CHAPTER II

METHOD OF SUBSTITUTION Roll: 240129

**2.1. Change of variable.**

Let , and let ,  
Then, by definition, and .  
Now, .  
 by definition, .

**Note 1.** Thus, if in the integral we put we are to replace by in the expression and also we ar to replace by and then we have to proceed with the integration with as the new variable. After evaluating the integral we are to replace by the equivalent expression in .

Note that though from we can write in making our substitution in the given integral, we generally use it in the differential form . It really means that when and are connected by the relation , I being the funetion of whose differential coefficient with respect to is , it is, when expressed in terms of , identical with the function whose differential coefficient with respect to is which later, by a proper choice of , may possibly be of a standard form, and therefore casy to find out.

**Note 2.** Sometimes it is found convenient to make the substitution in the form where corresponding differential form will be ; by means of these two relations, is transformed into the form

2.2. Illustrative Examples.

**Ex. 1.** Integrate .

Put .

.

**Ex. 2**. Imegrate   
Put

Cor. .

**Ex. 4**. Show that

(i) .  
(i) Put ; then .  
(ii) .

(ii) Similarly, by substituting ,this result follows. Otherwise:  
(i) .  
(ii) .

**EX.5.** Show that

Put   
A.

Itence.  
If the integramal be a fraction such that its numerator is flace differemention coefficient of the desominator, then the integral is equal at logklenominator|.

Thus,

The prociple is also illustrated in Ex, 4 above.

**Ex. 6.** tritegrate .

Now, since the sumerator of the integrand is the differential coefficient of the denominator.

**Ex. 7**. Integrate   
Multiplying the numerator and denominator by we have

Putting , so that ,

Similarly.

**Ex. 8**. thatrate .  
Hotales

Azz or ,  
Now the gives integral becomes

Ninel By the same process we can integrate , wherem is a posidive integer, being a rational number.

**Ex 9.** Iniegrnate .

Pat . Then .  
The given integral then

Note. By the same substitution the integral can be obtained where and are positive integers, or oven when they are fractions such that is a positive integral greater than unity.

Examples –

**(1) (i)**

**(ii)**

**(3) (i)**

**(4)(ii)**

put,

**(5) (i)**

(**6) (i)**

**(ii)**

put,

**(7) (ii)**

**(8)**

**(9) (ii)**

=

**(10)**

**(12) (i)**

**(17) (i)**

**(18) (i)**

put,

**(19) (ii)**

**(21) (i)**

**(29) (i)**

**(36) (ii)**

**(39)**

**Illustrative Examples** Roll: 240128

1. Integrate

Let,

1. Integrate

Put   
and ,

1. Integrate

Hene,

**miscellaneous**

1. . Ans.
2. . Ans.

and   
.

4.   
. Ans.

5.

6.   
 Ans.

**…** E N D**…**