**Particular Solution for Nonhomogeneous Differential Equations –Operator D Method ;**

The nonhomogeneous diff. eq. with form by operator ***D***  ;

So the particular solution for this eq. ;

Where

Or

The theorems on operator ***D*** can be used as rules where is differentiable function ,and ***b*** is constant then ;



To find the particular solution for nonhomogeneous eq. by these theorems ,then there are five cases;

**Case 1: If then ;**

1. **If then the particular solution for eq.; is ;**

….(1)

**Example 1:** Solve the differential equation

The characteristic eq. for homogeneous eq. is

the complementary function is

since

and the particular solution is;

then the general solution is ;

1. **If that is mean has factor from type , where r is positive integer then the particular solution for eq. is;**

……(2)

**Where**

**Note : If , Factories into its factors ,and then use (1) on the factor that don't equal**

**zero, and then use (2) .**

**Example 2:** Solve the differential equation

The characteristic eq. for homogeneous eq. is

the complementary function is )

and the particular solution is;

**=**

then the general solution is ;

**Case 2: If , or there are two ways ;**

1. **First Way ;Put ,and then find particular solution for as in case1 ,**

**and then find particular solution for as a real part for particular solution for**

**and then find particular solution for as an imaginary part for .**

1. **Second Way; By rule 3 put and on in as;**

**Example 3:** Solve the differential equation

The characteristic eq. for homogeneous eq. is and,

the complementary function is

and the particular solution is;

then the general solution is ;

**Example 4:** Solve the differential equation

The characteristic eq. for homogeneous eq. is ,and

the complementary function is )

the particular solution can't founded in previous way since ;

then

find the real part for particular solution for exponential function as;

the real part for particular solution is ;

so the particular solution is;

then the general solution is ;

**Case 3: If is polynomial ,to find the particular solution for eq. , where m is**

**positive integer , write as power for *D* has ;**

**for example if**

**Since then the particular solution is ;**

**Example 5:** Solve the differential equation

The characteristic eq. is ,and

the complementary function is

and the particular solution is

Then the general solution is ;

**Case 4:If where ,from functions,*cos bx ,sin bx* then the particular solution;**

**=**

**Example 6:** Solve the differential equation

The characteristic eq. is ,and

the complementary function is

and the particular solution is

Then the general solution is ;

**Case 5:If ,where is functions *cos ax ,sin ax* then to find the particular solution see**

**this example;**

**Example 7:** Solve the differential equation

The characteristic eq. is ,and

the complementary function is

and the particular solution is

which is an imaginary part for particular solution

Then the particular solution for the eq. is;

and the general solution for the eq. is;