

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

S.Y. B.Sc.

Mathematics at

Math - III [ 201]

(For Industrial Chemistry & For Computer Science Students)  
(ADVANCED CALCULUS)

[ To be in force from June 2006]

Limits and continuity of functions of two variables.

## Partial derivatives :

Partial derivatives, Geometrical Interpretation, Total differential, Composite function, Homogeneous function, Euler's theorem for homogeneous functions, Implicit function.

Taylor's theorem for functions of two variables, Maclaurin's expansion in power series.

Jacobians.

Maxima-Minima for functions of two variables:

Necessary and sufficient condition for extreme points.

Line Integrals.

Double Integrals. Change of order of double integration, Area and Volume.

## 1 functions

Real-valued functions. Equivalence. Countable & Uncountable sets, Real numbers, Greatest Lower bounds and Least Upper bounds.

## Sequences :

Sequences of real numbers. Sub-sequences, Limit of a sequence, Convergent sequences, Divergent sequences, Bounded sequences, Monotone sequences, Operations on convergent sequences, Operations on divergent sequences, Limit Superior and Inferior, Cauchy sequences.

The course is covered by the following reference books :

1. Shantinayakan : Differential Calculus. S. Chand & Co. New Delhi.  
Shantinayakan : Integral Calculus. S. Chand & Co. New Delhi.  
R.R. Goldberg : Methods of Real Analysis, Oxford & TBH Publishing Co.
4. J.N. Sharma Advanced Differential Calculus, Krishna Prakashan Mandir, Meerut.
5. [ .M. Apostol : Mathematical Analysis. Narosa Publishing House, New Delhi. O. N.P. Bhamore et al : Mathematics Paper III, Popular Prakashan, Surat.

# **VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

**S.Y. B.Sc.**

**Mathematics at**

**Math -IV [ 202 ]**

**(DIFFERENTIAL EQUATIONS)**

**(For Industrial Chemistry & For Computer Science Students)**

## **ORDINARY DIFFERENTIAL EQUATIONS :**

Linear differential equations with constant coefficients. Complementary functions, Particular integrals, General solution, Short Methods for finding particular integral.

Linear differential equations with coefficients. Homogenous linear differential equations.

Linear differential equations of second order, Transformation of equation by changing dependant variables and independent variable with the known integral of CF, Method of variation of parameters. Ordinary Simultaneous equations.

## **LAPLACE TRANSFORMS ;:**

Linearity of Laplace transform, Laplace transforms of standard functions, Existence theorem of Laplace transform, Laplace transform of derivatives and integrals, Shifting theorems, Differentiation and integration of Laplace transform. Inverse of Laplace transforms, Convolution Theorem (Only statement). Solution of differential equation.

## **PARTIAL DIFFERENTIAL EQUATIONS :**

Formation of Partial differential equations by the elimination of Arbitrary constants and arbitrary functions.

Partial Differential Equations of the first order, the complete and particular integrals, Lagrange's solution of the linear equation.

Some special types of equations which can be solved easily by the methods other than Charpit's method.

## **The course is covered by the following reference books :**

1. D.A. Murray : Introductory Course of Differential Equations, Orient Longman (2<sup>nd</sup> ed.).
2. Kreyszig Advanced engineering mathematics, John Wiley & Sons, New York '99.
3. A.R. Forsyth : A Treatise on Differential Equations, McMillan & Co.

London.

4. N.P.Bhamore & et el : Mathematics Paper IV: Popular Prakashan, Surat.
5. Vasisiha and Gupta : Integral Transforms:, Krishna Prakashan, Meerut.
6. Rai Singhanian M.D.: Differential Equations. S. Chand and Co., N. Delhi.
7. Gorakhprasad : Differential Equations, Pothishala Pvt. Ltd. Allahabad.
8. L.N. Sneddon : Elements of Partial Differential Equations, McGraw Hill Book Co.

**VEER NARMAD SOUTH GUJARAT UNIVERSITY,  
SURAT.**

**S.Y. B.Sc.**

**Mathematics at  
Math - V (203)  
(LINEAR ALGEBRA)**

Binary operations, Algebraic: structures, Operations on functions.

**Vector space :**

Definition and examples, Subspaces. Span of a set, More about subspaces, Direct sum of two subspaces, Linear dependence, Linear independence, Dimension and Basis.

**Linear transformations :**

Definition and examples, Range and kernel of a linear map, Rank-Nullity Theorem, Inverse of a linear transformation, consequences of Rank-Nullity Theorem, The space  $L(U,V)$  Composition of linear maps.

Matrix associated with a linear map, linear map associated with a matrix, Rank-Nullity Theorem for matrix (verification).

**Inner product spaces :**

Inner product spaces, Norm of a vector, Schwarz's inequality, Triangular inequality, Orthogonal vectors. Gram-Schmidt orthonormalization process, Orthonormal sets and basis. Orthogonal and Unitary matrices.

**The course is covered by the following reference books :**

1. Krishnamurthy, Arora & Mainre : An Introduction to Linear Algebra, PHI.
2. J.I.I. Sheth : Linear Algebra. Nirav Prakashan.
3. Aggarwal, Matharu : Linear Algebra, S. Chand and Co. Ltd., New Delhi 1991.
4. S. Kumaresan : Linear Algebra. Prentice Hall of India 2000.
5. S.K.Jain, A. Gunawardena P.R. Bhattachari : Basic Linear Algebra with MATLAB. Key College Publishing (Springer-Verlag) 2001.
6. Gupta : Linear Algebra. Pragat Prakashan.
7. Serge Lang : Linear Algebra, Addison-Wesley Pub. Co. (Student Ed.).
8. Balakrishnan : Linear Algebra, Ham-McGraw hill Ed.

# **VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

**S.Y. B.Sc.**

**Mathematics at**

**Math -[ 204] (P)**

**(PRACTICAL)**

One practical of 3 periods per division per week for Subsidiary Mathematics students]

1. Limit and Continuity of a function of two variables.
2. Partial derivatives and applications of Euler's theorem.
3. Evaluation of total differentials and composite functions.
4. Series expansion of a function of two variables using Taylor's theorem and MacLaurine's power series expansion.  
Maxima and minima of a function of two variables.
6. Lagrangian multiplier method.
7. Problems based on line Integrals
8. Problems based on double integrals.
9. Evaluation of double integrals. Using Jacobians.
10. Change of order of double integration.
11. Convergence of sequences of real numbers.
12. Mathematical models leading to second order ordinary differential equations : Mass - spring system.
13. Mathematical models leading to second order ordinary differential equations : LCR circuits.
14. Problems based on second order linear differential equations with constant coefficients.
15. Problems based on second order linear differential equations with variable coefficients.
16. Problems based on Laplace Transforms of derivatives and Integrals.
17. Solution of initial Value Problems by using Laplace transforms.
18. Mathematical models leading to the first order partial differential equations : Continuity equation.
19. Solution of non - Linear partial differential equations of the first order : Lagrange's solution.
20. Fourier series expansions of a periodic function in  $[-\pi, \pi]$

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

S.Y. B.Sc.

Mathematics at  
Math -[ 204](P)

(PRACTICAL)

1. Limit and Continuity of a function of two variables.
2. Partial derivatives and applications of Euler's Theorem.
3. Evaluation of total differentials and composite functions.
4. Series expansion of a Function of two variables using Taylor's theorem and MacLaurine's power series expansion. .
5. Maxima and minima of a function of two variables.
6. Lagrangian multiplier method.
7. Problems based on line Integrals
8. Problems based on double integrals.
9. Evaluation of double integrals.[ Using Jacobians]
10. Change of order of double integration.
11. Convergence of sequences of real numbers.
12. Mathematical models leading to second order ordinary differential equations :  
Mass - spring system.
13. Mathematical models leading to second order ordinary differential equations :  
LCR circuits.
14. Problems based on second order linear differential equations with constant coefficients.
15. Problems based on second order linear differential equations with variable coefficients.
16. Problems based on Laplace Transforms of derivatives and Integrals.
17. Solution of Initial Value Problems by using Laplace transforms.
18. Mathematical models leading to the first order partial differential equations :  
Continuity equation.
19. Solution of non-linear partial differential equations of the first order :  
Lagrange's solution.
20. Fourier series expansions of a periodic function in  $[-\pi, \pi]$
21. A matrix associated with a linear transformation.
22. A linear transformation associated with a matrix.
23. Verification of Rank - Nullity theorem of a linear transformations.
24. Inverse of a linear transformation.
25. Gram-Schmidt orthonormalization process.

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.**

**S.Y. B.Sc.**

**Mathematics at**

**IDS**

**(MATHEMETICAL METHODS)**

**July 2004 (1/2Paper)**

Solution of algebraic equations, Bisection method, Method of False Position, Newton Raphson method. Iteration method .

Interpolation, Finite differences, Forward & Backward differences, Divided differences, Netwton's formula for forward back ward and divided differences, Lagrange's formula.

Solutions of linear system, Gauss – Elimination method. Malthusian and Logistic laws of population model, Model for the spread of technological innovations, Models diffusion of Glucose or Medicine in the blood strem.

The course is covered from the following Reference Books:

1. S.S. Sastry :Int. methods of Numerical Analysis, Prentice- Hall of India Pvt. Ltd.
2. Goel & Mittal : Numerical Analysis, Pragati Prakashan, Meerut.
3. J.N. Kapur : Mathematical Modeling.
4. A.P. Verma : Differential Equations Models.
5. R.N. Desai : Granitik Models ( in Gujarati).

\* Use of Scientific non – Programmable calculator is allowed.

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

S.Y. B.Sc.

Mathematics at

IDS

(MATHEMATICAL METHODS)

(GROUP OF SYMMETRIES)

Definition of group, its elementary properties subgroup, conditions that a subset is a subgroup, Examples of groups including finite groups, Infinite groups – cycle group, Abelian group.

Symmetry elements and symmetry operations in space. Identity operation, rotation symmetries, Reflection symmetry, inversion symmetry, improper rotation symmetry, product of two symmetries.

Formation of groups of symmetries (in space) of the following Plane figures (regarded as rigid objects) :

1. An isosceles triangle (cyclic group  $C_2$  of order 2)
2. An equilateral triangle (the group  $S_3$  of order 6)
3. A rectangle (the group  $V_4$  of order 4)
4. A square (the group  $D_4$  of order 4)
5. A regular hexagon (the group  $D_6$  of order 12)

Concept of isomorphism of groups, Isomorphism of the multiplicative group with the group  $C_2$  of the symmetries of an isosceles triangle and of the group  $(1,3,5,7)$  under multiplication mod 8 with the group  $V_4$  if the symmetries of a rectangle.

Formation of group of symmetries of the following chemical molecule (configuration of atoms) and identification of these groups With previously constructed groups.

1.  $H_2O$  (The group  $V_4$ )
2.  $H_2O_2$
3. Trans -  $N_2 - F_2$  (the group  $V_4$ )
4.  $NH_3$ ,  $PCl_3$ ,  $CHCl_3$  (the group  $S_3$ )
5.  $C_3H_4$  (the group  $D_4$ )
6.  $PF_5$  (Trigonal Bipyramidal) (the group  $D_6$ )

**The course is covered by the following reference book.**

1. F.A. Cotton : Chemical application of group theory, Wiley Inter Science, Wiley Eastern Ltd., New Delhi.
2. G.Davidson : Introductory group theory for chemists, Applied Science Publisher.