

UNIVERSITY GRANTS COMMISSION WESTERN
REGIONAL OFFICE GANESHKHIND, PUNE 411007

**EXECUTIVE SUMMARY OF THE PROJECT ON
'CALCULUS AN INTUITIVE APPROACH '**

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3. UGC Approval No. and Date :- File No. 47-278/12 (WRO)
Dated 29th March, 2013.
4. Date of Implementation:- 1st April 2014
5. Tenure of the Project:- 1st April 2014 to 31st March 2015
6. Total Grant Allocated:- Rs. 105000/-
7. Total Grant Received:- Rs. 85000/-
8. Final Expenditure:- Rs. 83407/-
9. Tital of the Project:- 'Calculus an intuitive approach'
10. Objectives of the Project:- Primarily the project is written for the students of first year degree course. There are four fundamental concepts of Mathematics these are set, function, limit and continuity. The student must understand these concepts mathematically.
11. Whether objectives were achieved:- Yes
12. Achievements from the Project:- These are already given.
13. Summary of finding:- Attached
14. Contribution to society:- --

EXECUTIVE SUMMARY

As we all know the subject Mathematics is called as queen of all sciences. There are four fundamental pillars of mathematics these are set, function, limit and continuity. These concepts are very important concepts in mathematics. As far as students of first year degree course is considered these concepts are far more important for him. Among these concepts the concept of limit is slightly difficult to understand. When we consider sequences of real numbers, the concept of limit of a sequence is very important one. This concept involves notion of a distance. If x and y are any two real numbers then distance between them is given by $|x-y|$ where the modulus sign gives us the absolute value. The limit of a sequence of real numbers has following definition. The real number L is called as limit of a sequence S_n as n tends to infinity if for any real number $\epsilon > 0$ there exist a natural number n_0 such that $|S_n - L| < \epsilon$ for all natural numbers $n > n_0$. Here S_n means the n th term of the sequence which is a real number. L is also a real number, then $|S_n - L|$ simply gives us distance between S_n & L . Now if we choose smaller and smaller ϵ then the statement $|S_n - L| < \epsilon$ gives us the degree of closeness between S_n & L determined by ϵ or in general we can say that as the natural number n tends to infinity the real number S_n gets arbitrarily close to the real number L . Here $|S_n - L| < \epsilon$ gives us the open set or open interval $(L - \epsilon, L + \epsilon)$ and S_n will be any real number within the interval. Now we can say that S_n tends to L as n tends to infinity. If a student understands concept of limit of a sequence he can easily understand the concept of limit of a function of real number. For this purpose, although sequences is a function defined on set of natural numbers, I have taken sequences as first topic. Next to that the concept of continuity comes. When we say that a function $f(x)$ is continuous at a point $x=c$ we have to consider the behavior of function $f(x)$ near the point $x=c$. That is we have to consider how the function $f(x)$ behaves in small open interval centred around $x=c$. the word continuous means unbreakable or uninteruptible. Or continuous mean a thing without brake or gap.

△ △ Next I have considered derivative or differentiation. What actually derivative means? It is a rate of change in dependent variable subject to change in independent variable. Geometrically derivative at the point $x=c$ means slope of the tangent drawn to the curve $y=f(x)$ at $x=c$. But to draw a tangent at $x=c$ the curve must be continuous at $x=c$. So in order to have derivative at $x=c$ the function must be continuous at $x=c$. So continuity is necessary for having derivative. Suppose the independent variable x is changed by amount Δx Then we note the change in dependent variable y . If it is Δy then $\frac{\Delta y}{\Delta x}$ gives us average rate of change in y . Now we consider sequence of such ratios as Δx tends to zero. Then the limit of such sequence is called as derivative. Now we know that mean value theorems are very important for mathematics I have included the topic mean value theorems in the project.

The next two topics are of integration. The indefinite integral and definite integral. The indefinite integral is also called as antidifferentiation. If a function $f(x)$ has a derivative $F(x)$ then integration of $F(x)$ is the original function $f(x)$ plus a constant. The definite integral is again limit of sum. Also some geometric applications of definite integral are included.