

## SNS COLLEGE OF TECHNOLOGY

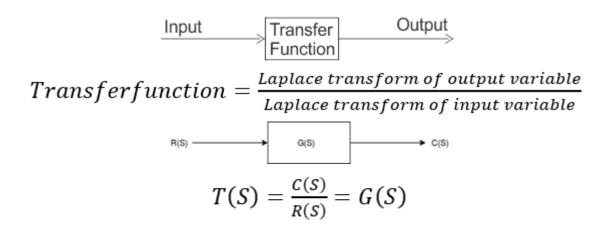
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## 23MCT203 - Theory of Control Engineering

## **Transfer Function**

The transfer function of a system is defined as the ratio of Laplace transform of output to the Laplace transform of input where all the initial conditions are zero.



## Where,

- 1. T(S) = Transfer function of the system.
- 2. C(S) = output.
- 3. R(S) = Reference output.
- 4. G(S) = Gain.

Steps to obtain transfer function -

**Step-1** Write the differential equation.

Step-2 Find out Laplace transform of the equation assuming 'zero' as an initial condition.

Step-3 Take the ratio of output to input.

Step-4 Write down the equation of G(S) as follows -

$$G(S) = \frac{C(S)}{R(S)}$$
  
=  $\frac{b_{[]}S^m + b_{m-1}S^{m-1} + \dots + b_1S + b_0}{a_nS^n + a_{n-1}S^{n-1} + \dots + a_1S + a_0}$  -----Eq.1

Here, a and b are constant, and S is a complex variable

Characteristic equation of a transfer function -

Here, the characteristic equation of a linear system can be obtained by equating the denominator to the polynomial of a transfer function is zero. Thus the characteristic equation of the transfer function of Eq.1 will be: