Course Code				
Course Category	**Basic Sciences**			
Course Title	**Transform Technique & Vector Calculus(TTVC)**			
Total Teaching Hrs and Credits	**Lectures**	**Tutorial**	**Laboratory**	**Credits**
	30	**15**	**--**	**2+1=03**

Pre-requisites:

- LADC & IC (Mathematics in F. Y. B. Tech)

Course Objectives:

1. To understand integral transform techniques and their applications.
2. To learn vectors calculus for applications in engineering field.

Course Outcomes:

After completion of this course students will be able to

1. Solve problems related to Fourier Transforms
2. Solve problems using Z transforms
3. Apply the knowledge of vector calculus for solving engineering problems

Course Contents:

1. Fourier Transform
2. Z-Transform
3. Vector Differential Calculus
4. Vector Integral Calculus

Tutorial Exercises:

1. Fourier Sine and Cosine Transforms.
2. Finite & Discrete Fourier Transform
3. Z-Transform and Inverse Z-Transform.
4. Solution of Difference Equation
5. Vector differentiation- problems on tangential & normal component, velocity, acceleration.
6. Gradient, divergence and curl.
7. Work done, Green's Lemma
8. Stoke's and Divergence Theorem.

Two tutorials will be conducted using Mathematical Software. Tutorial shall be engaged in four batches (batch size of 15 students) per division.

Learning Resources:

Reference Books

1. KreyszigErwin,"Advanced Engineering Mathematics" ,10th edition ,Wiley Eastern Limited 2015.
2. O' Neil Peter,"Advanced Engineering Mathematics" ,8th edition ,Cengage Learning 2015.

Dr. Prasad Khandekar
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3. Greenberg Michael D.,"Advanced Engineering Mathematics", 2nd edition, Pearson . 2009.
4. Grewal B.S., "Higher Engineering Mathematics" ,43rd edition Khanna Publishers 2014

Supplementary Reading:

Weber H.J. and Arfken G.B. "Mathematical Methods For Physicists" , 6th edition, Academic Press 2011.

Web Resources:

http://nptel.ac.in/courses/111105035/6
http://nptel.ac.in/courses/111105090

MOOCs :

https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/

Pedagogy:

1. Co-teaching
2. Audio- video techniques
3. Tutorials and class tests

Assessment Scheme:

Class Continuous Assessment : 100 Marks

Assignment/ short term Question answers Tests	Tutorial	Mid Term Test	Total
20 Marks	50 Marks	30 Marks	100 Marks

Laboratory Continuous Assessment : NA

Term End Examination: 50 marks

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Syllabus: Theory

Module No.	Contents	Workload in Hrs
		Theory
1	Fourier Transform: Fourier Integral theorem, Fourier Sine and Cosine Transforms, Inverse Fourier Transform. Finite Fourier Transform, Discrete Fourier Transform.	08
2	Z-Transform: Definition, Properties, Z- transform of standard sequences and their inverse, solution of difference equations.	08
3	Vector Differential calculus: Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Vector identities.	07
4	Vector integral Calculus: Line, Surface and Volume integration, Work done, Green's Lemma, Stoke's and Divergence Theorem. Applications in Engineering field(branch specific)	07

Tutorial:

Module No.	Contents	Workload in Hrs
		Tutorial
1	Fourier Sine and Cosine Transforms.	02
2	Finite & Discrete Fourier Transform	02
3	Z-Transform and Inverse Z-Transform.	02
4	Solution of Difference Equation	02
5	Vector differentiation- problems on tangential & normal component, velocity, acceleration.	02
6	Gradient, divergence and curl.	02
7	Work done, Green's Lemma	02
8	Stoke's and Divergence Theorem.	01

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COURSE STRUCTURE

Course Code	**SCI101B**			
Course Category	**Basic Sciences**			
Course Title	**Linear Algebra and Differential Calculus**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs.	03 hours	1 hour	--	2+1+0=3

Pre-requisites: HSC (Mathematics)

Course Objectives:

1) To learn Basic Concepts of Mathematicsuseful for Engineering.
2) To apply mathematical tools in various engineering problems.

Course Outcomes:

After completion of this course students will be able to

1) apply the knowledge of Matrices for solving system of Linear equations ,compute Eigen values and Eigen vectors and applications in computational geometry.
2) understand n^{th} order derivatives, Taylor's and Maclaurin's series expansion of a function useful in analysis of engineering problems.
3) deal with derivatives of functions of several variables that are essential in various branches of engineering.
4) examinemaxima / minima ofreal variable functions, error estimation and approximation. Apply concept of Jacobian to find functional dependence.

Course Contents:

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Theory of Matrices (10 Hrs.)

Rank of a matrix, System of Linear Equations,Linear dependence and Independence,Linear and Orthogonal Transformations, Orthogonal matrix,Matrix Eigen value problems, Caley-Hamilton Theorem, Applications of Matrices; scaling, stretching, reflections, rotation, translation in XY-plane, rotation about coordinate axes in three dimensional space.

Differential Calculus (05 Hrs.)

n^{th} derivative of standard functions, Leibnitz's Theorem and problems, Taylor's and Maclaurin's series expansion of a function.

Partial Differentiation (08 Hrs.)

Introduction to functions of several variable, Partial derivatives, Euler's Theorem for Homogeneous functions, Partial derivativesof Composite and Implicit functions, Total derivative.

Application of Partial Differentiation (07 Hrs.)

Errors and approximations,Maxima and Minima of a function of two independent variables, Lagrange's method of undetermined multipliers, Jacobians and Functional Dependence.

Tutorial Exercises:

1. Rank of a matrix, System of Linear Equations.
2. Linear dependence and Independence of vectors, Orthogonal matrix
3. Eigen values &Eigen Vectors, Applications of matrices.
4. n^{th}derivative of functions.
5. Leibnitz's Theorem.
6. Taylor's series and Maclaurin's series.
7. Partial Differentiation and related problems
8. Euler's Theorem and its deductions.
9. Partial derivativesof Composite function and Implicit functions,
10. Total derivative,Errors andApproximations.
11. Maxima and Minima of a function of two variable, Lagrange's method of undetermined multiplier.
12. Jacobians and Functional Dependence

Three tutorials will be conducted using Mathematical Software.

Learning Resources:

Reference Books

1. Kreyszig Erwin, "Advanced Engineering Mathematics", 10^{th} edition, Wiley Eastern Limited2015.
2. Greenberg Michael D., "Advanced Engineering Mathematics", 2^{nd}edition, Pearson 2009.
3. Grewal B.S. "Higher Engineering Mathematics", 44^{th} edition, Khanna Publishers 2017.
4. David F. Rogers, J. Alan Adams,"Mathematical Elements For Computer Graphics" McGraw-Hill 1976.

Supplementary Reading:

Weber H.J. and Arfken G.B. "Mathematical Methods For Physicists" , 6th edition, Academic Press 2011.

Web Resources:

http://nptel.ac.in/courses/111105035/6

https://www.khanacademy.org/math/precalculus/x9e81a4f98389efdf:matrices/x9e81a4f98389efdf:matrices-as-transformations/v/matrix-transformation-triangle

MOOCs (Coursera)
https://www.edx.org/course/calculus-1c-coordinate-systems-infinite-mitx-18-01-3x-0

https://nptel.ac.in/courses/122/104/122104017/

Pedagogy:

1. Team teaching
2. Group activity
3. Audio- video techniques
4. Tutorials and class tests

Assessment Scheme:

Class Continuous Assessment (CCA): 100 marks

short term Question answers Tests	Tutorial	Mid Term Test	Group Activity	Case study	MCQ	Oral	Attendance	Total
20 Marks	50 Marks	15 Marks	10 Marks	Nil	Nil	Nil	05 Marks	100 Marks

Laboratory Continuous Assessment (LCA): NA

Regularity and punctuality	Understanding of objective	Understanding of procedure	Experimental skills	Ethics

Term End Examination : 50 marks

Syllabus :

Module No.	Contents	Workload in Hrs		
		Theory	*Tutorial*	*Assess*
1	Theory of Matrices	10	3	--
2	Differential Calculus	5	3	--
3	Partial Differentiation	8	3	--
4	Applications of Partial Differentiation	7	3	---

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COURSE STRUCTURE

Course Code	**SCI103B**			
Course Category	**Basic Sciences**			
Course Title	**Integral Calculus**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	03 hours	1hour	---	2+1+0=3
Pre-requisites: HSC (Mathematics), Linear Algebra and Differential Calculus				

Course Objectives:

1) To learn Basic Concepts of Mathematics useful for Engineering.
2) To apply mathematical tools in various Engineering problems.

Course Outcomes:

After completion of this course, students will be able to

1) solve the differential equations which occur as models in Electrical circuits andheat transfer .(CL-II)
2) apply the knowledge of Geometry to draw the curves in Cartesian , polar and parametric form (CL-I)
3) apply methods of integration to compute area and volumes of two dimensional and three dimensional objects respectively(CL-I)
4) identify periodic wave forms in series of sines and cosines of multiple angles and carry out practical analysis(CL-I)

Course Contents:

Ordinary Differential Equations and Applications

Introduction to first order differential equations, modelling and solution of exact and linear differential equation.

Group Activity: Applications of Differential Equations to Orthogonal Trajectories, Electrical Circuits, 1-Dimensional Heat Conduction Problemsetc.

Introduction to tracing of curves and 3-dimensional coordinate system:

Standard and important curves in Cartesian, Parametric and Polar coordinates. Examples based on 3- dimensional Cartesian, spherical polar and cylindrical coordinate system.

Tools for Integration, Multiple Integrals and their Applications

Problems on Reduction formulae, Beta, Gamma functions, Differentiation under integral sign, Error functions.Double and Triple integrations.

Group activity: Applications of double and triple integrals incalculating Area and Volume.

Fourier series

Introduction to Fourier series,Dirichlet's conditions, Harmonic Analysis.

Tutorial Exercises:

1. Linear and Exact DifferentialEquations.
2. Applications of DifferentialEquations.
3. Tracing of Curves (Cartesian and Parametric)
4. Tracing of Curves (Polar) and 3-dim coordinate system.
5. Reduction Formulae and Gamma functions.
6. Beta Functions.
7. DUIS & error function.
8. Double Integral.
9. Triple Integral.
10. Area and Volume.
11. Fourier series
12. Fourier Series of Odd and Even Functions and Harmonic Analysis

Three tutorials will be conducted using Mathematical Software.

Learning Resources:

Reference Books

1. Kreyszig Erwin, "Advanced Engineering Mathematics", 10th edition, Wiley Eastern Limited2015.
2. Greenberg Michael D., "Advanced Engineering Mathematics", 2nd edition, Pearson 2009.
3. Grewal B.S. "Higher Engineering Mathematics", 44th edition, Khanna Publishers 2017.

Supplementary Reading:

Weber H.J. and Arfken G.B. "Mathematical Methods For Physicists" ,6th edition, Academic Press 2011.

Web Resources:

Differential Equations:

1. *http://nptel.ac.in/courses/111106100/1*
2. *http://nptel.ac.in/courses/111106100/4*

Fourier Series:
http://mathworld.wolfram.com/FourierSeries.html

MOOCs (Coursera)

https://www.edx.org/course/differential-equations-linear-algebra-and-nxn-systems-of-differential-equations

MIT Opencourseware

Pedagogy:

1. Team teaching
2. Group activity
3. Audio- video techniques
4. Tutorials and class tests

Assessment Scheme:

Class Continuous Assessment (CCA): 100 marks

Assignment/ short term Question answers Tests	Tutorial	Mid Term Test	Group Activity	Case study	MCQ	Oral	Attendance	Total
20 Marks	50 Marks	15 Marks	10 Marks	Nil	Nil	Nil	5 Marks	100 Marks

Laboratory Continuous Assessment (LCA): **NA**

Regularity and punctuality	Understanding of objective	Understanding of procedure	Experimental skills	Ethics

Term End Examination : 50 marks

Syllabus:

Module No.	Contents	Workload in Hrs		
		Theory	*Tutorial*	*Assess*
1	**Ordinary Differential Equations and Applications**	8	2	--
2	**Introduction to Tracing of Curves and 3 dimensional coordinate system**	4	2	--
3	**Tools for Integration, Multiple Integrals and their Applications**	13	6	--
4	**Fourier Series and Harmonic Analysis**	5	2	---

Prepared By	**Checked By**	**Approved By**
Prof. Gajanan Birajdar Subject Coordinator	Prof. Ramaa Sandu HOS, Mathematics and Statistics	Prof.Dr.Shubhalaxmi Joshi Associate Dean, Faculty of Science

Course Code				
Course Category	**Basic Sciences (BS)**			
Course Title	**Discrete Mathematics**			
Total Teaching Hrs and Credits	**Lectures**	**Tutorial**	**Laboratory**	**Credits**
	30	**15**	**--**	**2+1 = 03**

Pre-requisites:

- Basic Mathematics

Course Objectives:

1. To understand the logic for solving problems using set theory and combinatorial problem using probability theory
2. To gain the knowledge of relations and functions to solve relevant problems in computer science
3. To learn Graph Theory for modelling computer science problems
4. To acquire knowledge of concepts and applications of Trees

Course Outcomes:

After completion of this course students will be able to:

1. Analyze and Articulate the logic to solve a problem using set theory and combinatorial problem using probability theory
2. Apply knowledge of relations and functions to solve relevant problems in computer science
3. Model computer science problems using Graph theory
4. Demonstrate the concepts and applications of Trees in Computer Science

Course Contents:

1. Set Theory
2. Counting
3. Discrete Probability
4. Relations
5. Functions
6. Graph
7. Trees

Tutorial List:

1. Problem Solving on Set Theory
2. Questions on Counting
3. Problem solving on Discrete Probability
4. N-ary and Equivalence Relations
5. Problems on Bijective and Recursive Functions
6. Adjacency matrix and Shortest path problems using Graph
7. Huffman and Binary Search Tress

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Learning Resources:

Text Books:

1. Kenneth H. Rosen, ―Discrete Mathematics and its Applications‖, Tata McGraw-Hill, ISBN 978-0-07-288008-3, 7th Edition.
2. C. L. Liu, ―Elements of Discrete Mathematics‖, TMH, ISBN 10:0-07-066913-9.

Reference Books:

1. Bernard Kolman, Robert C. Busby and Sharon Ross, ―Discrete Mathematical Structures‖, Prentice-Hall of India /Pearson, ISBN: 0132078457, 9780132078450.
2. Dr. K. D. Joshi, ― Foundations of Discrete Mathematics‖, New Age International Limited, Publishers, January 1996, ISBN: 8122408265, 9788122408263

Supplementary Reading:

1. N. Biggs,"Discrete Mathematics", 2nd Edition, Oxford University Press
2. Data Structures – Seymour Lipschutz, Shaum's outlines, MCGraw – Hill Inc.

Web Resources:

https://learn.saylor.org/course/cs202
https://www.mooc-list.com/tags/discrete-mathematics

Web links:

https://www.tutorialspoint.com/discrete_mathematics/index.htm

MOOCs:

http://nptel.ac.in/courses/106106094/3
https://www.coursera.org/learn/discrete-mathematics

Pedagogy:

1. Chalk and Board
2. PPT
3. Two Teacher Method
4. Video Lectures

Assessment Scheme:

Class Continuous Assessment (CCA)- 100 Marks

Assignments	Test	Tutorials	MCQ / Active Learning
15 Marks	15 Marks	50 Marks	20 Marks

Term End Examination: 50 Marks

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Syllabus: Theory

Module No.	Contents	Workload in Hrs Theory
1	**Set Theory:** Sets, Combinations of sets, Venn Diagrams, Finite and Infinite sets: Uncountable and Countable, Principle of inclusion and exclusion, Multisets, Cartesian Product and Power Set Fuzzy sets, Basic concepts and types of Fuzzy sets, Operations on Fuzzy sets **Functions**: Surjective, Injective and Bijective functions, Inverse Functions and Compositions of Functions, Recursive Function.	07
2	**Relations:** Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Warshall's Algorithm to find transitive closure, Equivalence Relations, Partial Orderings - Chain, Anti chain and Lattices. **Counting:** The Basics of Counting, Permutations and Combinations, Binomial Coefficients, Algorithms for generating Permutations and Combinations, The Pigeonhole Principle, Introduction to groups, types of groups.	07
3	**Graphs:** Graph and Graph Models, Graph Terminology and Types of Graph, Representing Graph and Graph Isomorphism, vertex and edge Connectivity, Eulerian and Hamiltonian, Single source shortest path- Dijkstra's pseudo code algorithm, Planar Graph, Graph Coloring, digraphs.	08
4	**Trees:** Introduction, properties of trees, Binary search tree, decision tree, prefix codes and Huffman coding, Spanning Trees and Minimum Spanning Tree –Kruskal's and Prim's pseudo code algorithms, Case Study- Game Tree.	08

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Tutorial:

Module No.	Contents	Workload in Hrs
		Tutorial
1	Problem Solving on Set Theory	02
2	Questions on Counting	02
3	Problem solving on Discrete Probability	02
4	N-ary and Equivalence Relations	02
5	Problems on Bijective and Recursive Functions	02
6	Adjacency matrix and Shortest path problems using Graph	02
7	Huffman and Binary Search Tress	03

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