

Name of the Unit/Chapter/ Topic-Modulo arithmetic and Congruence Modulo

Objectives: Evolve the idea of modulus of an integer, Learn to apply arithmetic operations using modular arithmetic rules, Learn the concept of congruence modulo, Apply the definition in various problems

Content: Modulo Arithmetic, Congruence Modulo

Method: Lecture Method/ Activity Method / Demonstration Method/ Interaction method/ Problem solving Method

Teaching Aids(i)Power point presentation(ii)smart board(iii)chart -paper

Evaluation:(i)Find $25 \pmod{12}$ (ii) $17 +_{25} 13$ (iii) $17 -_3 13$ (iv)Find the congruence class of 4 modulo 7(v)Find $7^6 \pmod{3}$ (vi)Find the last digit in 12^{12} (vii)Least value of x for which $x \equiv 23 \pmod{7}$, 21Type equation here.

Learning outcomes: Students will be able to ----(i) Define modulus of an integer Apply arithmetic operations(ii)using modular arithmetic rules (iii)Define congruence modulo (iv)Apply the definition in various problems

Reference: (i)Reference book (ii)C.B.S.E students hand book

Name of the Unit/Chapter/ Topic – PIPES AND CISTERN

Objectives: Calculation of the portion of the tank filled or drained by the pipe(s) in unit time.

Content: Pipes and Cisterns are somewhat similar to the concepts of Work and Wages. The problems of pipes and cisterns usually have two kinds of pipes, **Inlet pipe and Outlet pipe / Leak**.

- Inlet pipe is the pipe that fills the tank/reservoir/cistern
- Outlet pipe / Leak is the one that empties it.

Method: Lecture Method/ Activity Method/ Demonstration Method/ Interaction method / Problem solving Method

Teaching Aids: Power point presentation, smart board, chart-paper, Model,



Evaluation:

- It takes two pipes A and B, running together, to fill a tank in 6 minutes. It takes A 5 minutes less than B to fill the tank, then what will be the time taken by B alone to fill the tank?
- If two pipes can fill a tank in 24 and 20 minutes respectively and another pipe can empty 3 gallons of water per minute from that tank. When all the three pipes are working together, it takes 15 minutes to fill the tank. What is the capacity of the tank?
- Pipe A can fill the tank 3 times faster in comparison to pipe B. It takes 36 minutes for pipe A and B to fill the tank together. How much time will pipe B alone take to fill the tank?

- Pipe A and Pipe B can be fill a tank in 20 minutes and 30 minutes respectively. Pipe C can empty the tank in 60 minutes. The tank is initially empty. Both the pipes A and B are opened. Pipe C is opened after 6 minutes. How much time does it take to fill the tank?
- Pipes P and Q can empty a tank in 1 hr and 1.5 hrs respectively. Pipes R and S can fill a tank in 2 hrs and 2.5 hrs respectively. The tank is filled to its capacity of 15 litres and all four pipes are opened simultaneously. How much water remains in the tank after an hour?
- Two pipes A and B can fill a tank in 20 min, when opened simultaneously. If pipe A alone takes 60 minutes to fill the tank, how much time will pipe B alone take to fill the tank?
- A tank has three inlets A,B and C. C takes twice the time taken by A to fill the tank and B takes half the time taken by A to fill the tank. If they can fill the tank together in 4 minutes, find the time taken by B to fill the tank?

Learning outcomes: Students will be able to determine the time taken by two or more pipes to fill or empty the tank.

Reference: Byjus.com

Name of the Unit/Chapter/ Topic: Matrices

Objectives: Evolve the idea of matrix, Learn to identify types of matrices, to find the order of matrices, learn to find the transpose of a matrix, Learn to find symmetric and skew-symmetric of a matrix, Learn to find addition, subtraction and multiplication of matrices

Content: Matrices and types of matrices, Equality of matrices, Transpose of a matrix, Symmetric and Skew symmetric matrix, Algebra of Matrices.

Method: Lecture Method/ Activity Method/Demonstration Method/ Interaction method/ Problem solving Method.

Teaching Aids: Power point presentation, smart board, chart-paper

Evaluation: (i) Write the order of matrix $\begin{bmatrix} 2 & 5 & 8 \\ 1 & 7 & 0 \end{bmatrix}$ (ii) find x and y if $\begin{bmatrix} x+y \\ x-y \end{bmatrix} = \begin{bmatrix} 8 \\ 4 \end{bmatrix}$ (iii) . if

$A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 2 & 4 \\ 3 & -2 & 6 \end{bmatrix}$. Find the value of $2A-B$. (iv) If $A' = \begin{bmatrix} -2 & 3 \\ 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 0 \\ 1 & 2 \end{bmatrix}$, then find $(A + 2B)'$.

(v) Construct a matrix of order 2×2 , whose elements are given by $a_{ij} = \frac{|4i-j|}{2}$ (vi) A matrix $A =$

$\begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix}$ and $A^2 = pA$, then write the value of p. (vii) . Express the matrix $A = \begin{bmatrix} 4 & 2 & -1 \\ 3 & 5 & 7 \\ 1 & -2 & 1 \end{bmatrix}$ as the sum of

a symmetric and skew –symmetric matrix. (viii) if $A = \begin{bmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix}$, find AB and BA.

Learning outcomes: Students will be able to ----(i) Define matrix (ii) Identify different kinds of matrices (iii) Find the size / order of matrices (iv) Determine equality of two matrices (v) Write transpose of given matrix (vi) Define symmetric and skew-symmetric matrix (vii) Perform operations like addition & subtraction on matrices of same order (viii) Perform multiplication of two matrices of appropriate order (ix) Perform multiplication of a scalar with matrix

Reference: (i) NCERT text book (ii) Reference book

Name of the Unit/Chapter/ Topic: APPLICATION OF DERIVATIVES

Objectives:

1. Determine the rate of change of various quantities

2. Understand the gradient of tangent and normal to a curve at a given point
3. Write the equation of tangents and normal to a curve at a given point
4. Define marginal cost and marginal revenue
5. Find marginal cost and marginal revenue
6. Determine whether a function is increasing or decreasing
7. Determine the conditions for a function to be increasing or decreasing
8. Determine critical points of the function
9. Find the point(s) of local maxima and local minima and corresponding local maximum and local minimum values
10. Find the absolute maximum and absolute minimum value of a function
11. Solve applied problems

Content:

1. To find the rate of change of quantities such as area and volume with respect to time or its dimension
2. Gradient / Slope of tangent and normal to the curve
3. The equation of the tangent and normal to the curve (simple problems only)
4. Examples related to marginal cost, marginal revenue, etc.
5. Simple problems related to increasing and decreasing behaviour of a function in the given interval
6. A point $x = c$ is called the critical point of f if f is defined at c and $f'(c) = 0$ or f is not differentiable at c
7. To find local maxima and local minima by: i) First Derivative Test ii) Second Derivative Test
8. Contextualized real life problems

Method: Lecture Method / **Analytic Method**/ Deductive method/ Interaction method/ Problem solving Method

Teaching Aids: Animations /visualisation of objects/ functions with the help of ICT

Evaluation

1. Find the value of 'b' for which $f(x) = x^2 + bx + 1$ is an increasing on $[1, 2]$.
2. Show that function $f(x) = x^3 - x^2 + 7x + 3$ do not have any max./min. value.
3. Find two positive numbers whose sum is 15 and the sum of whose square is minimum.
4. Show that among the rectangle of given perimeter, the square has the greatest area.

Learning outcomes: Students will be able to ----

1. Determine the rate of change of various quantities
2. Understand the gradient of tangent and normal to a curve at a given point
3. Write the equation of tangents and normal to a curve at a given point
4. Define marginal cost and marginal revenue
5. Find marginal cost and marginal revenue
6. Determine the conditions for a function to be increasing or decreasing
7. Find the point(s) of local maxima and local minima and corresponding local maximum and local minimum values
8. Solve applied problems

Reference:

<https://www.cbse.gov.in/>

Name of the Unit/Chapter/ Topic: INTEGRATION AND ITS APPLICATIONS

Objectives:

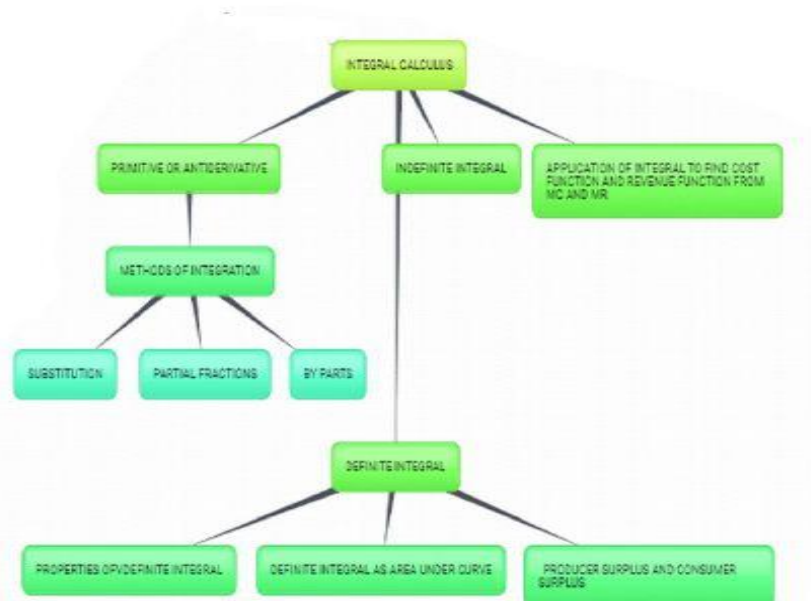
- Integration as a reverse process of differentiation
- Vocabulary and Notations related to Integration

- Simple integrals based on each method (non trigonometric function)
- Evaluation of definite integrals using properties
- Problems based on finding
 - i) Total cost when Marginal Cost is given
 - ii) Total Revenue when Marginal Revenue is given
 - iii) Equilibrium price and equilibrium quantity and hence consumer and producer surplus

Content: Integration, Indefinite Integrals as family of curves, Definite Integrals as area under the curve, Application of Integration.

Method: Lecture Method /Project method/ Demonstration Method/ Interaction method/ Heuristic or Discovery Method

Teaching Aids: Concept map



Evaluation:

1. Evaluate $\int \frac{1}{x^8} dx$

2. Fill in the blanks

i) Cost Function, $C(x) =$ _____

ii) Revenue Function, $R(x) =$ _____

iii) Consumers' Surplus, $CS =$ _____

iv) Producers' Surplus, $PS =$ _____

Learning outcomes: Students will be able to ----

- I. Define the terms: primitive or anti derivative and indefinite integrals
- II. Understand integration as inverse process of differentiation
- III. Understand the indefinite integrals as family of curves
- IV. Find the integral of simple algebraic functions by substitution, using partial fractions and by parts
- V. Define definite integral as area of the region bounded by the curve $y=f(x)$, the xaxis and the ordinate $x=a$ and $x=b$
- VI. Apply properties of definite integrals
- VII. Apply the definite integral to find consumer surplus-producer surplus

Reference: CBSE HANDBOOK APPLIED MATHEMATICS CLASS XI, internet sources.

Name of the Unit/Chapter/ Topic: - DIFFERENTIAL EQUATIONS AND MODELING

Objectives: 1. Concept of Differential Equations and its' Degree and Order.

2. Elimination of arbitrary constant to form the Differential Equation.

3. To solve the Differential Equations.

4. To apply the Differential Equations.

Content: Differential Equations, Order and Degree, Formulating and Solving Differential Equations (Variable Separable and linear Differential Equations) and Application of Differential Equations.

Method: Analytic Method/Synthetic Method/ Inductive & deductive method / Interaction method/ Problem solving Method.

Teaching Aids: The graphs of bacterial growth, the graph of amount paid for a loan in a bank, Graph of carbon decay.

Evaluation: 1. Find order and degree of the following differential equations if exists.

$$\frac{dy}{dx} + \frac{y}{x} = x^3$$

(a)

$$\frac{d^3y}{dx^3} + x^2 \left(\frac{d^2y}{dx^2} \right)^3 = 0$$

(b)

$$xy \frac{d^2y}{dx^2} + x \left(\frac{dy}{dx} \right)^2 - y \frac{dy}{dx} = 0$$

(c)

$$\frac{d^2y}{dx^2} + y^2 + e^{\frac{dy}{dx}} = 0$$

(d)

$$\left(\frac{d^3y}{dx^3} \right)^2 - 3 \frac{d^2y}{dx^2} + 2 \left(\frac{dy}{dx} \right)^4 = y^4$$

(e)

2. Verify that the function $y = ae^{bx}$ is a solution of the differential equation $\frac{d^2y}{dx^2} - b^2y = 0$

3. Form a differential equation representing the family of parabolas having vertex at origin and axis along positive direction of y-axis.

4. Solve the differential equation $\frac{dy}{dx} = e^{x+y} + x^2 e^y$

Learning outcomes: Students will be able to identify a Differential Equation, to understand about Degree and Order of Differential Equations, to differentiate between different type of Differential Equations and able to apply the appropriate method to solve and apply in real life problems and to correlate Differential Equation with other subjects.

Reference: All the sites from where the graphs will be taken, Text book of XII.

Name of the Unit/Chapter/ Topic: PROBABILITY DISTRIBUTIONS

Objectives:

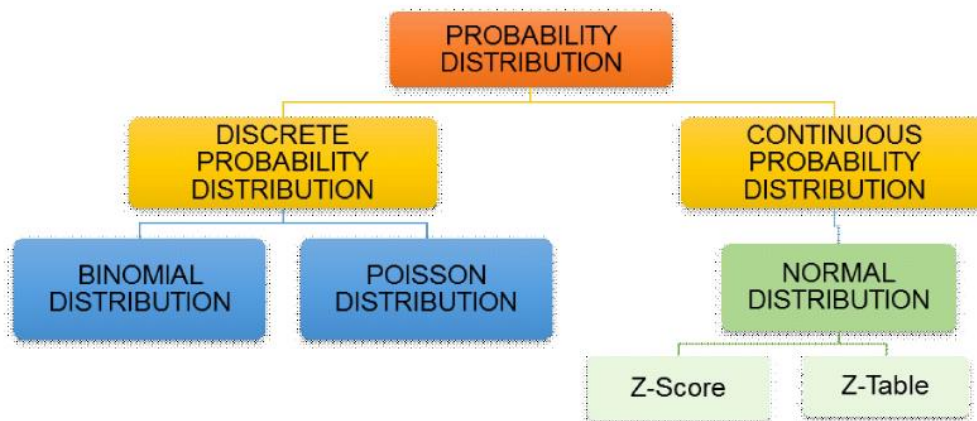
- Definition and example of discrete and continuous random variable and their distribution
- The expected value of discrete random variable as summation of product of discrete random variable by the probability of its occurrence
- Characteristics of the binomial distribution
- Binomial formula: $P(r) = {}^n C_r p^r q^{n-r}$ Where n = number of trials, p = probability of success, q = probability of failure
- Mean = np Variance = npq Standard Deviation = \sqrt{npq}
- Characteristics of Poisson Probability distribution Poisson formula: $P(x) = \frac{\lambda^x e^{-\lambda}}{x!}$.
- Mean = Variance = λ
- Characteristics of a normal probability distribution
- Total area under the curve = total probability = 1

- Standard Normal Variate: $Z = \frac{x - \mu}{\sigma}$ where x = value of the random variable, μ = mean, σ = S.D

Content: Probability Distribution, Mathematical Expectation, Variance, Binomial Distribution, Poisson Distribution, Normal Distribution

Method: Lecture Method/Deductive method / Demonstration Method/ Problem solving Method

Teaching Aids:



Evaluation:

- Let $\mu = E(X)$ be the mean of X . Then the variance of X , denoted by $\text{Var}(X)$ is given by $\text{Var}(X) = \underline{\hspace{2cm}}$
- How to calculate standard deviation denoted by σ_x ?
- What is the probability of 'r' successes in 'n' Bernoulli trials is given by $P('r' \text{ successes})$?
- In a standard normal distribution of data, the Z-score is given by $Z \underline{\hspace{2cm}}$.

Learning outcomes: Students will be able to ----

- Understand the concept of Random Variables
- Distinguish between discrete and continuous random variable
- Understand and apply the concept of Probability Distribution
- Write probability distribution of discrete random variable
- Calculate the mathematical expectation and variance of a discrete random variable
- Understand and apply the concept of Binomial Distribution
- Calculate the mathematical expectation and variance for a binomial distribution
- Understand and apply the concept of Poisson Distribution
- Calculate the mathematical expectation and variance for a Poisson distribution
- Understand and apply the concept of Normal Distribution
- Calculate the mathematical expectation and variance for a normal distribution
- Calculate Z-Score and Use Z-Table to interpret normal distribution data set

Reference: CBSE HANDBOOK APPLIED MATHEMATICS CLASS XI, internet sources.

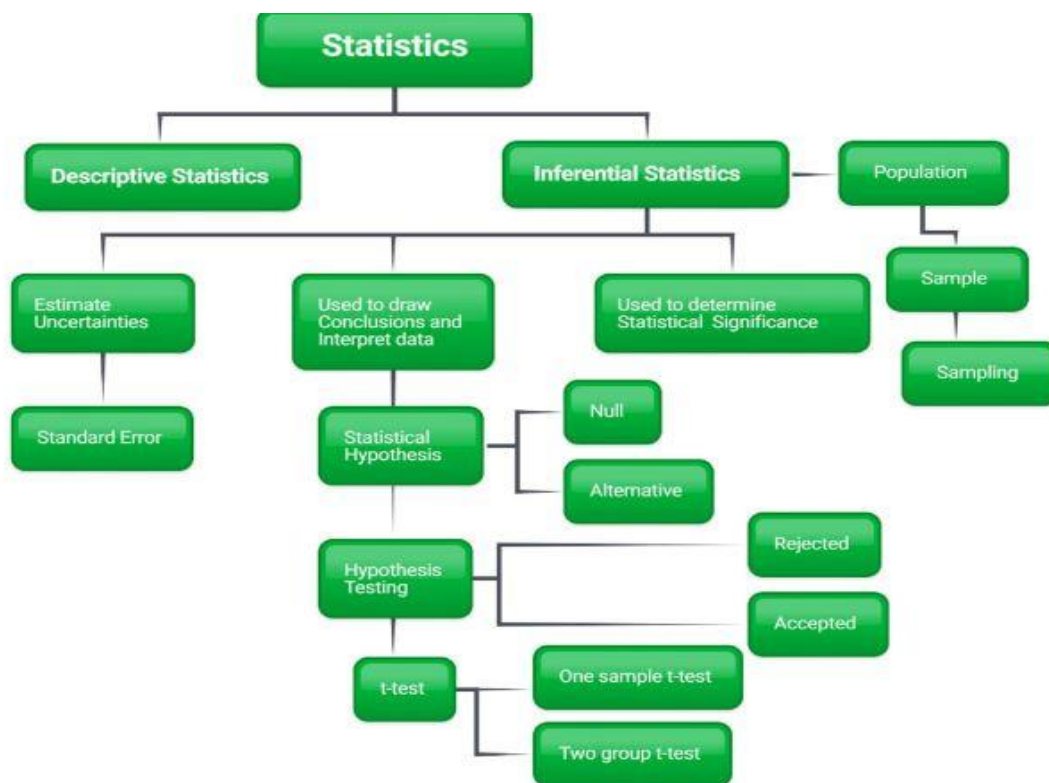
Name of the Unit/Chapter/ Topic: INFERENTIAL STATISTICS

Objectives:

- Develop an understanding of population and sample
- Understand the concept of parameter and statistical interferences
- Understand the idea of a hypothesis testing.
- Use and extend the knowledge of inferential statistics and their applications in real-life situations

Content:

- Population and Sample
- Parameter and Statistics and Statistical Interferences
- t-Test (one sample t-test and two independent groups t-test)
-



Method: Lecture Method / **Analytic Method**/ Demonstration Method/ Interaction method/ Problem solving Method/

Teaching Aids: Concept chart , Data of various observations

Evaluation:

1. What do you called assumed hypothesis which is tested for rejection considering it to be true ?
2. A population consists of four observations 1,3,5,7. What is variance ?
3. A sample of 50 bulbs is taken at random. Out of 50 we found 15 bulbs are of Bajaj, 17 are of Surya and 18 are of Crompton . What is the point estimate of population proportion of Surya ?

Learning outcomes: Students will be able to ----

- Define Population and Sample
- Differentiate between population and sample
- Define a representative sample
- from a population Differentiate between a representative and no representative sample
- Draw a representative sample using simple random sampling
- Draw a representative sample using and systematic random sampling

Reference:

1. Intro to Inferential Statistics (Free course on Udacity) https://www.udacity.com/course/intro-to-inferential-statistics--ud201?irclid=x7HRwbRQBxyLUMFwUx0Mo3QnUkEXcow3a1SISi0&irgwc=1&utm_source=affiliate&utm_medium=&aff=259799&utm_term=&utm_campaign=_gtc_search_&utm_content=&adid=788805
2. Statistical Resources
<https://sixsigmastats.com/>

Name of the Unit/Chapter/ Topic: TIME BASED DATA

Objectives:

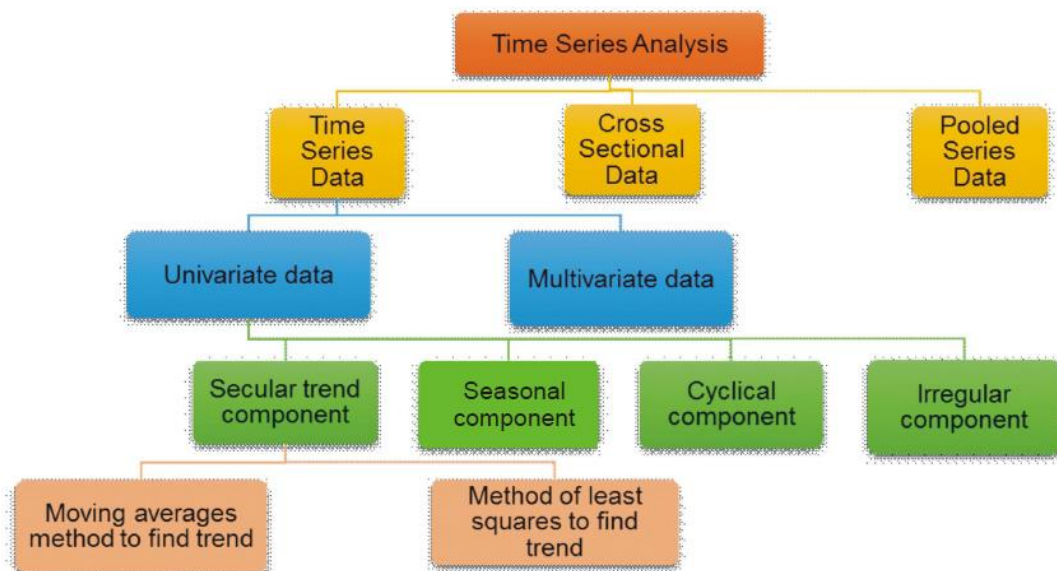
- Meaning and Definition
- Secular trend
- Seasonal variation
- Cyclical variation
- Irregular variation
- Fitting a straight line trend and estimating the value
- The tendency of the variable to increase or decrease over a long period of time
- Moving Average method

- Method of Least Squares

Content: Time Series, Components of Time Series, Time Series analysis for univariate data, Secular Trend, Methods of Measuring trend.

Method: Lecture Method/ **Synthetic Method**

Teaching Aids: Concept map



Evaluation:

1. A rise in prices before Eid is an example of _____
2. Prosperity, Recession, and depression in a business is an example of _____
3. Graph of time series is called _____
4. A fire in a factory delaying production for some weeks is _____
5. Seasonal variations are _____

Learning outcomes: Students will be able to ----

- I) Identify time series as chronological data
- II) Distinguish between different components of time series
- III) Solve practical problems based on statistical data and Interpret the result
- IV) Understand the long term tendency
- V) Demonstrate the techniques of finding trend by different methods

Reference: CBSE HANDBOOK APPLIED MATHEMATICS CLASS XI, internet sources.

Name of the Unit/Chapter/ Topic: Financial Mathematics

Objectives:

1. The concepts of perpetuity, Sinking funds, EMI, Returns, compound annual growth rate and Depreciation.
2. Calculate perpetuity, EMI, Rate of Returns, compound annual growth rate and Depreciation.
3. Differentiate between Sinking funds and saving account, compound annual growth rate and growth rate.

4. Use all the above topics in his/her daily life.

Content: Perpetuity, Sinking funds, Calculation of EMI, Calculation of Returns, Nominal Rate of return, Compound Annual Growth rate and Linear Method of Depreciation.

Method: Analytic Method, Interaction method and Problem solving Method

Teaching Aids: Table for calculation of EMI, growth and Depreciation used in Banks and LIC office.

Evaluation:

1. At what rate converted semi-annually will the present value of perpetuity of Rs 450 payable at the end of each 6 months be Rs 20,000?
2. What is the difference between annuity and perpetuity?
3. What is difference between Present Value and Future Value of an annuity?
4. What is reason behind equal amount of EMI?
5. Explain the nominal rate of interest and effective rate of interest with an example.
6. What is the difference between Sinking Fund and saving account?
7. Give few examples where depreciation value can be calculated? How we can distinguish between Growth and depreciation value?
8. Calculate CAGR of unit sales on the basis of given information:

Year	2013	2014	2015	2016	2017
Sales	53,000	60,786	73,450	86,000	105,000

Learning outcomes: Students will be able to understand rate of growth and depreciation and its application

Reference: 1. www.cbse.nic.in

2. www.sbi.co.in

3. www.licindia.in

Name of the Unit/Chapter/ Topic: - LINEAR PROGRAMMING

Objectives:

- Maximize or minimize the value of a function within a given region,
- Use linear programming to maximize or minimize a value in a real-life situation.

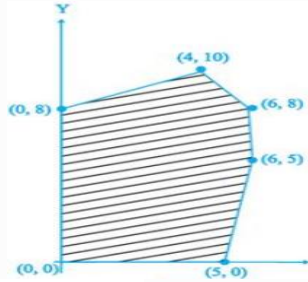
Content: Introduction and related terminology, mathematical formulation of Linear Programming Problems, Different type of LPP, graphical method of solution for problems in two variables, feasible and infeasible regions, feasible and infeasible solutions, optimal feasible solution.

Method: Lecture Method / **Analytic Method/Synthetic Method/** Inductive & deductive method / Interaction method/ Heuristic or Discovery Method/ Problem solving Method.

Teaching Aids: Graph papers, different colour pens, geometry box.

Evaluation:

1. The feasible solution for an LPP is shown in Figure. Let $Z = 3x - 4y$ be the objective function. Minimum of Z occurs at which given point.



- (a) (0, 8) (b) (0,0) (c) (5,0) (d) (4,10)
2. A corner point of a feasible region is a point in the region which is the _____ of two boundary lines.
3. In a L.P.P, the linear inequalities or restrictions on the variables are called _____.
4. In a LPP if the objective function $Z = ax + by$ has the same maximum value on two corner points of the feasible region, then every point on the line segment joining these two points give the _____ value.
5. What is feasible and infeasible region in an LPP?

Learning outcomes: Students will be able to

- formulate a given simplified description of a suitable real-world problem as a linear programming model in general, standard and canonical forms
- sketch a graphical representation of a two-dimensional linear programming model given in general, standard or canonical form
- classify a two-dimensional linear programming model by the type of its solution
- solve a two-dimensional linear programming problem graphically
- use the simple method to solve small linear programming models by hand, given a basic feasible point.

Reference: Text book of XII.