

23. Consider the hypothesis $H_o : \mu \leq 18, H_o : \mu > 18$. A sample of 28 provided sample mean $\bar{x} = 20$, sample S.D., $S = 5.68$, Test whether the null hypothesis is correct or not. [Use $t_{27}(0.05) = 2.052$]

24. Evaluate $\int \frac{x+1}{\sqrt{2x+1}} dx$

25. Marginal revenue function of a commodity is $MR = 12 - 3x^2 + 4x$. Find total revenue from rate of 4 units.

Section – C

26. The demand and supply functions are $D(x) = 25 - x^2$ and $S(x) = 2x + 1$ respectively. Find

   a) The equilibrium point
   b) Consumer's surplus at equilibrium point
   c) Producer's surplus at equilibrium point

27. The mean weekly sales of a four-wheeler were 50 units per agency in 20 agencies. After an advertising campaign, the mean weekly sales increased to 55 units per agency with standard deviation of 10 units. Test whether the advertising campaign was successful.

   (Use $\sqrt{5} = 2.24$, t_{19} (0.05) = 1.729)

28. Solve LPP graphically

   Maximum and minimize $Z = 3x + 5y$ subject to conditions
   $$3x - 4y + 12 \geq 0$$
   $$2x - y + 2 \geq 0$$
   $$2x + 3y - 12 \geq 0$$
   $$0 \leq x \leq 4, \qquad y \geq 2$$

29. Mr. Malik invested Rs. 16,500 on Rs. 100 shares at premium of Rs. 10 paying 15% divider At the end of the year, he sells the shares at a premium of Rs. 20. Find rate of return.

30. In a bank, principal increases continuously at the rate of 10% per year. In how many ye Rs. 5000 double itself?

31. Evaluate $\int (\log x)^2 dx$

b) Cooling   c) Refrigeration   d) Deep freezing

ating

main principle of washing ...

10. Relation between marginal and average cost of producing 'x' units of a product is.

a) $\frac{d}{dx}(AC) = x(MC - AC)$ b) $\frac{d}{dx}(AC) = x(AC - MC)$

c) $\frac{d}{dx}(AC) = \frac{1}{x}(AC - MC)$ d) $\frac{d}{dx}(AC) = \frac{1}{x}(MC - AC)$

11. The marginal revenue function of a community is $MR = 12 + 4x - 3x^2$, find revenue function

a) $12x + x^2 + x^3$ b) $12x + 2x^2 - x^3$ c) $12x - 2x^2 + x^3$ d) $12x + 2x^2 + x^3$

12. The sum of order and degree of differential equation $\frac{dx}{dx} + y = \frac{1+y}{x}$ is

a) 1   b) 2   c) 3   d) 0

13. Solution of differential equation $\frac{dx}{x} + \frac{dy}{y} = 0$ is

a) $\frac{1}{x} + \frac{1}{y} = C$ b) $xy = C$ c) $x + y = C$ d) $\log x \log y = C$

14. A fund which is created to accumulate money over the years to discharge a future obligation is called

a) perpetuity   b) bonds   c) EMI   d) sinking fund

15. A statement made about a population for testing a purpose is called

a) Sample   b) statistics   c) hypothesis   d) none of these

16. Value of $\int_2^4 \frac{x}{x^2+1} dx$ is equal to

a) $\frac{1}{4}\log\left(\frac{5}{17}\right)$ b) $\frac{1}{2}\log\left(\frac{17}{5}\right)$ c) $\frac{1}{2}\log\left(\frac{5}{17}\right)$ d) none of these

17. Value of $\int 2^{2x}.3^x \, dx$ is equal to

a) $\frac{12^x}{\log 12} + C$ b) $\frac{2^{2x}.3^x}{\log 2 .\log 3} + C$ c) $\frac{4.6^x}{\log 6} + C$ d) $(12)^x.\log 12 + C$

18. At what rate of interest will the present value of perpetuity of Rs. 500 payable at the end of each quarter be Rs. 40,000?

a) 1.25% p.a   b) 2.5% p.a   c) 5% p.a   d) 6% p.a

Assertion - Reason Based Questions

The following questions consists of two statements – Assertion (A) and Reason (R). Answer the question selecting appropriate option given below:
a) Both A and R are true and R is correct explanation for R.
b) Both A and R are true but R is not correct explanation for R.
c) A is true but R is false.
d) A is false but R is true.

Section – D

32. The I.Q of 16 students from one area of a city showed a mean of 107 with a standard deviation of 10 while I.Q's of 14 students from another area of city showed a mean of 112 with standard deviation of 8. Is there a significant difference between the IQ's of the two groups at (i) 1% and (ii) 5% level of significance.

33. Evaluate $\int \frac{x^3}{x^4+3x^2+2} dx$

34. The value of a car depreciate 10% every year. By what percent will be value of the car decreases after 3 years.

35. A dietician wishes to mix two kinds of food X and Y in such a way that the mixture contains atleast 10 units of vitamin A, 12 units of vitamin B and 8 units of vitamin C. The vitamin contents of one kg food is given below:

Food	Vitamin A	Vitamin B	Vitamin C
X	1 unit	2 units	3 units
Y	2 units	2 units	1 unit

One kg of food X costs ₹ 24 and one kg of food Y costs ₹ 36. Using linear programming, find the least cost of the total mixture which will contain the required vitamins.

Section – E (Case Studies)

36. Read the following and answer the questions:

A factory manufactures tennis rackets and cricket bats. A tennis racket takes $1\frac{1}{2}$ h of machine time and 3 h of craftsmanship in its making, while a cricket bat takes 3 h of machine time and 1 h of availability of not more than 42 h of machine time and 24 h of craftsmanship. Profit on a racket and on a bar Rs. 20 and Rs. 10 respectively.
   a) If x and y are the numbers of bats and rackets manufactured by the factory, then write the expression of total profit.
   b) Write the constraint that related the number of craftsmanship hours.
   c) Determine the maximum profit (in Rs.) earned by the factory.

37. Read the following and answer the questions:

The marginal revenue of a product (in Rs.) is given by $MR = 7 - 4x + 3x^2$, where x is the number of units produced and sold.
   a) Find the revenue function.
   b) Find the demand function.
   c) Find the average revenue.

38. Read the following and answer the questions:

In the year 2010, Mr. Aggarwal took a home loan of Rs. 30,00,000 from State Bank of India at 7.5% p.a. compounded monthly for 20 years.
   a) Find EMI.
   b) Find the principal paid by Mr. Aggarwal in 150th instalment.
   c) Find the total interest paid by Mr. Aggarwal.

                        OR

   c) How much was paid by Mr. Aggarwal to repay the entire amount of home loan
      (use $(1.00625)^{240} = 4.4608$ and $(1.00625)^{91} = 1.7629$)