

SEMESTER-I

F.Y (VOCATIONAL SKILL COURSE (VSC))		
Title of the Course and Course Code : VGVUSVS103	CALCULUS -I	No. of Credits: 02
Unit No.	Content	No. of Lectures
I	<p>Real Number System</p> <p>Real number system R and order properties of R , Absolute value and its properties, AM-GM inequality, Cauchy Schwarz inequality, Intervals and neighbourhoods, Hausdroff property, Bounded sets, supremum, infimum and their properties, statement of L.U.B. axiom, Archimedean property and its applications, Density of rationals in R, Existence of nth root of positive real numbers.</p>	10 Hrs.
II	<p>Sequences</p> <p>Definition of a sequence and examples, convergence and divergence of sequences, Boundedness of convergent sequence, Uniqueness of limit of a convergent sequence, Algebra of convergent sequences, Sandwich theorem, Monotone sequences, monotone convergence theorems and consequences. Subsequence, Cauchy sequence and examples. Every convergent sequence is a Cauchy sequence. Boundedness of a Cauchy sequence. Cauchy Completeness property.</p>	10 Hrs.
III	<p>Limits and Continuity</p> <p>Graphs of some standard functions such as $x , e^x, \sin x, \cos x, \tan x, \ln x, \frac{1}{x}$ over suitable intervals of R. limit of a function, $(\epsilon - \delta)$ definition of limit of a function, Evaluation of limit of simple functions using $(\epsilon - \delta)$ definition, uniqueness of limit when it exists, Algebra of limits, Sandwich theorem for limits, one sided limit, non-existence of limits, limit at infinity and infinite limits.</p> <p>Continuous functions: Continuity of a real valued function on a set in terms of limits, examples, Continuity of a real valued function at end points of domain, Sequential continuity, Algebra of continuous functions, discontinuous functions, examples of removable and essential discontinuity.</p>	10 Hrs.

Learning Objectives:

- 1) Understand the relationships between natural numbers, integers, rational numbers, and irrational numbers as subsets of the real numbers.
- 2) Understand the domain and range of a sequence.
- 3) Classify a sequence as finite or infinite.
- 4) To understand the behavior of a function as its independent variable approaches a specific value.

Learning Outcomes:

After learning this course, the learner will be able to

- 1) Understand many properties of the real line \mathbb{R} and learn to define sequence in terms of functions from \mathbb{R} to a subset of \mathbb{R} .
- 2) Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- 3) Calculate the limit and examine the continuity of a function at a point.
- 4) Sketch curves in Cartesian and polar coordinate systems.

Recommended Books:

- 1) Calculus ,Vipul Prakashan,Latika Bonde, Nithya Sai Narayana.
- 2)Calculus,Sheth Publication, Dr.Neena A. Joshi, Dr.Anil S.Vaidya.

Reference Books:

1. Robert G. Bartle, Donald R. Sherbert, Introduction to Real Analysis, third edition, John Wiley & Sons, Inc.
 2. R. R. Goldberg, Methods of real analysis, Indian Edition, Oxford and IBH publishing, New Delhi.
 3. Tom M. Apostol, Calculus Vol.1, Second edition, John Wiley & Sons.
 4. Ajit Kumar, S. Kumaresan, A Basic Course in Real Analysis, CRC Press.
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Vocational Skill Course (VSC)		
Title of the course and course code : VGVUSVSP103	CALCULUS-I (PRACTICAL)	No.of credits:02
Practical /lab work to be performed in computer lab.		
List of practicals to be done using SageMath/Scilab/Maxima/Python.		
1) Order properties, absolute value		
2)AM-GM inequality		
3) Hausdorff property.		
4) Bounded sets		
5) Supremum and Infimum		
6) Archimedian property		
7) Convergent sequences .		
8) Divergent sequences .		
9) Sandwich theorem.		
10) Monotone sequences		
11) Cauchy sequences		
12) Subsequences		
13) Drawing graphs of functions.		
14) Limits and Continuity of functions.		
15) Non-existence of limits .		