STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086
M.Sc. DEGREE: BRANCH I - MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)
MODERN ALGEBRA

CODE : 15MT/PC/MA14 **CREDITS: 4**
L T P: 4 1 0
TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- To introduce the general concepts in Advanced Abstract Algebra
- To give developments in various algebraic structures
- To lay the foundation for a variety of courses

Unit 1 **(16 hrs.)**

Group Theory

1.1 Counting Principle
1.2 Cauchy's Theorem
1.3 Sylow's Theorem (second proof only)
1.4 Direct Products
1.5 Finite Abelian Groups

Unit 2 **(10 hrs.)**

Ring Theory

2.1 Euclidean Rings
2.2 Definition- Properties
2.3 Unique Factorization Theorem
2.4 A particular Euclidean ring
2.5 Fermat's Theorem

Unit 3 **(10 hrs.)**

Ring Theory (contd.)

3.1 Polynomial Rings
3.2 Polynomials over the Rational Field

Unit 4 **(14 hrs.)**

Fields

4.1 Extension Fields
4.2 The Transcendence of e
4.3 Roots of Polynomials

Unit 5 **(15 hrs.)**

Fields (contd.)

5.1 More about Roots

5.2 The Elements of Galois Theory (Exclude proof of Galois theorem)

5.3 Solvability by Radicals

TEXT BOOK

Herstein, I. N. *Topics in Algebra.* 2nd Ed. New Delhi : Wiley Eastern Limited, 2007.

Chapter 2 Sections 2.11 – 2.14 (omit Lemma 2.12.1, Lemma 2.12.2)
Chapter 3 Sections 3.7 - 3.10
Chapter 5 Sections 5.1 - 5.3, 5.5- 5.7

BOOKS FOR REFERENCE

Fraleigh J.B. *A First course in Abstract Algebra*. 2nd ed. London : Addison – Wesley Publishing Company, 1975.

Lang Serge, *Algebra*_ 3rd Revised ed. New Delhi : Springer International Edition, 2004.

Santiago, M.L. *Modern Algebra.* New Delhi : Tata McGraw-Hill Publishing Company Limited, 2002.

Vasistha A.R., and A.K. Vasistha.. *Modern Algebra*. Meerut : Krishna Prakashan Media (P) Ltd., 2006.

WEB RESOURCES

http://cs.jsu.edu/~leathrum/Mathlets/polyroots.html
http://www.akiti.ca/PolyRootRe.html

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: 2×2 = 4 (Two questions to be set)
Section B: 2×6 = 12 (Three questions to be set)
Section C: 2×17= 34 (Three questions to be set)

Third Component :

List of evaluation modes:
Seminars
Quiz
Open book tests
Group discussion

Assignments
Project
Theorem writing technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A: $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B: $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit)
Section C: $3 \times 20 = 60$ (Five questions to be set without omitting any unit)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086

M.Sc. DEGREE: BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

REAL ANALYSIS

CODE : 15MT/PC/RA14 **CREDITS: 4**
L T P: 4 1 0
TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- To introduce the general concepts of Analysis in the Euclidean space $\Re^n$
- To lay the foundation for a variety of courses
- To impart knowledge on the concepts of double sequences and double series
- To impart knowledge on the concepts of Infinite Series and Infinite Products

Unit 1 **(14 hrs.)**

Elements of point set Topology

1.1 Euclidean Space $\Re^n$
1.2 Open Balls and Open Sets in $\Re^n$
1.3 Structure of Open Sets in $\Re^1$
1.4 Closed Sets – Adherent and Accumulation points
1.5 Bolzano-Weierstrass Theorem
1.6 Cantor Intersection Theorem
1.7 Lindelöf Covering Theorem
1.8 Heine–Borel Covering Theorem
1.9 Compactness in $\Re^n$

Unit 2 **(10 hrs.)**

Infinite Series and Infinite Products

2.1 Double Sequences
2.2 Double Series
2.3 Rearrangement Theorem for Double Series
2.4 Sufficient Condition for Equality of Iterated Series
2.5 Multiplication of Series
2.6 Cesaro Summability
2.7 Infinite Products

Unit 3 **(13 hrs.)**

Sequences and Series of Functions

3.1 Pointwise Convergence
3.2 Uniform Convergence – Examples
3.3 Uniform Convergence and Continuity

3.4 Cauchy Condition for Uniform Convergence
3.5 Uniform Convergence of Infinite Series of Functions
3.6 Uniform Convergence and Double Sequences
3.7 Taylor's Series generated by a Function
3.8 Bernstein's Theorem

Unit 4 **(14 hrs.)**

Multivariable Differential Calculus

4.1 The Directional Derivative
4.2 Directional Derivative and Continuity
4.3 Total Derivative - Total Derivative expressed in terms of Partial Derivatives
4.4 Jacobian Matrix
4.5 Chain Rule – Matrix Form
4.6 Mean Value Theorem
4.7 Sufficient Condition for Differentiability
4.8 Equality of Mixed Partial Derivatives
4.9 Taylor's Formula for Functions from $\Re^n$ to $\Re^1$

Unit 5 **(14 hrs.)**

Implicit Functions and Extremum Problems

5.1 Implicit Functions and Extremum Problems
5.2 Functions with non-zero Jacobian Determinant
5.3 The Inverse Function Theorem
5.4 Implicit Function Theorem
5.5 Extrema of Real Valued Functions of one Variable
5.6 Extrema of Real Valued Functions of several Variables

TEXT BOOK

Apostol, Tom M., *Mathematical Analysis* 2nd ed. New Delhi: Addison – Wesley / Narosa Indian Student Edition, 1974.

Chapter 3	Sections	3.1 – 3.12.
Chapter 8	Sections	8.20 – 8.26.
Chapter 9	Sections	9.1 - 9.6, 9.12, 9.19, 9.20.
Chapter 12	Sections	12.1 - 12.5, 12.7 - 12.14.
Chapter 13	Sections	13.1 - 13.6.

BOOKS FOR REFERENCE

Charles G Denlinger, Sorensen Harry A, *Elements of Real Analysis*, New Delhi: Jones & Bartlett Learning, 2011.

Malik S C, *Principles of Real Analysis*. Third edition. New Delhi: New Age international Publishers, 2011.

Nader Vakil, *Real Analysis Through Modern Infinitesimals*, Cambridge university press, 2011.

Terrance J Quinn, *Pathways to Real analysis*, New Delhi: Narosa Publishing House, 2009.

WEB RESOURCES

http://www.maa.org/sites/default/files/images/upload_library/47/StemkoskiStorm/TaylorApprox.html

http://www.maa.org/sites/default/files/images/upload_library/47/StemkoskiStorm/MVT.html

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: 2×2 = 4 (Two questions to be set)
Section B: 2×6 = 12 (Three questions to be set)
Section C: 2×17= 34 (Three questions to be set)

Third Component :

List of evaluation modes:
Seminars
Quiz
Open book tests
Group discussion
Assignments
Project
Theorem writing technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A: $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B: $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit)
Section C: $3 \times 20 = 60$ (Five questions to be set without omitting any unit)

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M.Sc. DEGREE: BRANCH I – MATHEMATICS

SYLLABUS

(Effective from the academic year 2015 – 2016)

CONTINUUM MECHANICS

CODE: 15MT/PC/CM14 **CREDITS: 4**

L T P: 4 1 0

TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- To introduce the concept of stress and strain analysis
- To introduce the laws involved in the motion of flow

Unit 1 (15 hrs.)

Analysis of Stress

1.1 Continuum Concept
1.2 Homogeneity, Isotropy, Mass-Density
1.3 Body Forces, Surface Forces
1.4 Cauchy's Stress Principle, The Stress Vector
1.5 State of Stress at a Point, Stress Tensor
1.6 The Stress Tensor-Stress Vector Relationship
1.7 Force and Moment, Equilibrium, Stress Tensor Symmetry
1.8 Stress Transformation Laws
1.9 Stress Quadric of Cauchy
1.10 Principal Stresses, Stress Invariants, Stress Ellipsoid
1.11 Deviator and Spherical Stress Tensors

Unit 2 (9 hrs.)

Deformation

2.1 Particles and Points
2.2 Continuum Configuration, Deformation and Flow Concepts
2.3 Position Vector, Displacement Vector
2.4 Lagrangian and Eulerian Descriptions
2.5 Deformation Gradients, Displacement Gradients
2.6 Deformation Tensors

Unit 3 (14 hrs.)

Strain Tensors, Motion and Flow

3.1 Finite Strain Tensors
3.2 Small Deformation Theory, Infinitesimal Strain Tensors
3.3 Relative Displacements, Linear Rotation Tensor, Rotation Vector
3.4 Principal Strains, Strain Invariants, Cubical Dilatation

3.5 Spherical and Deviator Strain Tensors
3.6 Motion, Flow, Material Derivative
3.7 Velocity, Acceleration, Instantaneous Velocity Field
3.8 Path Lines, Stream Lines, Steady Motion

.

Unit 4 **(16 hrs.)**

Fundamental Laws of Continuum Mechanics

4.1 Rate of Deformation, Vorticity, Natural Strain
4.2 Physical Interpretation of Rate of Deformation and Vorticity Tensors
4.3 Material Derivatives of Volume, Area and Line Elements
4.4 Conservation of Mass, Continuity Equation
4.5 Linear Momentum Principle, Equations of Motion
4.6 Equilibrium Equations
4.7 Angular Momentum Principle

Unit 5 **(11 hrs.)**

Linear Elasticity

5.1 Generalized Hooke's Law, Strain Energy Function
5.2 Isotropy, Anisotropy, Elastic Symmetry
5.3 Isotropic Media, Elastic Constants

TEXT BOOK

Mase George E., *Continuum Mechanics*. Schaum's Outlines, Tata McGraw-Hill Publishing Company Ltd., 2005.

Chapter 2	Sections 2.1 - 2.10, 2.14
Chapter 3	Sections 3.1 - 3.8, 3.13, 3.14
Chapter 4	Sections 4.1 - 4.6
Chapter 5	Sections 5.1 - 5.3
Chapter 6	Sections 6.1 - 6.3

BOOKS FOR REFERENCE

Temam,Roger M , Srivastava,R.J, Temam,Roger M , Srivastava,R.J, *Mathematical Modeling in Continuum Mechanics*, London: Cambridge university press, 2005.

George E Mase, Srivastava,R.J, Schaum's outlines *Theory and Problems of Continuum Mechanics,* New Delhi: Tata McGraw hill, 2005.

Garry E, Boroman, *Essential Quantum Mechanics*, New York: Oxford University Press, 2011.

Mukherjee B.N, B.C Das, *Dynamics*, Kolkata: U.N. Dhur & Sons Private Ltd., 2010.

JOURNALS

The Journal of Strain Analysis for Engineering Design (J STRAIN ANAL ENG) Publisher: Institution of Mechanical Engineers (Great Britain); Joint British Committee for Stress Analysis, Professional Engineering Publishing

The Journal of Strain Analysis for Engineering Design. Editor: Professor E A Patterson, University of Liverpool, UK.

Journal of the Mechanics and Physics of Solids, Plane strain deformation near a crack tip in a power-law hardening material. Volume 16, Issue 1, January 1968, Pages 1–12.

Journal of Applied Mechanics | Volume 36 | Issue 1 | Research Paper, Elastic-Plastic Deformation at Finite Strains, E. H. Lee**.**

WEB RESOURCES

http://www.mae.ncsu.edu/zhu/courses/mae314/lecture/Lecture2_Stress-Strain.pdf
http://www.brown.edu/Departments/Engineering/Courses/En221/Notes/notes.html
http://www.brown.edu/Departments/Engineering/Courses/En221/Notes/Elasticity/Elasticity.htm

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: 2×2 = 4 (Two questions to be set)
Section B: 2×6 = 12 (Three questions to be set)
Section C: 2×17= 34 (Three questions to be set)

Third Component :

List of evaluation modes:
Seminars
Quiz
Open book tests
Group discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A: $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B: $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit)
Section C: $3 \times 20 = 60$ (Five questions to be set without omitting any unit)

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M.Sc. DEGREE: BRANCH I – MATHEMATICS

SYLLABUS

(Effective from the academic year 2015 – 2016)

DIFFERENTIAL EQUATIONS

CODE: 15MT/PC/DE14 **CREDITS : 4**

L T P : 4 1 0

TOTAL TEACHING HOURS : 65

OBJECTIVES OF THE COURSE

- To introduce mathematical techniques for analyzing and solving ordinary and partial differential equations.
- To apply ordinary and partial differential equations to dynamical problems of practical interest

Unit 1 **(13 hrs.)**

Linear Differential Equations of Higher Order

1.1 Introduction – Linear Dependence and Wronskian

1.2 Basic Theory for Linear Equations

1.3 Abel's Formula

Some Special Functions of Mathematical Physics

1.4 Legendre Equation and Legendre Polynomials

1.5 Bessel Equation

Unit 2 **(15 hrs.)**

Existence and Uniqueness of Solutions

2.1 Introduction – Lipschitz condition – Gronwall Inequality

2.2 Successive Approximation

2.3 Picard's Theorem

Boundary Value Problems

2.4 Introduction – Sturm-Liouville problem

Unit 3 **(13 hrs.)**

Partial Differential Equations

3.1 General Method of Solving Equations of Order One but of any Degree - Charpit's Method

3.2 Partial Differential Equations of Order Two with Variable Coefficients – Canonical Forms

Boundary Value Problems

3.3 Derivation of One and Two Dimensional Wave Equation – One Dimensional Heat Equation

Unit 4 **(13 hrs.)**

Solution to Boundary Value Problems

4.1 Solution by Separation of Variables Method

4.2 Solution of One, Two and Three Dimensional Heat Equation
4.3 Solution of One and Two Dimensional Wave Equation

Unit 5 **(11 hrs.)**

Solution to Boundary Value Problems (contd.)

5.1 Solution of Two and Three Dimensional Laplace Equation
5.2 Use of Plane Polar Co-ordinates for Solution of Two Dimensional Laplace Equation

TEXT BOOKS

Deo, S. G. and Ragavendra V. *Ordinary Differential Equations and Stability Theory*. New Delhi: Tate McGraw – Hill Publishing Company Limited, 1980.

Chapter 2 Sections 2.1 – 2.3, 2.5
Chapter 3 Sections 3.3, 3.5
Chapter 5 Sections 5.1 – 5.4
Chapter 7 Sections 7.1 – 7.2

Raisinghania M.D. *Advanced differential equations*, New Delhi: S.Chand & Co. Ltd., Ramnagar,. 2000

Chapter 2 Sections 2.5
Chapter 4 Sections 4.7
Boundary Value Problems
Chapter 1 Sections 1.1 – 1.20

BOOKS FOR REFERENCE

Ahmed Shair and M. Rao Rama Mohana. *Theory of Ordinary Differential Equations with Applications in Biology and Engineering*. New Delhi: Affiliated East – West Press Pvt. Ltd.,1999.

Coddington, Earl A. *An Introduction to Ordinary Differential Equations*. New Delhi: Prentice – Hall of India Pvt. Ltd., 1998.

Donald Greenspan, *Introduction to Partial Differential Equations*, New Delhi: Tata McGraw – Hill Publishing Co. Ltd., 1961.

Sharma, J.N. and Kehar Singh. *Partial Differential Equations for Engineers and Scientists.* New Delhi: Narosa Publishing House, 2000.

Simmons George F., and Robertson John S., *Differential Equations with Applications and Historical notes,* New Delhi: Tata McGraw – Hill Publishing Company Ltd., 1991.

Sneddon Ian N. *Elements of Partial Differential Equations***,** International Student Edition, New Delhi: McGraw – Hill Book Co. Inc. 1957.

JOURNAL
International Journal of Mathematical Education in Science and Technology

WEB RESOURCES

www.physics.nus.edu.sg/~phylimhs/SeriesODE7.pdf
tutorial.math.lamar.edu/.../**SeparationofVariables**.aspx
nptel.ac.in/courses/111107063/

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: 2×2 = 4 (Two questions to be set)
Section B: 2×6 = 12 (Three questions to be set)
Section C: 2×17= 34 (Three questions to be set)

Third Component :

List of evaluation modes:
Seminars
Quiz
Open book tests
Group Discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A: $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B: $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit).
Section C: $3 \times 20 = 60$ (Five questions to be set without omitting any unit).

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M.Sc. DEGREE : BRANCH I – MATHEMATICS

SYLLABUS
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LINEAR ALGEBRA

CODE : 15MT/PC/LA24 **CREDITS: 4**
L T P: 4 1 0
TOTAL TEACHING HOUR: 65

OBJECTIVES OF THE COURSE

- To introduce the canonical forms for linear transformations on vector spaces
- To introduce the forms on inner product spaces

Unit 1 **(10 hrs.)**

Modules

1.1 Definition and Examples
1.2 Direct Sum
1.3 Fundamental Theorem on Finitely Generated Modules

Unit 2 **(13 hrs.)**

Linear Transformations

2.1 Canonical Forms: Triangular Forms
2.2 Canonical Forms: Nilpotent Transformations

Unit 3 **(12 hrs.)**

Linear Transformations (contd.)

3.1 Canonical Forms: A Decomposition of V: Jordan Form
3.2 Canonical Forms: Rational Canonical Form

Unit 4 **(15 hrs.)**

Elementary Canonical Forms

4.1 Characteristic Values
4.2 Annihilating Polynomials
4.3 Invariant Subspaces
4.4 Simultaneous Triangulation; Simultaneous Diagonalization

Unit 5 **(15 hrs.)**

Inner Product Spaces

5.1 Linear Functionals and Adjoints
5.2 Unitary Operators
5.3 Normal Operators
5.4 Forms on Inner Product Spaces

TEXT BOOKS

Herstein . I.N. *Topics in Algebra*. 2nd Ed. New Delhi : Wiley Eastern limited, 1994.
Chapter 4 Section 4.5.
Chapter 6 Sections 6.4 – 6.7

Hoffman, Kenneth and Ray Kunze. *Linear Algebra*.2nd ed.New Delhi : Prentice-Hall of India. Private Ltd., 1971.
Chapter 6 Sections 6.2 - 6.5
Chapter 8 Sections 8.3 - 8.5
Chapter 9 Sections 9.1 - 9.2

BOOKS FOR REFERENCE

Artin Michel, *Algebra.* New Delhi : Prentice Hall of India Private Ltd., 2007.

Lang Serge, *Algebra* 3rd Revised Ed. New Delhi : Springer International Edition, 2004.

Noble Ben, Daniel James W. *Applied Linear algebra* , India : Prentice-Hall of India, 1969.

Sahai Vivek, and Vikas Bist. *Linear Algebra*. New Delhi : Narosa Publishing House, 2002.

WEB RESOURCES
http://www.math.ucla.edu/~tao/resource/general/115a.3.02f/linearMap.html
http://www.math.ucla.edu/~tao/resource/general/115a.3.02f/EigenMap.html

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**
Section A: 2×2 = 4 (Two questions to be set)
Section B: 2×6 = 12 (Three questions to be set)
Section C: 2×17= 34 (Three questions to be set)

Third Component :
List of Evaluation Modes:
Seminars
Quiz
Open Book Tests
Group Discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A : $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B: $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit).
Section C : $3 \times 20 = 60$ (Five questions to be set without omitting any unit).

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M.Sc. DEGREE : BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

MEASURE THEORY AND INTEGRATION

CODE: 15MT/PC/MI24 **CREDIT: 4**
L T P: 4 1 0
TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- To introduce the concept of non-negative measures on the real line
- To develop the theory of integration via: measure, the knowledge of which is essential for working in most branches of modern Analysis
- To introduce a study of inequalities and the L^p-spaces
- To introduce the concept signed measures and decomposition theorems

Unit 1 **(12 hrs.)**

Measure on the Real Line

1.1 Lebesgue Outer Measure
1.2 Measurable Sets
1.3 Regularity
1.4 Measures and Outer Measures

Unit 2 **(12 hrs.)**

Abstract Measure Spaces

2.1 Measurable Functions
2.2 Borel and Lebesgue Measurability
2.3 Completion of a Measure
2.4 Measure Spaces

Unit 3 **(15 hrs.)**

Integration of Functions

3.1 Integration of Non-negative Functions
3.2 The General Integral
3.3 Riemann and Lebesgue Integrals
3.4 Integration with respect to a Measure

Unit 4 **(13 hrs.)**

L^P Spaces

4.1 L^P Spaces
4.2 Convex Function

4.3 Completeness of L^P

Convergence

4.4 Convergence in Measure

Unit 5 **(13 hrs.)**

Signed measures and their derivatives

5.1 Signed Measures

5.2 Hahn, Jordan Decompositions

5.3 The Radon Nikodym theorem

5.4 Some Applications of the Radon Nikodym Theorem

TEXT BOOK

G. de Barra. *Measure Theory and Integration*. New Delhi : New Age International Pvt. Limited, 1981.

Chapter 2	Sections	2.1 – 2.5
Chapter 3	Section	3.1, 3.2, 3.4
Chapter 5	Section	5.1, 5.4 – 5.6
Chapter 6	Sections	6.1, 6.2, 6.5
Chapter 7	Sections	7.1
Chapter 8	Sections	8.1 - 8.4

BOOKS FOR REFERENCE

Ganapathy Iyer, V., *Mathematical Analysis*, New Delhi : Tata McGraw Hill Publishing Company Ltd., 1977.

Munroe, M.E. *Introduction to Measure and Integration***,** (Second Printing), USA : Addison Wesley, Publishing Company, Inc., 1959.

Rana, I.k., *An introduction to Measure and Integration***,** New Delhi : Narosa Publishing House, 1997.

Royden, H.L. *Real Analysis*. 3rd ed. Ninth Indian Reprint. New Delhi: Prentice- Hall of India Private Limited, 2003.

WEB RESOURCES

http://www.maa.org/sites/default/files/images/upload_library/47/StemkoskiStorm/RiemannSums.html

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: 2×2 = 4 (Two questions to be set)
Section B: 2×6 = 12 (Three questions to be set)
Section C: 2×17= 34 (Three questions to be set)

Third Component :

List of Evaluation Modes:
Seminars
Quiz
Open Book Tests
Group Discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A: $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B: $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit).
Section C: $3 \times 20 = 60$ (Five questions to be set without omitting any unit).

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M.Sc. DEGREE: BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

RESEARCH METHODS AND TOOLS

CODE:15MT/PC/RT24 **CREDITS: 4**
L T P: 1 0 5
TOTAL TEACHING HOURS: 78

OBJECTIVES OF THE COURSE

- To inculcate research curiosity
- To acquaint with research methodology
- To provide the necessary mathematical tools to prepare a project

Unit 1 (13 hrs.)

Research Methodology

1.1 Introduction – Motivation
1.2 Formulating a Research Problem
1.3 Data Collection – Analyzing and Processing
1.4 Report Writing – Content – Format – Text Layout – Style – Packaging and Presentation, Characteristics of Good Reporting, Suggestions and Recommendations

Unit 2 (13 hrs.)

Creating a Document Using Latex

2.1 Typesetting – Font – Document – Document Class – Page Style – Numbering – Formatting
2.2 Typesetting Mathematics – Typesetting Theorems – Floats
2.3 Cross References – Foot notes – Bibliography

Unit 3 (13 hrs.)

Multimedia: Macromedia Flash 8

3.1 Vector Drawing
3.2 Timeline – Tool bar – Panel
3.3 Creating Objects – Editing Objects – Color and Text – Symbols and Instances
3.4 Frames and Layers
3.5 Animations
3.5 Interactivity

Unit 4 **(13 hrs.)**

Mathematical Software: MATHCAD 14

4.1 Creating Mathcad Worksheets: Working with Math, text regions
4.2 Computational Features: Calculations – Operators – Built-in functions – Vectors, Matrices and Data Arrays
4.3 Graphing: 2D plots – 3D plots
4.4 Symbolic Calculations
4.5 Programming

Unit 5 **(26 hrs.)**

Project Preparation and Presentation involving

5.1 Mathcad
5.2 Flash
5.3 Latex

TEXT BOOKS AND REFERENCE BOOKS

Blake Bonnie, Sahlin Doug, *Flash 8 – A Beginners' Guide*, New Delhi: Dreamtech Press, 2006.

Kothari C R, *Research Methodology*, New Delhi: New Age International Publishers Ltd, 2004.

Larsen W Ronald, *Introduction to Mathcad 13*, New Jersey: Pearson Prentice Hall, 2007.

Leslie Lamport, *LaTeX : A Documentation Preparation System User's Guide and Reference Manual* **,** Mass : Addison Wesley, 1994.

Reinhardt Robert, Dowd Snow, *Flash MX Bible*, New Delhi: Wiley – Dreamtech India Pvt. Ltd, 2002.

Steven G. Krantz, *Mathematical Publishing*, USA : AMS Publication, 2005.

Suresh Chandra, *Research Methodology*, New Delhi: Narosa Publishing House, 2013.

User's Guide Mathcad 14 – 2007 USA: Parametric Technology Corporation, 2007.

WEB RESOURCES

http://www.cv.nrao.edu/~abridle/toolmemo/miktex_manual.pdf
http://w3.id.tue.nl/fileadmin/id/objects/E-Atelier/Phidgets/Software/Flash/fl8_tutorials.pdf

PATTERN OF EVALUATION

INTERNAL ASSESSMENT – 90 Mins.

Third Component – Project

Continuous Assessments I and II:

Theory (10 marks): 1×10=10 (Two questions to be set from Unit 1)
Practical (40 marks): 2×20=40 (Three questions to be set)

END SEMESTER EXAMINATION – 3 Hours

Theory (20 marks) : 2×10=20 (Three questions to be set from Unit 1)
Practical(80 marks) : 4×20=80 (Four questions to be answered without omitting any Section:

Section – A (Two questions to be set from Unit 2)
Section – B (Two questions to be set from Unit 3)
Section – C (Two questions to be set from Unit 4))

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M.Sc. DEGREE: BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

COMPLEX ANALYSIS

CODE: 15MT/PC/CA34 **CREDITS: 4**
L T P: 4 1 0
TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- To introduce a modern treatment to classical Complex analysis
- To develop clear thinking and analyzing capacity for research

Unit 1 (12 hrs.)

Complex Integration

1.1 Fundamental Theorems: Line Integrals as Functions of Arcs
1.2 Cauchy's Theorem for a Rectangle
1.3 Cauchy's Theorem in a Disk
1.4 Cauchy's Integral Formula: the Index of a Point with respect to a Closed Curve
1.5 The Integral Formula

Unit 2 (14 hrs.)

Complex Integration (continued)

2.1 General Form of Cauchy's Theorem: Chains and Cycles
2.2 Simple Connectivity
2.3 Homology
2.4 General Statement of Cauchy's Theorem
2.5 Proof of Cauchy's Theorem
2.6 Harmonic Functions: Definition and Basic Properties
2.7 The Mean Value Property
2.8 Poisson's Formula
2.9 Schwarz's Theorem
2.10 The Reflection Principle

Unit 3 (13 hrs.)

Series and Product Development

3.1 Partial Fractions and Factorization: Partial Fractions
3.2 Infinite Products
3.3 Canonical Products
3.4 Gamma Function
3.5 Entire Functions: Jensen's Formula
3.6 The Riemann Zeta Function: The Product Development

3.7 Extension of $\zeta(z)$ to the Whole Plane
3.8 The Functional Equation
3.9 The Zeros of the Zeta Function

Unit 4 **(14 hrs.)**

Series and Product Development (contd.)

4.1 Normal Families**:** Equicontinuity
4.2 Normality and Compactness
4.3 Arzela's Theorem
4.4 Families of Analytic Functions

Unit 5 **(12 hrs.)**

Conformal mapping

5.1 The Riemann Mapping Theorem: Statement and Proof
5.2 Boundary Behavior
5.3 Use of the Reflection Principle
5.4 Analytic Arcs
5.5 Conformal Mapping of Polygons: The Behavior at an Angle
5.6 The Schwarz Christoffel Formula
5.7 Mapping on a Rectangle
5.8 The Triangle Functions of Schwarz
5.9 Application to Fluid Dynamics: Fluid Flow in a Channel through a Slit
5.10 Application to Fluid Dynamics: Flow in a Channel with an Offset

TEXT BOOKS

Ahlfors, Lars V. *Complex Analysis*, 3rd ed. International Series in Pure and Applied Mathematics. New Delhi: McGraw Hill International Book Co., 1979.

Chapter 4	Section 1: 1.3 – 1.5
	Section 2: 2.1, 2.2
	Section 4: 4.1– 4.5
	Section 6: 6.1 – 6.5
Chapter 5	Section 2: 2.1 – 2.4
	Section 3: 3.1
	Section 4: 4.1 – 4.4
	Section 5: 5.1 – 5.4
Chapter 6	Section 1: 1.1 – 1.4
	Section 2: 2.1 – 2.4.

Churchill R.V., and J.W. Brown. *Complex Variables and Applications*. 5th edition. New York: McGraw Hill Publishing Company, 1990.

Chapter 10 Sections 92 - 93

BOOKS FOR REFERENCE

Conway John B., *Functions of one complex variable*, New Delhi. : Narosa Publishing House, 1978.

John M. Howie, *Complex Analysis*, Springer-Verlag, London Ltd., 2003.

Thoedre W. Gamelin, *Complex Analysis*, Springer-Verlag, New York INC, 2001.

RudinWalter, *Real and Complex Analysis* (II Edition), New Delhi : Tata McGraw Hill Publishing Co., 1974.

WEB RESOURCES

http://www.math.ucla.edu/~tao/java/Ftoc.html
http://fermi.la.asu.edu/ccli/applets/confmap/conform.html

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: 2×2 = 4 (Two questions to be set)
Section B: 2×6 = 12 (Three questions to be set)
Section C: 2×17= 34 (Three questions to be set)

Third Component :

List of Evaluation Modes:
Seminars
Quiz
Open Book Tests
Group Discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A : $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B: $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit)
Section C : $3 \times 20 = 60$ (Five questions to be set without omitting any unit)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086
M.Sc. DEGREE : BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

FLUID DYNAMICS

CODE : 15MT/PC/FD34 **CREDITS : 4**
L T P : 4 1 0
TOTAL TEACHING HOURS : 65

OBJECTIVES OF THE COURSE

- To introduce the concept of fluids in motion, equation of motion of a fluid
- To study two and three dimensional viscous flow

Unit 1 **(12 hrs.)**

The Kinematics of Fluids in Motion

1.1 Real Fluids and Ideal fluids – Velocity of a Fluid at a Point
1.2 Stream Lines and Path Lines – Velocity Potential – Vorticity
1.3 Local and Particle Rates of Change
1.4 Equation of Continuity
1.5 Acceleration of a Fluid – Conditions at a Rigid Boundary

Unit 2 **(14 hrs.)**

Equations of Motion of a Fluid

2.1 Pressure at a Point in a Fluid at Rest
2.2 Pressure at a Point in a Moving Fluid – Conditions at a Boundary of Two Inviscid Immiscible Fluids
2.3 Euler's Equation of Motion – Bernoulli's Equation
2.4 Steady Motion under Conservative Body Forces
2.5 Kelvin's Circulation Theorem

Unit 3 **(12 hrs.)**

Some Two and Three – Dimensional Flows

3.1 Sources, Sinks and Doublets - Meaning of Two-Dimensional
3.2 Axi Symmetric Flows - Stoke's Stream Function Special Forms of the Stream Function for Axi-symmetric Irrotational Motions
3.3 Some Flows involving Axial Symmetry
3.4 Irrotational Stationary Sphere in a Uniform Stream – Sphere moving with Constant in Liquid which is otherwise at Rest

Unit 4 **(12 hrs.)**

Complex Velocity Potential

4.1 Complex Velocity Potential for Standard Two Dimensional Flows
4.2 Milni – Thomson Circle theorem – Extension of the Circle Theorem
4.3 Theorem of Blasius

Unit 5 **(15 hrs.)**

Viscous Flow

5.1 Stress Components in a Real Fluid – Coefficient of Viscosity and Laminar Flow
5.2 Navier – Stokes Equation of Motion of a Viscous Fluid
5.3 Some Solvable Problems in Viscous Flow
5.4 Steady Viscous Flow in Tubes of Uniform Cross-section

TEXT BOOK

Chorlton.F. *Text book of Fluid Dynamics***.** 1st ed. New Delhi: B.S. Publishers & Distributors, Shadara, 1985.

Chapter 2	Sections 2.1 - 2.10;
Chapter 3	Sections 3.1 - 3.7, 3.12,
Chapter 4	Sections 4.1, 4.2.
Chapter 5	Sections 5.1 - 5.6, 5.8, 5.9,
Chapter 8	Sections 8.8 - 8.11.

BOOKS FOR REFERENCE

Duncan W.J., Thom. A.S. and Young A.D., *Mechanics of Fluids***.** Great Britain : The English Language book society, 1975.

Joseph H. Spurk, *Fluid Mechanics: Problems and Solutions.* Springer-Verlag, 2003.

Thomson Milne L.M., *Theoretical Hydro Dynamics***.** (IV Edition), New York. : Macmillan and Co., 1960.

JOURNALS

Fluid Dynamics - Springer - Springer Science+Business Media/ link.springer.com
Open Journal of Fluid Dynamics_Engineering | Physics .../www.scirp.org/**journal**

WEB RESOURCES

http://www.springer.com/physics/classical+continuum+physics/
http://www.efluids.com/efluids/pages/j_midpages/inter_journal_of_fluid.htm

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: 2×2 = 4 (Two questions to be set)
Section B: 2×6 = 12 (Three questions to be set)
Section C: 2×17= 34 (Three questions to be set)

Third Component :

List of Evaluation Modes:
Seminars
Quiz
Open Book Tests
Group Discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A: $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B: $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit)
Section C: $3 \times 20 = 60$ (Five questions to be set without omitting any unit)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086
M.Sc. DEGREE: BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

GRAPH THEORY

CODE: 15MT/PC/GT34 **CREDITS: 4**
L T P: 4 1 0
TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- To give a broader view of concepts in basic graph theory
- To emphasize on computational aspect of graph theory
- To introduce Networking and to study some networks and its topological properties

Unit 1 **(10 hrs.)**

Graphs and Subgraphs

1.1 Graphs and Simple Graphs – Graph Isomorphism, Incidence and Adjacency Matrices, Subgraphs, Vertex Degrees, Paths and Connection, Cycles
1.2 Shortest Path Problem
1.3 Dijkstras Algorithm

Trees

1.4 Trees
1.5 Cut Edges and Bonds
1.6 Cut Vertices

Unit 2 **(16 hrs.)**

Connectivity

2.1 Connectivity

Matchings

2.2 Matchings
2.3 Matchings and Coverings in Bipartite Graphs

Independent sets

2.4 Independent Sets

Domination number

2.5 The Domination Number

Unit 3 **(15 hrs.)**

Vertex Colourings

3.1 Chromatic Number
3.2 Brooks' Theorem
3.3 Chromatic Polynomials

Edge Colorings

3.4 Edge Chromatic Number
3.5 Vizing's Theorem
3.6 The Timetabling Problem

Unit 4 **(14 hrs.)**

Planar Graphs

4.1 Plane and Planar Graphs
4.2 Euler's Formula
4.3 Kuratowski's Theorem
4.4 Five-Colour Theorem

Directed Graphs

4.5 Directed Graphs
4.6 Directed Paths

Unit 5 **(10 hrs.)**

Interconnection Networks and Graphs

5.1 Graphs and Interconnection Networks- Interconnection Networks, Adjacency Matrices and other Concepts, Trees and *k*-ary Trees, Embedding of Graphs, Diameter of Graphs
5.2 Basic Principles of Network Design

Well-known Topological Structures of Interconnection Networks

5.3 Hypercube Networks
5.4 De Bruijn Networks
5.5 Kautz Networks
5.6 Circulant Networks

TEXT BOOKS

Bondy J.A., Murty U.S.R. *Graph Theory with Application*. London: The Macmillan Press Ltd., 1982.

Chapter 1	Sections 1.1 to 1.8
Chapter 2	Sections 2.1 to 2.3
Chapter 3	Sections 3.1
Chapter 4	Sections 4.1 to 4.2
Chapter 5	Sections 5.1, 5.2
Chapter 6	Sections 6.1 – 6.3
Chapter 7	Section 7.1
Chapter 8	Sections 8.1, 8.2, 8.4
Chapter 9	Sections 9.1, 9.3, 9.5 (Theorem 9.10 statement only), 9.6 (Omit Theorem 9.12)
Chapter 10	Sections 10.1, 10.2

Parthasarathy K.R., *Basic Graph Theory*. New Delhi: Tata McGraw-Hill Publishing Company Limited. 1994.

Chapter 10	Section 10.4.2

Xu Junming, *Topological Structure and Analysis of Interconnection Networks*. U.S.A.: Kluwer Academic Publishers, 2001.

Chapter 1 Sections 1.1.2, 1.2.4, 1.3.1, 1.3.2, 1.4.1 (definitions only), 1.6.1 & 1.6.2
Chapter 3 Sections 3.1.1 & 3.1.2, 3.2.1, 3.2.6, 3.3.1, 3.4.5 (Theorem 3.4.12 statement only; Omit Theorems 3.2.1, 3.2.14, 3.3.1, 3.4.13)

BOOKS FOR REFERENCE

Aldous Joan M. & Robin J. Wilson, *Graphs and Applications An Introductory Approach*. New York: Springer International Edition, 2007.

Arumugam S. and Ramachandran S. *Invitation to Graph Theory*. Chennai: Scitech Publications India Pvt. Ltd., Reprint 2013.

Balakrishnan R, Sethuraman G, Wilson R.J., *Graph Theory and it's Applications*. New Delhi: Narosa Publishing House, 2004.

Diestel Reinhard. *Graph Theory.* New York: Springer, 2006.

Geir Agarnarsson, Raymond Greenlaw, *Graph Theory: Modeling, Applications and Algorithms.* New Delhi: Pearson Education, 2012.

Thakur Prasad, *A First Course in Graph Theory.* New Delhi: Anmol Publications Pvt. Ltd., 2014.

JOURNALS

Journal of Graph Theory
Arcs Combinatoria
Journal of Combinatorics
SIAM Journal on Discrete Mathematics
Information Processing Letters
Discrete Mathematics
Journal of Discrete Algorithms
Graphs and Combinatorics
Advances in Computational Mathematics

WEB RESOURCES

http://world.mathigon.org/GraphTheory
http://press.princeton.edu/titles/10314.html
http://www.open-graphtheory.org
http://www.math.nsysu.edu.tw/~zhu/papers.html
http://www.worldscientific.com/worldscinet/join

PATTERN OF EVALUATION

Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: 2×2 = 4 (Two questions to be set)
Section B: 2×6 = 12 (Three questions to be set)
Section C: 2×17= 34 (Three questions to be set)

Third Component :

List of Evaluation Modes:
Seminars
Quiz
Open Book Tests
Group Discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A: $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B: $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit)
Section C: $3 \times 20 = 60$ (Five questions to be set without omitting any unit)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086

M.Sc. DEGREE: BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

TOPOLOGY

CODE : 15MT/PC/TO34 **CREDITS: 4**
L T P: 4 1 0
TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- To introduce the structural study of topology
- To introduce the concepts of compactness, connectedness and separation axioms in a topological space

Unit 1 **(15 hrs.)**

Topological Spaces

1.1 Topological Spaces
1.2 Basis for a Topology
1.3 The Product Topology on X×Y
1.4 The Subspace Topology
1.5 Closed Sets and Limit Points

Unit 2 **(12 hrs.)**

Connectedness

2.1 Connected Spaces
2.2 Connected Subspaces of the Real Line
2.3 Components and Local Connectedness

Unit 3 **(12 hrs.)**

Compactness

3.1 Compact Spaces
3.2 Compact Subspaces of the Real Line
3.3 Limit Point Compactness

Unit 4 **(13 hrs.)**

Countability and Separation Axiom

4.1 The Countability Axioms
4.2 The Separation Axioms
4.3 Normal Spaces
4.4 The Urysohn Lemma
4.5 The Urysohn Metrization Theorem
4.6 The Tietz Extension Theorem

Unit 5 **(13 hrs.)**

Continuous Functions

5.1 Continuous Functions
5.2 The Product Topology
5.3 Tychonoff Theorem

TEXT BOOK

Munkres James R. *Topology*, New Delhi : Prentice Hall of India Private Limited, Second ed. 2000

Chapter 2	Sections 12,13,15 – 19
Chapter 3	Sections 23 – 27
Chapter 4	Sections 30 – 35
Chapter 5	Section 37

BOOKS FOR REFERENCE

Kumaresan S , Aaker D.A, *Topology of Metric Spaces*, Ed. 2 New Delhi: Narosa Publishing House, 2005.

Simmons, G.F. *Introduction to Topology and Modern Analysis*. New-York : McGraw Hill Book Co. Inc., (6th Reprint 2006), 1963.

Viro O Ya , Others, *Elementary Topology*, American Mathematical Society, 2008.

Wayne C Patty, *Foundations of Topology,* Ed. 2, New Delhi : Jones & Bartlett Learning, New Delhi, 2010.

WEB RESOURCES

http://math.nie.edu.sg/wkho/Talks_files/topappl.pdf
http://www.msc.uky.edu/droyster/courses/fall99/math4181/classnotes/notes5.pdf

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: 2×2 = 4 (Two questions to be set)
Section B: 2×6 = 12 (Three questions to be set)
Section C: 2×17= 34 (Three questions to be set)

Third Component :

List of Evaluation Modes:
Seminars
Quiz
Open Book Tests
Group Discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A : $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B: $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit)
Section C : $3 \times 20 = 60$ (Five questions to be set without omitting any unit)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086

M.Sc. DEGREE: BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

SUMMER INTERNSHIP

CODE : 15MT/PN/SI 32 **CREDIT : 2**

OBJECTIVE OF THE COURSE

- To provide opportunity to gain experience in various fields

FIELD WORK : (3 Weeks)

Summer Internship: a minimum period of three weeks during the summer holidays between the second and third semesters

EVALUATION:

SUMMER INTERSHIP : 100 Marks
(Mathematical work: 40 + Presentation: 40 + Report: 20)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086
M.Sc. DEGREE: BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

FUNCTIONAL ANALYSIS

CODE:15MT/PC/FA44 **CREDIT: 4**
L T P: 4 1 0
TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- To introduce an abstract approach to analysis
- To highlight the interplay between algebraic structures and distance structures
- To introduce Operator theory and its application to finite dimensional Spectral Theory

Unit 1 **(15 hrs.)**

Fundamentals of Normed Spaces

1.1 Normed Spaces
1.2 Continuity of Linear Maps
1.3 Hahn-Banach Theorems
1.4 Banach Spaces

Unit 2 **(15 hrs.)**

Bounded Linear Maps on Banach Spaces

2.1 Uniform Boundedness Principle
2.2 Closed Graph and Open Mapping Theorems
2.3 Bounded Inverse Theorems
2.4 Spectrum of a Bounded Operator

Unit 3 **(10 hrs.)**

Spaces of Bounded Linear Functionals

3.1 Duals and Transposes
3.2 Weak and Weak * Convergence
3.3 Reflexivity

Unit 4 **(15 hrs.)**

Geometry of Hilbert Spaces

4.1 Inner Product Spaces
4.2 Orthonormal Sets
4.3 Projection and Riesz Representation Theorems

Unit 5 **(10 hrs.)**

Bounded Operators on Hilbert Spaces

5.1 Bounded Operators and Adjoints

5.2 Normal, Unitary and Self Adjoint Operators

TEXT BOOK

Balmohan V. Limaye, *Functional Analysis*, New Delhi: New Age International(P) limited, 1996, Third Edition 2014.

Chapter II : Sec. 5 – 8 (omit Pages 117 -124; 132 – 134)
Chapter III : Sec. 9 – 12 (omit Pages 144 – 161; 203 – 215)
Chapter IV : Sec. 13 – 16 (omit Pages 226 – 260; 273 – 280; 288 - 301)
Chapter VI : Sec. 21, 22, 24
Chapter VII: Sec. 25 – 26

BOOKS FOR REFERENCE

Chandrasekhara K Rao, Ander Paul, *Functional Analysis*, New Delhi: Narosa Publishing House, 2006.

Kesavan S , Aaker D.A, Sharfuddin Ahmad, *Functional Analysis*, Hindustan Book Agency, 2009.

Nair Thamban, Abrams Charles, *Functional analysis – A first course,* Prentice-hall, 2002.

Siddiqi,A.H , Manchanda P, *Introduction to Functional Analysis with Application*, Anamaya, 2006.

WEB RESOURCES

http://www.mth.kcl.ac.uk/staff/eb_davies/printmaster.pdf

http://math.univ-lyon1.fr/~attal/Op_and_Spect.pdf

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: $2 \times 2 = 4$ (Two questions to be set)
Section B: $2 \times 6 = 12$ (Three questions to be set)
Section C: $2 \times 17 = 34$ (Three questions to be set)

Third Component :

List of Evaluation Modes:
Seminars

Quiz
Open Book Tests
Group Discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A : $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B: $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit).
Section C : $3 \times 20 = 60$ (Five questions to be set without omitting any unit).

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086
M.Sc. DEGREE: BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

CALCULUS OF VARIATION AND INTEGRAL EQUATIONS

CODE: 15MT/PC/CI44 **CREDITS: 4**
L T P: 4 1 0
TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- To introduce methods for finding the extrema of a functional defined over a class of functions
- To formulate Integral Equations of boundary value problems with more general boundary conditions

Unit 1 (13 hrs.)

Variational Problems with Fixed Boundaries

1.1 The Concept of Variation and its Properties
1.2 Euler's Equation
1.3 Variational Problems for Functionals of the Form
1.4 Functionals Dependent on Higher Order Derivatives
1.5 Functional Dependent on Functions of Several Independent Variables
1.6 Variational Problems in Parametric Form

Unit 2 (13 hrs.)

Variational Problems with Moving Boundaries

2.1 Variational Problem with a Movable Boundary for a Functional Dependent on Two Functions
2.2 One- Sided Variations
2.3 Reflection and Refraction of Extremals – Diffraction of Light Rays

Unit 3 (13 hrs.)

Fredholm Integral Equations

3.1 Introduction - Definition
3.2 Abel's Problem
3.3 Linear and Non-linear Integral Equations
3.4 Fredholm Integral Equations
3.5 Volterra Integral Equations
3.6 Special Kinds of Kernals
3.7 Eigen Values and Eigen Functions

Unit 4 **(13 hrs.)**

Conversion of Ordinary Differential Equations into Integral Equations

4.1 Initial Value Problems

4.2 Methods of Converting an Initial Value Problem into a Volterra Integral Equation

4.3 Boundary Value Problems – Examples

4.4 Methods of Converting a Boundary Value Problem into a Fredholm Integral Equation

Unit 5 **(13 hrs.)**

Homogeneous Fredholm Integral Equations

5.1 Characteristic Values – Characteristic Functions

5.2 Solution of Homogeneous Fredholm Integral Equations of the Second Kind with Separable Kernels

TEXT BOOKS

Gupta A.S., *Calculus of Variations with Applications***,** Prentice Hall of India Pvt., Ltd., New Delhi, 1997

Chapter 1 Sections 1.1 – 1.6
Chapter 2 Sections 2.1 – 2.5

Raisinghania.M.D.,*Integral Equations and Boundary Value Problems*, S. Chand & Co., New Delhi, 2007

Chapter 1 Sections 1.1 – 1.12
Chapter 2 Sections 2.1 – 2.6
Chapter 3 Sections 3.1 – 3.3

BOOKS FOR REFERENCE

Gupta.S, *Calculus of Variations with Applications*, PHI, New Delhi, 2005.

Ram P. Kanwal, *Linear Integral Equations, Theory and Techniques*. Academic Press, New York, 2012.

Sudir K. Pundir and Rimple Pundir, *Integral Equations and Boundary Value Problems*. Pragati Prakasam, Meerut, 2005.

JOURNALS

Journal of Calculus of Variation- An open access Journal

Calculus of Variations and Partial Differential Equations, ISSN: 0944-2669 (Print) **1432-0835 (Online)**

WEB RESOURCES

www.degruyter.com/view/j/acv

http://www.springer.com/mathematics/analysis/journal
http://journals.academia.edu/AdvancesInCalculusOfVariations

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: 2×2 = 4 (Two questions to be set)
Section B: 2×6 = 12 (Three questions to be set)
Section C: 2×17= 34 (Three questions to be set)

Third Component :

List of Evaluation Modes:
Seminars
Quiz
Open Book Tests
Group Discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination:

Total Marks: 100 **Duration: 3 Hours**

Section A: $5 \times 2 = 10$ (Five questions to be set, selecting one question per unit)
Section B: $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit).
Section C: $3 \times 20 = 60$ (Five questions to be set without omitting any unit).

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086
M.Sc. DEGREE: BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015-2016)

DIFFERENTIAL GEOMETRY

CODE : 15MT/PC/DG44 **CREDIT: 4**
L T P: 4 1 0
TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- To introduce advanced concepts in differential geometry of space curves
- To introduce the fundamental forms
- To lay the foundation for study of surfaces leading to advanced courses in geometry

Unit 1 **(14 hrs.)**

Curves in the Plane and in Space

1.1 Curve, Arc-Length, Re-parameterization
1.2 Curvature, Plane Curves, Space Curves

Unit 2 **(12 hrs.)**

Surfaces in Three Dimensions

2.1 Surface, Smooth Surface
2.2 Tangents, Normal and Orientability, Examples of Surfaces

Unit 3 **(15 hrs.)**

The First Fundamental Form

3.1 Lengths of Curves on Surfaces
3.2 Isometrics of Surfaces
3.3 Conformal Mappings of Surfaces
3.4 Surface Area

Unit 4 **(12 hrs.)**

Curvature of Surfaces

4.1The Second Fundamental Form
4.2 The Curvatures of Curves on a Surface
4.3 The Normal and Principle Curvatures

Unit 5 **(12 hrs.)**

Gaussian Curvature

5.1 The Gaussian and Mean Curvatures
5.2 The Pseudosphere
5.3 Flat Surfaces

Geodesics

5.4 Definition and Basic Properties
5.5 Geodesic Equation
Gauss's Theorema Egregium
5.6 Gauss's Remarkable Theorem

TEXT BOOK

Pressley Andrew, *Elementary Differential Geometry*, London: Springer – Verlag, 2001.

Chapter 1 : Sec. 1.1 – 1.3
Chapter 2 : Sec. 2.1 – 2.3
Chapter 4 : Sec. 4.1 – 4.4
Chapter 5 : Sec. 5.1 – 5.4
Chapter 6 : Sec. 6.1 – 6.3
Chapter 7 : Sec. 7.1 – 7.3
Chapter 8 : Sec. 8.1 – 8.2
Chapter 10 : Sec. 10.1

BOOKS FOR REFERENCE

Ethan D. Bloch, *A First Course in Geometric Topology and Differential Geometry*, Boston: Birkhäuser, 1997.

Struik, Dirk J., *Lectures on Classical Differential Geometry*, II Edition, London: Addison – Wisely Publishing Co., 1961.

Wardle, K.L., *Differential Geometry*, London: Routledge and Kegan Paul, 1965.

Weatherburn, C.E., *Differential Geometry of Three Dimensions*, London: The Syndics of the Cambridge University Press, 1971.

Willmore, T.J., *An Introduction to Differential Geometry*, London : Oxford University Press, 1972.

JOURNAL

Differential Geometry and Its Applications

WEB RESOURCE

http://dga.math.muni.cz/

PATTERN OF EVALUATION
Continuous Assessment:

Total Marks: 50 **Duration: 90 Mins.**

Section A: $2 \times 2 = 4$ (Two questions to be set)
Section B: $2 \times 6 = 12$ (Three questions to be set)
Section C: $2 \times 17 = 34$ (Three questions to be set)

Third Component :

List of Evaluation Modes:
Seminars
Quiz
Open Book Tests
Group Discussion
Assignments
Project
Theorem Writing Technique
Problem Solving

End Semester Examination Duration:

Total Marks: 100 **Duration: 3 Hours**

Section A : $5 \times 2 = 10$ (One question to be set from each unit)
Section B : $5 \times 6 = 30$ (Seven questions to be set, without omitting any unit)
Section C : $3 \times 20 = 60$ (Five questions to be set without omitting any unit)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI – 600 086
M.Sc. DEGREE : BRANCH I – MATHEMATICS

SYLLABUS
(Effective from the academic year 2015 – 2016)

DISSERTATION

CODE : 15MT/PC/DI45 **CREDITS : 5**

Preparation of Dissertation

The Dissertation shall contain at least 35 pages and shall be typed with double spacing. The format for the thesis is as follows:

1. Cover page shall contain
   a) Title of the dissertation
   b) Dissertation submitted at the major level for the M.Sc degree course in the IV semester.
   c) Name of the Candidate
   d) Department of Mathematics
      Stella Maris College (Autonomous), Chennai – 86
   e) Month, Year
2. The dissertation shall contain
   a) Contents page
   b) i. Certificate page
      ii. Acknowledgement page
   c) At least 3 Chapters including an introductory chapter (comprising motivation, basic concepts needed / used in the thesis and outline of the thesis)
   d) Conclusions / interpretations arrived at may be given at the end of each problem / each chapter concerned.
   e) List of figures / list of abbreviations (if needed) shall be given as an appendix
   f) Bibliography shall be given in alphabetical / chronological order at the end.
3. Each candidate may prepare 3 copies of the thesis using a Scientific Word or Word, one copy for her and submit 2 copies to the Head of the department 15 days before the commencement of the fourth semester examination.
4. The candidate may be advised that the dissertation will be valued and given credit on the criteria of
   a) Motivation towards the chosen area / formulation of the problem
   b) Methodology, Analysis, logic and reasoning
   c) Capacity to interpret the results obtained
5. The Controller of Examination is requested to arrange for the valuation of the Dissertation as well as the conduct of the Viva – Voce at the college where the candidates take examinations, within two weeks of the last date of examination for M.Sc. Degree. The panel of examiners will consist of an external examiner and the guide. The guidelines for the Viva-Voce examiners would be that a) They

will satisfy themselves that this is a work of the candidate as certified by the department b) The thesis is in the given form and c) The candidate has clear understanding of the concepts, discussed in the thesis.

The Department should certify as follows :
This is to certify that the dissertation in the broad area _____ titled _____ is submitted by _____- at the major level for the degree of Master of Science (Mathematics) during the year_____

sd/ sd/
Head of the Department Guide

6. A) Guidelines for evaluation

The maximum mark for the dissertation is 75 divided into four components

i.	Style, format and neatness in presentation	10
ii	Chapterisation, logic and reasoning	10
iii	Methodology – Analysis and interpretation	30
iv	Viva	25

B) There will be double valuation for the dissertation by the guide and an External examiner who will conduct the viva – voce. The norms for evaluation will be same as applicable for theory papers.

PATTERN OF EVALUATION:

External Testing :
Dissertation : 75 marks
Viva : 25 marks