SYLLABUS

B.Com I Year

Subject – Business Mathematics

UNIT – I	Brief history of Vedic mathematics in Indian knowledge tradition, methods and practice of quick calculation of addition, multiplication, division, square and square root of numbers through Vedic mathematics, method of quick verification of answers from Digital Sum.
UNIT – II	Rules for sign in Algebra and practice, Rules for calculation (BODMAS) and practice, Simultaneous Equations – Meaning, Characteristic, types, calculation (with word problems)
UNIT – III	Theory of Indices (preliminary knowledge only formulae), Logarithms and Antilogarithms – principles and calculation, Percentage
UNIT – IV	Ratio, Proportion, Discount and Brokerage
UNIT – V	Commission , Average, profit and loss
Unit - VI	Simple Interest, Compound Interest

UNIT-II

Chapter – 4 - Simultaneous Equations

Equation – Equations signify relation of equality between two algebraic expressions symbolized by the sign of equality '='. In other words, an equation is statement which says that the two algebraic expressions are equal and is satisfied only for certain values of the variables.

Identify – When equality of two algebraic expressions hold true for all values of variables then it is called an identity.

Root of an Equation – The value of unknown or variable for which the equation is true is known as the root of the equation. To find the roots of an equation means to solve the equations.

Degree of an Equation – The degree of an equation is the highest exponent of the variable x or variables (x, y, …) present in the equation is called the degree of an equation.

Linear Equation – An equation which involves power of an unknown quantity not higher than unity (one) is called a linear equation.

One variable Linear Equation – A linear equation in one variable (x, say) in which the highest degree of the variable x is 1. A linear equation in one variable is, in general, written as ax+by = c or ax = c. This equation is also called, "First degree equation in x" or simple equation.

Two variable equation – A linear equation in two variables (x, y, say) in which the highest degree of the variables x and y each is 1. A linear equation in two variables, is general, is written as ax+by+c = 0 or ax+by=d.

Three variable equation – A linear equation in three variables (x, y, z, say) in which the highest degree of the variables x, y and z each is 1. A linear equation in three variables, in general, is written as $a_1x+b_1y+c_1z=d$.

Types of Simultaneous Equations –

i) Linear Simultaneous Equations in two Variables – Two linear equations in two variables together are linear simultaneous equations in two variables, e.g.:

$$4x+y = 2$$
$$3x-5y = 18$$

ii) Linear Simultaneous Equations in three Variables – Three linear equations in three variables together are linear simultaneous equations in three variables, e.g.:

$$3x+5y-7z = 13$$
$$4x+y-12z = 6$$
$$2x+9y-3z = 20$$

iii) Specific type of Simultaneous Equations – The equations in other than linear form are called specific type equations, e.g.:

i) quadratic equation : $ax^2 + bx + c = 0$

ii) reciprocal equation : $\frac{a}{x} + \frac{b}{y} = c$

iii) a $\left(\frac{y}{x}\right) + c = by, etc.$

Characteristics of Simultaneous Equations –

1) A system of linear equations in one variable is not taken under simultaneous equations.

2) The set of values of two variables x and y which satisfy each equation in the system of equations is called the solution of simultaneous equations.
   The solutions of two variable linear simultaneous equations may be –
   i) Infinitely many,
   ii) An unique solution, or
   iii) No solution.
3) For simultaneous equations –
   $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$
   a. If $\frac{a1}{a2} = \frac{b1}{b2} = k$ and $c1 = k$ C_2 then there are infinitely many solutions.
   b. If $\frac{a1}{a2} = \frac{b1}{b2} = c1 \neq$ kc_2, then there is no solution.
   c. If $c_2 \neq 0$, then $c_1 = kc2 \rightarrow \frac{c1}{c2} = k, hence$

$$\frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2} \rightarrow infinitely\ many\ solutions$$

$$and\ \frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2} \rightarrow no\ solution$$

   d. If c_1 and c_2 both are zero (i.e., $c_1=0=c_2$)

Methods of Types of Solving Simultaneous Equation

1. Method of Substitution
2. Method of Elimination
3. Method of Comparison
4. Method of Cross – Multiplication

1. **Method of Substitution :** The substitution method is one of the algebraic methods to solve simultaneous linear equations. It involves substituting the value of any one of the variables from one equation to the other equation.
2. Let us assume two linear equations: 2x+3(y+5)=0 and x+4y+2=0.
3. **Step 1:** Simplify the given equation by expanding the parenthesis if needed. So, here we can simplify the first equation to get 2x + 3y + 15 = 0. Now we have two equations as,
4. 2x + 3y + 15 = 0 ______ (1)
5. x + 4y + 2 = 0 _______ (2)
6. **Step 2:** Solve any one of the equations for any one of the variables. You can use any variable based on the ease of calculation. Suppose we are solving 2nd equation for x. So, we get x = -4y - 2.
7. **Step 3:** Substitute the obtained value of x in the other equation. So we are substituting x = -4y-2 in the equation 2x + 3y + 15 = 0, we get, 2(-4y-2) + 3y + 15 = 0.
8. **Step 4:** Now, simplify the new equation obtained using arithmetic operations.. We get, -8y-4+3y+15=0
9. -5y + 11 = 0
10. -5y = -11
11. y = 11/5
12. **Step 5:** Now, substitute the value of y in any of the given equations. Let us substitute the value of y in equation (2).
13. x + 4y + 2 = 0
14. x + 4 × (11/5) + 2 = 0
15. x + 44/5 + 2 = 0
16. x + 54/5 = 0
17. x = -54/5

18. Therefore, after solving the given linear equations by substitution method, we get x = -54/5 and y= 11/5.

2. Method of Elimination : The elimination method is useful to solve linear equations containing two or three variables. We can solve three equations as well using this method. But it can only be applied to two equations at a time. Let us look at the steps to solve a system of equations using the elimination method

Ex. : Let, x+y=8 __ (1) and 2x-3y=4 __ (2)

Step 1: To make the coefficients of x equal, multiply equation (1) by 2 and equation (2) by 1. We get,

(x+y=8) × 2 __ (1)

(2x-3y=4) × 1 __ (2)

So, the two equations we have now are 2x+2y=16 __ (1) and 2x-3y=4 __ (2).

Step 2: Subtract equation 2 from 1, we get, y=12/5.

$$\begin{array}{rcrcr} \cancel{2x} & + & 2y & = & 16 \\ \cancel{2x} & - & 3y & = & 4 \\ - & & + & & - \\ \hline & & 5y & = & 12 \end{array}$$

$$\boxed{y = \frac{12}{5}}$$

Step 3: Substitute the value of y in equation 1, we get, x + 12/5 = 8

x = 8 - 12/5

x = 28/5

Therefore, x = 28/5 and y=12/5.

3. Method of Comparison : Steps to solve the system of linear equations by using the comparison method **to find the value of x and y.** Therefore, we have compared the values of x obtained from equation (i) and (ii) and formed an equation in y, so this method of solving simultaneous equations is known as the comparison method

Ex. : 3x – 2y = 2 ---------- (i)

7x + 3y = 43 --------- (ii)
Now for solving the above simultaneous linear equations by using the method of comparison follow the instructions and the method of solution.

Step I: From equation 3x – 2y = 2 --------- (i), express **x** in terms of **y**.

Likewise, from equation 7x + 3y = 43 -------- (ii), express **x** in terms of **y**.
From equation (i) 3x – 2y = 2 we get;

3x – 2y + 2y = 2 + 2y (adding both sides by 2y)

or, 3x = 2 + 2y

or, 3x/3 = (2 + 2y)/3 (dividing both sides by 3)

or, x = (2 + 2y)/3

Therefore, x = (2y + 2)/3 ---------- (iii)

From equation (ii) 7x + 3y = 43 we get;

7x + 3y – 3y = 43 – 3y (subtracting both sides by 3y)

or, 7x = 43 – 3y

or, 7x/7 = (43 – 3y)/7 (dividing both sides by 7)

or, x = (43 – 3y)/7

Therefore, x = (–3y + 43)/7 ---------- (iv)

Step II: Equate the values of **x** in equation (iii) and equation (iv) forming the equation in **y**
From equation (iii) and (iv), we get;

(2y + 2)/3 = (–3y + 43)/7 ---------- (v)

Step III: Solve the linear equation (v) in **y**
(2y + 2)/3 = (–3y + 43)/7 ---------- (v) Simplifying we get;

or, 7(2y + 2) = 3(–3y + 43)

or, 14y + 14 = –9y + 129

or, 14y + 14 – 14 = –9y + 129 – 14

or, 14y = -9y + 115

or, 14y + 9y = –9y + 9y + 115

or, 23y = 115

or, 23y/23 = 115/23

Therefore, y = 5

Step IV: Putting the value of **y** in equation (iii) or equation (iv), find the value of **x**
Putting the value of **y** = 5 in equation (iii) we get;

x = (2 × 5 + 2)/3

or, x = (10 + 2)/3

or, x = 12/3

Therefore, x = 4

Step V: Required solution of the two equations

Therefore, x = 4 and y = 5

Method of Cross Multiplication : Cross-multiplication is a technique to determine the solution of linear equations in two variables. It proves to be the fastest method to solve a pair of linear equations. For a given pair of linear equations in two variables:

$$a_1x+b_1y+c_1=0$$

$$a_2x+b_2y+c_2=0$$

By using cross multiplication, the values x and y will be:

$$\frac{X}{B_1C_2 - B_2C_1} = \frac{Y}{A_2C_1 - A_1C_2} = \frac{1}{A_1B_2 - A_2B_1}$$