IFET COLLEGE OF ENGINEERING

DEPT: ECE YEAR/SEM: I/I

Subject: Engineering Mathematics-I Subject Code:MA8151

UNIT-1

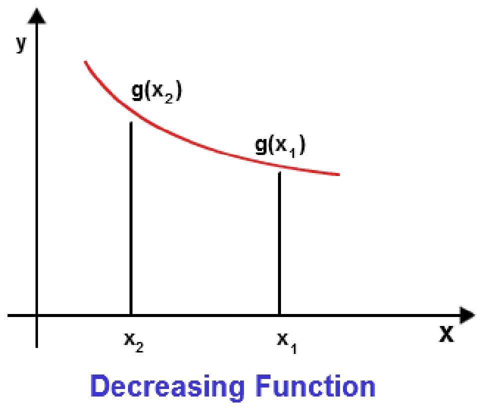
TOPIC- **Monotonic function**

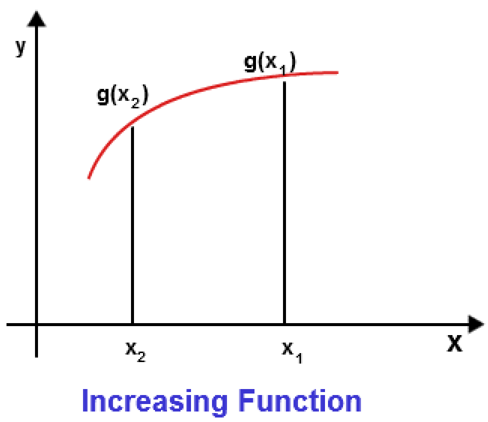
Monotonic functions preserve the given order. The term 'monotonic' means 'no change'. In the context of monotonic function, we can say that this is the function whose successive values are decreasing, increasing or constant.

Generally, the value of a function is vary as the variation of independent value. Monotonic functions sound like maintaining order of function values as independent variable changes. For example, linear polynomials are monotonic.

The graph of a linear polynomial is always a straight line and it maintains monotonic nature over the domain, R (real numbers). If a function is monotonic on an interval then it is decreasing and increasing on that interval.

Derivative test also helps to find whether function is decreasing, increasing or constant. These functions are always regarded as finite valued functions. The concept of monotonic function first used in calculus and later generalized to abstract setting of order theory. In calculus, there are various functions like one to one function, onto functions, monotonic function etc. In this section we will learn about monotonic function in detail.





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UNIT-2

TOPIC- Maxima & Minima – Introduction to Optimization using maxima and minima.

Introduction to Optimization

Optimization is an important tool in making decisions and in analysing physical systems. In mathematical terms, an **optimization problem** is the problem of finding the best solution from among the set of all feasible solutions

Optimization means we are trying to find a maximum or minimum value. Unbounded means there are no constraints on the function

A first objective is to seek the weakest conditions for the existence of an admissible point achieving the extremum (a minimum or a maximum) of an objective function. This will require notions such as continuity, compactness, and convexity and their relaxation to weaker notions of semi continuity, bounded lower or upper sections, and quasiconvexity. When the set of admissible points is specified by differentiable constraint functions, dualizing the necessary optimality condition naturally leads to the introduction of the Lagrange multipliers and the Lagrangian for which the number of unknowns is increased by the number of multipliers associated with each constraint function.

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UNIT-3

Topic -Integration -Integration of some special function (Beta and Gamma)

Beta integral

$$\Gamma(z) = \int_0^\infty e^{-t}\, t^{z-1}\, dt$$

$$u = t^z \quad \Rightarrow \quad du = z t^{z-1}\, dt$$

$$dv = e^{-t}\, dt \quad \Rightarrow \quad v = -e^{-t}$$

$$\Gamma(z+1) = \int_0^\infty e^{-t}\, t^z\, dt = \Big[-e^{-t}\, t^z \Big]_0^\infty + z \int_0^\infty e^{-t}\, t^{z-1}\, dt$$

$$t = 0 \quad \Rightarrow \quad t^n \to 0$$

$$t = \infty \quad \Rightarrow \quad e^{-t} \to 0$$

Therefore

$$\Gamma(z+1) = z \underbrace{\int_0^\infty e^{-t}\, t^{z-1}\, dt}_{\Gamma(z)} = z\, \Gamma(z), \qquad z > 0$$

When $z = 1 \quad \Rightarrow \quad t^{z-1} = t^0 = 1$, and

$$\Gamma(1) = 0! = \int_0^\infty e^{-t}\, dt = \left[-e^{-t} \right]_0^\infty = 1$$

and in turn

$$\begin{aligned}
\Gamma(2) &= 1\, \Gamma(1) = 1 \cdot 1 = 1! \\
\Gamma(3) &= 2\, \Gamma(2) = 2 \cdot 1 = 2! \\
\Gamma(4) &= 3\, \Gamma(3) = 3 \cdot 2 = 3!
\end{aligned}$$

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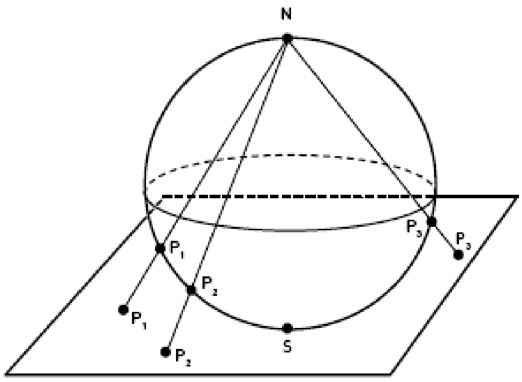
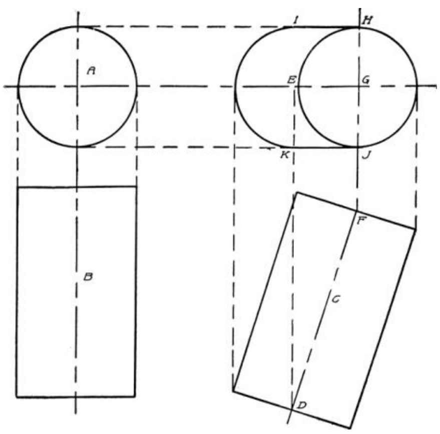
UNIT-4

Triple integration-Projection of 3d to 2d

Sphere to circle



Cylinder to rectangle



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UNIT-5

Differential equation -Introduction to Non-homogeneous partial differential equation

We consider a first-order nonhomogeneous linear differential equation with constant coefficient

$$y' + ay = f(x)$$

Here f(x) is a continuous function of the variable x; a is a constant. Such equations are called nonhomogeneous because of the term f(x) which prevents the equation from being strictly linear. Step1 First, we will look for the solution of the homogeneous part of the equation

$$y' + ay = 0$$

By rearranging this equation, we get

$$y' = -ay$$

we showed earlier that the general solution of such a homogeneous differential equation is

$$y = Ae^{-ax}$$

where A is constant. (Note: look for the variable of equation

Step 2 Second: we will use the method of undetermined coefficients to find a particular solution of the originally given nonhomogeneous differential equation.