MAHENDRA ARTS & SCIENCE COLLEGE

(AUTONOMOUS)

[Accredited by NAAC 'A' Grade & Recognized under u/s 2(f) and 12B of the UGC act 1956]

KALIPPATTI-637501

DEGREE OF MASTER OF SCIENCE

CHOICE BASED CREDIT SYSTEM

SYLLABUS FOR M.Sc. MATHEMATICS

FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR

2016 – 2017 ONWARDS

MAHENDRA ARTS & SCIENCE COLLEGE

(Autonomous)

KALIPPATTI, NAMAKKAL (Dt) – 637501.

REGULATIONS FOR M.Sc. MATHEMATICS DEGREE COURSE

with Semester System and CBCS Pattern

(Effective from the academic year 2016-2017)

1. OBJECTIVE OF THE COURSE

To develop the Post Graduates in Mathematics with strong knowledge of theoretical Mathematics subjects who can be employed in research and development units of industries and academic institutions.

2. ELIGIBILITY FOR ADMISSION

A candidate who has passed B.Sc., Mathematics degree of any University accepted by the College Academic Council as equivalent there to subject to such conditions as may be prescribed therefore shall be permitted to appear and qualify for the **M.Sc. Mathematics** degree examination of after a course of study of two academic years.

3. DURATION OF THE COURSE

The course for the degree of **Master of Science in Mathematics** shall consist of two academic years divided into four semesters. Each semester consist of 90 working days.

4. COURSE OF STUDY

The course of study shall comprise instructions in Core and Elective subjects according to the syllabus and books prescribed from time to time. This syllabus for various subjects shall be clearly demarcated into five viable UNITs in each paper / subject.

5. EXAMINATIONS

The Theory examination shall be three hours duration to each paper at the end of each semester. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examination. The practical examinations for PG course should be conducted at the end of the every semester.

6. a) SUBMISSION OF RECORD NOTE BOOKS FOR PRACTICAL EXAMINATIONS

Candidates appearing for practical examinations should submit bonafide Record Note Books prescribed for practical examinations, otherwise the candidates will not be permitted to appear for the practical examinations. However, in genuine cases where the students, who could not submit the record note books, they may be permitted to appear for the practical examinations, provided the concerned Head of the department from the institution of the candidate certified that the candidate has performed the experiments prescribed for the course. For such candidates who do not submit Record Books, zero (0) marks will be awarded for record note books.

7. REVISION OF REGULATIONS AND CURRICULUM

The college may revise / amend / change the Regulations and Scheme of Examinations, if found necessary.

8. PASSING MINIMUM

a) THEORY

The candidate shall be declared to have passed the examination if the candidate secure not less than 50 marks out of 100(CIA – 12 marks out of 25 and EA – 38 marks out of 75) in the examination in each theory paper.

b) PRACTICAL

The candidate shall be declared to have passed the examination if the candidate secure not less than 50 marks put together out of 100(CIA – 20 marks out of 40 and EA – 30 marks out of 60) in the examination in each practical paper.

9. EVALUATION PATTERN

Theory: Internal [CIA]: 25 Marks & External [EA]: 75 Marks Max. Marks: 100

Internal Marks Distribution [CIA] (Total Marks: 25)

- Attendance : 5 Marks
- Assignment : 5 Marks
- Seminar : 5 Marks
- Internal Examinations : 10 Marks

External Marks Distribution [EA] (Total Marks: 75)

Practical: Internal [CIA]: 40 Marks & External [EA]: 60 Marks Marks: 100

Internal Marks Distribution Practical / Software Development Lab [CIA]

(Total Marks: 40)

- Preparation of Record & Submission : 15 Marks
- Internal Practical Examinations : 25 Marks

The components for continuous internal assessment are:

- Attendance : 5 Marks
- Model Practical Examinations : 20 Marks

External Marks Distribution Practical [EA] (Total Marks: 60)

For each Practical question the marks should be awarded as follows (External):

(i) Algorithm / Flowchart - 20%

(ii) Writing the program in the main answer book - 30%

(iii) Test and debug the programs - 30%

(iv) Printing the correct output - 20%

(Marks may be proportionately reduced for the errors committed in each of the above)

PROJECT DISSERTATION (Max. 100 Marks)

Internal : 25 Marks

Evaluation (External) : 25 Marks

Viva -Voce (Joint) : 50 Marks

10. QUESTION PAPER PATTERN

Theory: Time: 3 Hours Max.Marks: 75

PART-A (5 x 5 = 25)

Answer all the questions (Either or type from each unit)

PART-B (5 x 10 = 50)

Answer all the questions (Either or type from each unit)

Practical: Time: 3 Hours Max.Marks: 60

1. One compulsory question from the given list of objectives : 30 Marks

2. One either / OR type question from the given list of objectives : 30 Marks

11. REGULATIONS OF PROJECT WORK

- Students should do their five months [December to April] Project work in Company / Institutions
- The candidate should submit the filled in format as given in **Annexure – I** to the department for approval during the first week of January in their project semester
- Each internal guide shall have maximum of 4 Students
- Periodically the project should be reviewed minimum three times by the advisory committee
- The students should prepare three copies of the dissertation and submit the same to the college in the month of April for the evaluation by examiners. After evaluation one copy is to be retained in the college library and the student can hold one copy.
- A sample format of the dissertation is enclosed in **Annexure – II**
- Format of the Title page and certificate are enclosed in **Annexure – III**
- The Students should use Power Point Presentation during their Project Viva-voce Examinations.

12. CLASSIFICATION OF SUCCESSFUL CANDIDATES

- FIRST CLASS WITH DISTINCTION – 75% and above at the first appearance
- FIRST CLASS - 60% and above
- SECOND CLASS - 50% to 59%

13. COMMENCEMENT OF REGULATION

These regulations shall take effect from the academic year 2016 – 2017, i.e. for students who are to be admitted to the first year of the course during the academic year 2016 – 17.

ANNEXURE – I

College Name :

Course :

Student Name :

Register Number :

Title of the Project :

Address of Organization / Institution :

Name of the Guide :

Qualification :

Teaching Experience :

Place:

Date:

Signature of Guide

HEAD OF THE DEPARTMENT

ANNEXURE II

Dissertation & Mini Project:

(a) Topic:

The topic of the dissertation shall be assigned to the candidate before the beginning of third semester and a copy of the same should be submitted to the University for approval

(b) No. of copies project / dissertation:

The students should prepare **Three** copies of dissertation and submit the same for the evaluation by Examiners. After evaluation one copy is to be retained in the college library and one copy is to be submitted to the COE and one copy can be held by the student.

Format to be followed: The formats / certificate for project / dissertation to be submitted by the students is given below:

Format for the preparation of project work:

(a) Title page

(b) Bonafide Certificate

(c) Acknowledgement

(d) Table of contents

CONTENTS **Chapter No.**	**Title**	**Page No.**
1.	Introduction	
2.	Review of Literature	
3.	Results	
4.	Summary	
5.	References	

ANNEXURE III

1) Format of the Title page

TITLE OF THE DISSERTATION

A Dissertation submitted in partial fulfillment of

the requirements for the degree of

Master of Science in Mathematics

by

STUDENT NAME

Reg.No:

College

Emblem

DEPARTMENT OF MATHEMATICS

MAHENDRA ARTS & SCIENCE COLLEGE

(Autonomous)

KALIPPATTI – 637 501.

MONTH – YEAR

2) Format of the Certificate

MAHENDRA ARTS & SCIENCE COLLEGE

(Autonomous)

KALIPPATTI – 637 501.

MONTH – YEAR

PROJECT WORK TITLE OF THE DISSERTATION

Bonafide Work done by

STUDENT NAME

REG. NO

A Dissertation submitted in partial

fulfillment of the requirements for the degree of

Master of Science in Mathematics

INTERNAL GUIDE **HEAD OF THE DEPARTMENT**

Submitted for the Viva-Voce Examination held on _____

Internal Examiner **External Examiner**

14. STRUCTURE OF THE PROGRAMME:

MAHENDRA ARTS & SCIENCE COLLEGE
(AUTONOMOUS)
DEPARTMENT OF MATHEMATICS
M.Sc MATHEMATICS – SYLLABUS :- 2016-2017

SEM	COURSE CODE	COURSE	COURSE TITLE	HRS / WEEK	CREDIT	CIA MARKS	SE MARKS	TOTAL MARKS
I	M16PMA01	CORE I	Advanced Algebra-I	6	5	25	75	100
	M16PMA02	CORE II	Advanced Real Analysis-I	6	5	25	75	100
	M16PMA03	CORE III	Ordinary Differential Equations	6	4	25	75	100
	M16PMA04	CORE IV	Classical Mechanics	6	5	25	75	100
		ELECTIVE- I	Elective from Group-I	6	4	25	75	100
Total				**30**	**23**	**125**	**375**	**500**
II	M16PMA05	CORE V	Advanced Algebra-II	6	5	25	75	100
	M16PMA06	CORE VI	Advanced Real Analysis-II	6	5	25	75	100
	M16PMA07	CORE VII	Partial Differential Equations	6	4	25	75	100
		ELECTIVE II	Elective from Group-II	5	4	25	75	100
	M16PCSED1	EDC	-	5	4	25	75	100
	M16PHR01		Human Rights	2	2	25	75	100
	M16PMAPR1		Mini Project	-	1	100	-	100
Total				**30**	**25**	**250**	**450**	**700**
III	M16PMA08	CORE VIII	Complex Analysis	6	5	25	75	100
	M16PMA09	CORE I X	Topology	6	5	25	75	100
	M16PMA10	CORE X	Measure Theory and Integration	6	5	25	75	100
	M16PMA11	CORE XI	Differential Geometry	6	5	25	75	100
		ELECTIVE- III	Elective from Group-III	6	4	25	75	100
Total				**30**	**24**	**125**	**375**	**500**
IV	M16PMA12	CORE XII	Functional Analysis	6	5	25	75	100
	M16PMA13	CORE XIII	Graph Theory	6	5	25	75	100
	M16PMA14	CORE XIV	Calculus of Variation & Integral Equations	6	4	25	75	100
		ELECTIVE-IV	Elective from Group-IV	6	4	25	75	100
	M16PMAPR2	PROJECT WORK	-	6	4	25	75	100
		Total		**30**	**22**	**125**	**375**	**500**
		Grand total		**120**	**94**	**625**	**1575**	**2200**

Core Based Elective:

GROUP	PAPER CODE	CORE BASED ELECTIVE
I	M16PMAE01	Numerical Analysis
	M16PMAE02	Probability Theory
II	M16PMAE03	Fluid Dynamics
	M16PMAE04	Stochastic Process
III	M16PMAE05	Discrete Mathematics
	M16PMAE06	C ++
	M16PMAE07	Difference Equations
IV	M16PMAE08	Number Theory
	M16PMAE09	Optimization Techniques
	M16PMAE10	Practical – C++

COURSE OFFERED BY OTHER DEPARTMENTS:

Extra Disciplinary Course (EDC):

SEMESTER	COURSE	PAPER CODE	PAPER NAME
II	COURSE-I	M16PMAED1	Quantitative Aptitude
	COURSE-II	M16PMAED2	Operation Research

VALUE ADDED COURSE FOR COMPUTER SCIENCE:

SEMESTER	PAPER CODE	PAPER NAME
I	M16PCSS01	Soft Skills

SEMESTER-I

Core - I	M.Sc. Mathematics	2016 - 2017
M16PMA01	ADVANCED ALGEBRA-I	
Credit: 5		

Unit I:

Another counting principle, Sylows theorem,

Unit II:

Direct product , finite abelian groups , Ideals and Quotient Rings, more Ideals and Quotient Rings,

Unit III:

The field of Quotients of an Integral Domain.Euclidean Rings,

A particular Euclidean Ring.

Unit IV:

Polynomial rings – rings over rational field rings over commutative ring

Unit V:

Vector spaces – Dual spaces – Inner product spaces& modules.

Text Book:

Topics in Algebra by I.N. Herstein, Second Edition, John Wiley and sons, 1999.

Chapter 2: Sections 2.11, 2.12, 2.13, 2.14.

Chapter 3: Sections 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11

Chapter 4: Sections 4.3 to 4.5)

Reference:

1.S.Lang Algebra, 3rd Edition, Addison Wesley, Mass 1993.

2. John B.Fraleigh – A first course in abstract Algebra, Addison Wesley, Mass 1982.

3. M.Artin, Algebra, Prentice Hall of India, NewDelhi, 1991.

Core - II	M.Sc. Mathematics	2016 - 2017
M16PMA02	ADVANCED REAL ANALYSIS –I	
Credit: 5		

UNIT – I:

Basic Topology – Finite, countable, and Uncountable sets – Metric Spaces – Compact Sets –Perfect sets – connected sets.

UNIT –II :

Numerical Sequences – Convergent sequences – Cauchy Sequences – Upper and LowerLimits – Some special sequences.

UNIT-III:

Numerical Series – Series of nonnegative Terms – The Number e– The Root and Ratio Test –Power series – Summation by Parts – Absolute Convergence – Addition and Multiplication ofseries – Rearrangement Theorems.

UNIT-IV:

Continuity – Limits of Functions – Continuous Functions – Continuity and Compactness – Continuity and Connectedness.

UNIT-V:

Differentiation – The Derivative of a Real function – Mean Value Theorems – The Continuityof Derivatives – L'Hospital's Rule – Derivative of Higher Orders – Taylor's Theorem.

TEXT BOOK:

Principles of Mathematical analysis (Third edition)by Walter Rudin,

Chapters 2, 3, 4, and 5.

Reference:

1. T.M. Apostol, Mathematical Analysis, Narosa Publ. House, New Delhi, 1985.

2. H.L. Royden, Real Analysis, Macmillan Publ. Co. Inc. 4th edition, New York, 1993.

3. V. Ganapathy Iyer, Mathematical Analysis, Tata McGraw Hill, New Delhi, 1970.

Core - III	M.Sc. Mathematics	2016 - 2017
M16PMA03	ORDINARY DIFFERENTIAL EQUATIONS	
Credit: 4		

Unit I:

Linear Equations with Constant Coefficients:

Introduction – Second order homogeneous equations – Initial value problem – Linear dependence and independence – A formula for the Wornskian.

(Chapter 2: Section 1 to 5)

Unit II:

Linear Equations with Constant Coefficients (Contd.):

Non-homogeneous equations of order two – Homogenous and non-homogeneous equations of order n – Initial value problem – Annihilater method to solve a non-homogeneous equation. (Chapter 2: Section 6 to 11)

Unit III:

Linear Equations with Variable Coefficients:

Initial value problems for homogeneous equations – solutions of homogeneous equations-Wronskian and linear independence – Reduction of the order of homogeneous equation. (Chapter 3: Section 1 to 5)

Unit IV:

Linear Equations with Regular Singular Points:

Linear equation with regular singular points – Euler equation – second order equations with regular singular points – solutions and properties of Legendre and Bessels equation.

(Chapter 3: Section 8 & Chapter 4: Section 1 to 4 and 7 and 8)

Unit V:

First Order Equation – Existence and Uniqueness:

Introduction – Existence and uniqueness of solutions of first order equations – Equations with variable separated – Exact equations – Method of successive approximations – Lipschitz Condition – Convergence of the successive approximations. (Chapter 5: Section 1 to 6)

Text Book:

E.A.Codington, An Introduction to Ordinary Differential Equation, Prentice Hall of India, New Delhi, 1994.

Reference:

1. R.P Agarwal and Ramesh C.Gupta, Essentials of Ordinary Differential Equation. McGraw, Hill, New York, 1991.

2. D.Somasundram, Ordinary Differential Equations, Narosa Publ.House, Chennai – 2002.

Core - IV	M.Sc. Mathematics	2016 - 2017
M16PMA04	CLASSICAL MECHANICS	
Credit: 5		

Unit I:

Mechanical Systems:

The Mechanical System – Generalized co–ordinates – Constraints – Virtual work – Energy and Momentum.

(Chapter 1 Sections 1.1 to 1.5)

Unit II:

Lagrange's Equations:

Lagrange's Equation – Derivation of Lagrange's Equations – Examples – Integrals of motion.

(Chapter 2 Sections 2.1 to 2.3)

Unit III:

Hamilton's Equation:

Hamilton's Equation – Hamiltons Principle – Hamilton's Equation – Other Variational Principle.

(Chapter 4 Sections 4.1 to 4.3)

Unit IV:

Hamilton – Jacobi Theory:

Hamilton – Jacobi Theory – Hamilton Principle Function – Hamilton – Jacobi Equation – Separability.

(Chapter 5 Sections 5.1 to 5.3)

Unit V:

Canonical Transformation:

Canonical Transformation – Differential forms and generating functions – Special Transformations – Lagrange and poisson brackets.

(Chapter 6 Sections 6.1 to 6.3)

Text Book:

D. Greenwood, Classical Dynamics, Prentice Hall of India, New Delhi, 1985.

Reference :

1. H.Goldstein, Classical Mechanics, Narosa Publishing House, NewDelhi, 2001.

2. J.L. Synge and B.A. Griffth, Principles of Mechanics, McGraw Hill Book Co. New York,1970.

3. N.C. Rane and P.S.C. Joag, Classical Mechanics, Tata McGraw Hill, New Delhi, 1991.

ELECTIVE GROUP-I

Elective - I	M.Sc. Mathematics	2016 - 2017
M16PMAE01	NUMERICAL ANALYSIS	
Credit: 4		

Unit I :

Numerical solutions to ordinary differential equation:

Numerical solutions to ordinary differential equation – Power series solution – Pointwise method – Solution by Taylor's series – Taylor's series method for simultaneous first order differential equations – Taylor's series method for Higher order Differential equations –

(Chapter 11: Sections 11.1 to 11.6)

Unit II :

Picard and Euler Methods:

Picard's Method of successive approximations – Picard's method for simultaneous first order differential equations – Picard's method for simultaneous second order differential equations – Euler's Method – Improved Euler's method – Modified Euler's Method.

(Chapter 11: Sections 11.7 to 11.12)

Unit III :

Runge – Kutta Method:

Runge's method – Runge-Kutta methods – Higher order Runge-Kutta methods- Runge-Kutta methods for simultaneous first order differential equations – Runge-Kutta methods for simultaneous second order differential equations -Predictor – Corrector methods – Milne's method – Adam – Bashforth method

(Chapter 11: Sections 11.13 to 11.20)

Unit IV :

Numerical solutions to partial differential equations:

Introduction Difference Quotients – Geometrical representation of partial differential quotients – Classifications of partial differential equations – Elliptic equation – Solution to Laplace's equation by Liebmann's iteration process.

(Chapter 12: Sections 12.1 to 12.6)

Unit V :

Numerical Solutions to partial differential equations (contd.)

Poisson equation – its solution – Parabolic equations – Bender – Schmidt method – Crank – Nicholson method – Hyperbolic equation – Solution to partial differential equation by Relaxation method.

(Chapter 12: Sections 12.7 to 12.10)

Text Book:

V.N Vedamurthy and **Ch. S.N.Iyengar;** Numerical Methods, Vikas Publishing House Pvt Ltd., 1998.

References:

1. S.S. Sastry, Introductory methods of Numerical Analysis, Printice of India, 1995

2. C.F. Gerald, and P.O. Wheathy, Applied Numerical Analysis, Fifth Edition, Addison Wesley, 1998.
3. M.K. Venkatraman, Numerical methods in Science and technology, National Publichers Company, 1992. 4. P. Kandasamy, K. Thilagavathy, K. Gunavathy, Numerical Methods, S. Chand & Company, 2003.

[OR]

Elective - II	M.Sc. Mathematics	2016 - 2017
M16PMAE02	PROBABILITY THEORY	
Credit: 4		

Unit I:

Random Events and Random Variables - Random events – Probability axioms – Combinatorial formulae – conditional probability – Bayes Theorem – Independent events – Random Variables – Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables.

Chapter 1: Sections 1.1 to 1.7, Chapter 2: Sections 2.1 to 2.9

Unit II:

Parameters of the Distribution - Expectation- Moments – The Chebyshev Inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types.

Chapter 3: Sections 3.1 to 3.8

Unit III:

Characteristic functions - Properties of characteristic functions – Characteristic functions and moments – semi-invariants – characteristic function of the sum of the independent random variables – Determination of distribution function by the Characteristic function – Characteristic function of multidimensional random vectors – Probability generating functions.

Chapter 4: Sections 4.1 to 4.7 24

Unit IV:

Some probability distributions - One point , two point , Binomial – Polya – Hypergeometric – Poisson (discrete) distributions – Uniform – normal gamma – Beta – Cauchy and Laplace (continuous) distributions.

Chapter 5: Section 5.1 to 5.10 (Omit Section 5.11)

Unit V:

Limit Theorems - Stochastic convergence – Bernoulli law of large numbers – Convergence of sequence of distribution functions – Levy-Cramer Theorems – De Moivre-Laplace Theorem – Poisson, Chebyshev, Khintchine Weak law of large numbers – Lindberg Theorem – Lyapunov Theroem – Borel-Cantelli Lemma - Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.

Chapter 6: Sections 6.1 to 6.4, 6.6 to 6.9, 6.11 and 6.12. (Omit Sections 6.5, 6.10, 6.13 to 6.15)

Text Book:

M. Fisz, Probability Theory and Mathematical Statistics, John Wiley and Sons, New York, 1963.

References:

1. R.B. Ash, Real Analysis and Probability, Academic Press, New York, 1972

2. K.L.Chung, A course in Probability, Academic Press, New York, 1974.

3. Y.S.Chow and H.Teicher, Probability Theory, Springer Verlag. Berlin, 1988 (2nd Edition)

4. R.Durrett, Probability : Theory and Examples, (2nd Edition) Duxbury Press, New York, 1996.

5. V.K.Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi, 1988(3rd Print).

6. S.I.Resnick, A Probability Path, Birhauser, Berlin, 1999.

7. B.R.Bhat, Modern Probability Theory (3rd Edition), New Age International (P)Ltd, New Delhi, 1999.

8. J.P. Romano and A.F. Siegel, Counter Examples in Probability and Statistics, Wadsworth and Brooks / Cole Advanced Books and Software, California, 1968.

Semester-II

Core - V	M.Sc. Mathematics	2016 - 2017
M16PMA05	ADVANCED ALGEBRA-II	
Credit: 5		

Unit I:

Field theory:

Extension field – roots of polynomials - more about roots

(Chapter5 Sections 5.1, 5.3 and 5 .5)

Unit II:

Galois Theory:

Elements of Galois theory – Solvability by radicals

(Chapter 5 Section 5.6, 5.7)

Unit III

Rings and ring homomorphism's –Extension and Contraction – exact sequences

Unit IV

Chain conditions – Primary decomposition in Noethorian rings

Unit V

Artin rings – Discrete valuation rings – Dedekind domains – Fractional ideals

Text book:

1.I.N Herstein : Topics in Algebra, 2nd Edition, John Wiley and Sons, Newyork, 2003.

[UNIT-I&II]

2. Introduction to Commutative Algebra, by M.F.Atiyah and I.G.Macdonald, Addison – Wesley Publication Company, Inc, 1969.

[UNIT-III,IV&V]

Reference's:

1.S.Lang Algebra, 3rd Edition, Addison Wesley, Mass 1993.

2. John B.Fraleigh – A first course in abstract Algebra, Addison Wesley, Mass 1982.

3. M.Artin, Algebra, Prentice Hall of India, NewDelhi, 1991.

4. N.S. Gopalakrishnan, Commutative Algebra, Oxonian Press Pvt. Ltd, New Delhi, 1988

5.F.W. Andeson and K.R. Fuller, Rings and Categories of Modules, 2nd Edition, Graduate Text in Mathematics Vol. 13, Springer-Verlag, New York, 1992

6. H.Matsumura, Commutative ring theory, Cambridge University Press, 1986.

Core - VI	M.Sc. Mathematics	2016 - 2017
M16PMA06	ADVANCED REAL ANALYSIS-II	
Credit: 5		

Unit I:

The Riemann – steiltjes integral – Definition and Existence of the integral – properties of integral – integration and Differentiation – Rectifiable Curves .

Unit II:

Sequences and series of functions – Discussion of main problem – Uniform Convergence and Continuity – Uniform Convergence and Integration – Uniform Convergence and Differentiation – Equicontinuous Family of function – The Stone – Weierstrass theorem

Unit III:

Some special Functions – Power series – the Exponential and Logarithmic series – The Trigonometric Function – The Algebraic Completeness of the Complex Field – Fourier series – The Gamma Functions .

Unit IV :

Linear transformations, Differentiation, the contraction principle, the inverse function theorem, the implicit function theorem.

Unit V:

The Rank theorem, determinants, derivatives of higher order, differentiation of integrals.

Text Books

1. Walter Rudin – Principles of Mathematical Analysis, 3rd edition, MC Graw Hill Book Co., Kogaskusha, 1976.

Reference:

1. H.L. Royden, Real Analysis, Macmillan Publ. Co. INC., 4th edition, New York, 1993.
2. V. Ganapathy Iyer, Mathematical Analysis, Tata MC Graw Hill, New Delhi, 1970.
3. T.M. Apostol– Mathematical Analysis, 2nd edition, Narosa Publ. House, New Delhi, 1985.

Core - VII	M.Sc. Mathematics	2016 - 2017
M16PMA07	PARTIAL DIFFERENTIAL EQUATIONS	
Credit: 4		

Unit I:

second order Partial Differential Equations:

Origin of second order partial differential equations – Linear differential equations with constant coefficients – Method of solving partial (linear) differential equation – Classification of second order partial differential equations – Canonical forms – Adjoint operators – Riemann method.

(Chapter 2 : Sections 2.1 to 2.5)

Unit II:

Elliptic Differential Equations:

Elliptic differential equations – Occurrence of Laplace and Poisson equations – Boundary value problems – Separation of variables method – Laplace equation in cylindrical – Spherical co-ordinates, Dirichlet and Neumann problems for circle – Sphere.

(Chapter 3 : Sections 3.1 to 3.9)

Unit III:

Parabolic Differential Equations:

Parabolic differential equations – Occurrence of the diffusion equation – Boundary condition – Separation of variable method – Diffusion equation in cylindrical – Spherical co-ordinates

(Chapter 4: Sections 4.1 to 4.5)

Unit IV:

Hyperbolic Differential Equations:

Hyperbolic differential equations – Occurrence of wave equation – One dimensional wave equation – Reduction to canonical form – D'Alembertz solution – Separation of variable method – Periodic solutions – Cylindrical – Spherical co-ordinates – Duhamel principle for wave equations.

(Chapter 5 : Sections 5.1 to 5.6 and 5.9)

Unit V:

Integral Transform:

Laplace transforms – Solution of partial differential equation – Diffusion equation – Wave equation – Fourier transform – Application to partial differential equation – Diffusion equation – Wave equation – Laplace equation.

(Chapter 6 : Sections 6.2 to 6.4)

Text Book:

J.N. Sharma and **K.Singh**,

Partial Differential Equation for Engineers and Scientist, Narosa publ. House, Chennai, 2001.

Reference:

1. I.N.Snedden, Elemetns of Partial Differeential Equations, McGraw Hill, New York 1964.

2. K.Sankar Rao, Introduction to partial Differential Equations, Prentice Hall of India, New Delhi, 1995.

3. S.J. Farlow, Partial Differential Equations for Scientists and Engineers, John Wiley sons, New York, 1982.

ELECTIVE GROUP-II

Elective - III	M.Sc. Mathematics	2016 - 2017
M16PMAE03	FLUID DYNAMICS	
Credit: 4		

UNIT I :

Real fluids and ideal fluids - Velocity of a fluid at a point - Streamlines and pathlines - Steady and unsteady flows. Velocity potential - Vorticity vector - Local and particle rates of change - Equation of continuity - Worked examples - Acceleration of a point of a fluid.

UNIT II:

Pressure at a point in a fluid at rest - Pressure at a point in a moving fluid - Conditions at a boundary of two inviscid Immissible fluids - Euler's equations of motion - Bernoulli's equation – Worked examples - Some flows involving axial symmetry - Some special two dimensional flows – Impulsive motion.

UNIT III:

Some three dimensional flows - Sources, sinks and doublets - Images in a rigid infinite plane - Axis-symmetric flows - Stokes stream function - Some special forms of the stream function for Axissymmetric irrotational motions.

UNIT IV:

Two dimensional flow - Use of cylindrical polar coordinates - Stream function. Complex potential for two-dimensional irrotational - Incompressible flow - Complex velocity potential for standard two-dimensional flows - Uniform stream, line sources and line sinks, line doublets, line vortices - Worked examples.

UNIT V :

Two dimensional image systems – Milne-Thomson circle theorem - Some applications of the circle theorem - Extension of the circle theorem - Theorem of Blasius - Use of conformal transformation– Some hydro dynamical aspects of conformal transformation - Worked example.

Text Book:

1.F. Chorlton, Textbook of Fluid Dynamics, CBS Publication and Distribution (2004).

UNIT I Chapter 2 Sections 2.1 to 2.9

UNIT II Chapter 3 Sections 3.1 to 3.6, 3.9 to 3.11

UNIT III Chapter 4 Sections 4.1 to 4.3, 4.5, 4.5.1

UNIT IV Chapter 5 Sections 5.1 to 5.6

UNIT V Chapter 5 Sections 5.7 to 5.10.2

Reference Book:

1. M.D. Raisinghania, Fluid Dynamics, S. Chand, (2008).

2. G.K. Batchelor, An Introduction to Fluid Mechanics, Foundation Books, (1984).

OR

Elective - IV	M.Sc. Mathematics	2016 - 2017
M16PMAE04	STOCHASTIC PROCESS	
Credit: 4		

Unit I:

Stochastics Process: Introduction – Specification of Stochastic Processes, Stationaryprocesses, Martingales, Markov Chains: Definitions and Examples, Higher transitionprobabilities, classification of states and chains.

Unit II:

Stability of Markov chain, Markov chains with denumerable number of states, Poissonprocess.

Unit III:

Poisson process and related distributions – Markov chain with discrete state space.

Unit IV:

Renewal process: Renewal process-Renewal process in continuous time – Renewal equation – Stopping time: Wald's equation – Renewal theorems

.

Unit V:

Markov Renewal and semi-markov processes: Introduction – Definitions and Preliminaries results – Markov renewal equations – Limiting behaviours.

Text Book:

" Stochastic Processes", Prof. J. Medhi

Unit I: Chapter2: 2.1 to 2.4; Chapter3: 3.1, 3.2, 3.4 (3.3 is not included)

Unit II: Chapter3: 3.6, 3.8, 4.1 (pages 157-169)

Unit III: Chapter4: 4.2 to 4.5 (pages 170-206)

Unit IV: Chapter6: 6.1 to 6.5 (pages 242 – 272)

Unit V: Chapter7: 7.1 to 7.4 (pages 313 – 331) (example problems only)

Reference:

" Stochastic Processes", T.Veerarajan.

Semester-III

Core - VIII	M.Sc. Mathematics	2016 - 2017
M16PMA08	COMPLEX ANALYSIS	
Credit: 5		

Unit I :

Complex Functions

Spherical representation of complex numbers – Analytic function – Limits and continuity – Analytic Functions – Polynomials – Rational functions – Elementary theory of Power series – Sequences – Series – Uniform Convergence – Power series – Abel's limit theorem – Exponential and Trigonometric functions – Exponential - Trigonometric functions – Periodicity – The Logarithm.

(Chapter 1 : Sections 2.4 and Chapter 2 : Sections 1 to 3)

Unit II :

Analytical Functions as Mappings

Analytical Functions as Mappings – Conformality - Arcs and closed curves – Analytic functions in Regions – Conformal mapping – Length and area – Linear transformations –Linear group – Cross ratio – Symmetry –Oriented Circles –Families of circles –Elementary conformal mappings –Use of level curves – Survey of Elementary mappings – Elementary Riemann surfaces. (Chapter 3 : Sections 2 to 4)

Unit III :

Complex Integration

Complex Integration – Fundamental Theorems – Line integrals –Rectifiable Arcs-Line Integrals as Arcs – Cauchy's Theorem for a Rectangle and in a disk – Cauchy's Integral Formula – Index of point with respect to a closed curve- The Integral formula – Higher order derivatives – Local properties of analytic functions – Taylor's Theorem – Zeros and Poles –Local mapping - Maximum Principle.

(Chapter 4 : Sections 1 to 3)

Unit IV :

Complex Integration (Conted)

The general form of Cauchy's Theorem – Chains and Cycles – Simple connectivity – Homology – General statement of cauchy's theorem – Proof of Cauchy's theorem – Locally exact differentials – Multiply connected regions – Calculus of residues – Residue Theorem – Argument Principle-Evaluation of Definite Integrals

(Chapter 4 : Sections 4 and 5)

Unit V :

Harmonic functions and Power series expansions

Harmonic Functions – Definition and basic properties- Mean-Value Property-Poisson's formula's – Schwarz's Theorem – Reflection Principle- Weierstrass's theorem- Taylor's series –Laurent series.

(Chapter 4 : Sections 6 and Chapter 5 : Sections 1)

Text Books:

L.V Ahifors, Complex Analysis, 3rd edition, Mc Graw Hill Inter., Edition, New Delhi,1979.

Reference Books:

1. J.B Conway, Functions of one Complex variable, Narosa Publ. House, New Delhi,1980

2. S.Ponnusamy, Foundations of Complex Analysis, Narosa Publ. House, New Delhi,2004.

3. S.Lang, Complex-Analysis, Addison – Wesley Mass,1977.

Core - IX	M.Sc. Mathematics	2016 - 2017
M16PMA09	TOPOLOGY	
Credit: 5		

UNIT-I

Topological spaces- Basis for a topology- the order topology-the product totopology -the sub space topology- closed sets and limit points

UNIT-II

Continuous functions-the product topology- the metric topology-the metric topology(cont)

UNIT-III

Connected spaces- connected sets in the real line-component and path components

UNIT-IV

Compact spaces- compact sets in the real line-limit point-compactness

UNIT-V

The countability axioms- the separation axioms-the Urysohn lemma-the Urysohn metrization theorem- The Tietze extension theorem..

TEXT BOOK:

TOPOLOGY-A.FIRSR COURSE by JAMES R.MUNKRES (P.H.I) 3rdEDITION

UNIT-1 SECTIONS 12,13,14,15,16,17

UNIT-2 SECTIONS 18,19,20,21

UNIT-3 SECTIONS 23,24,25

UNIT-4 SECTIONS 27,28,29

UNIT-5 SECTIONS 31,32,33,34,35.

References:

1. J. Dugundji, Topology, Prentice Hall of India, New Delhi,1975.

2. G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Book Co, New York, 1963.

3. S.T. Hu, Elements of General Topology, Holden Day, Inc. New York, 1965.

Core - X	M.Sc. Mathematics	2016 - 2017
M16PMA10	MEASURE THEORY & INTEGRATION	
Credit: 5		

Unit I:

Lebesgue Measure:

Lebesgue Measure – Introduction – Outer measure – Measurable sets and Lebesgue measure – Measurable functions – Little Woods' Three Principle.

(Chapter 3: Sections 1 to 3, 5 and 6)

Unit II:

Lebesgue integral :

Lebesgue integral – The Riemann integral – Lebesgue integral of bounded functions over a set of finite measure – The integral of a nonnegative function – The general Lebesgue integral.

(Chapter 4: Sections 1 to 4)

Unit III:

Differentiation and Integration :

Differentiation and Integration – Differentiation of monotone functions – Functions of bounded variation – Differentiation of an integral – Absolute continuity.

(Chapter 5: Sections 1 to 4)

Unit IV :

General Measure and Integration :

General Measure and Integration – Measure spaces – Measurable functions – integration – Signed Measure – The Radon – Nikodym theorem.

(Chapter 11: Sections 1 to 3, 5 and 6)

Unit V:

Measure and Outer Measure

Measure and outer measure – outer measure and measurability – The Extension theorem – Product measures.

(Chapter 12: Sections 1, 2 and 4)

Text Book:

H.L.Royden, Real Analysis, Mc Millian Publ. Co, New York, 1993.

Reference:

1. G. de Barra, Measure Theory and integration, Wiley Eastern Ltd, 1981.

2. P.K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age Int. (P) Ltd., NewDelhi, 2000.

3. Walter Rudin, Real and Complex Analysis, Tata McGraw Hill Publ. Co. Ltd., New Delhi, 1966.

Core - XI	M.Sc. Mathematics	2016 - 2017
M16PMA11	DIFFERENTIAL GEOMETORY	
Credit: 5		

Unit-I

Theory of Space Curves:

Theory of space curves – Representation of space curves – Unique parametric representation of a space curve – Arc-length – Tangent and osculating plane – Principle normal and binormal – Curvature and torsion – Behaviour of a curve near one of its points – The curvature and torsion of a curve as the intersection of two surfaces.

(Chapter 1 : Sections 1.1 to 1.9)

Unit II:

Theory of Space Curves (Contd.):

Contact between curves and surfaces – Osculating circle and osculating sphere – Locus of centre of spherical curvature – Tangent surfaces – Involutes and Evolutes – Intrinsic equations of space curves – Fundamental Existence Theorem – Helices.

(Chapter 1 : Sections 1.10 to 1.13 and 1.16 to 1.18)

Unit III:

Local Intrinsic properties of surface:

Definition of a surface – Nature of points on a surface – Representation of a surface – Curves on surfaces – Tangent plane and surface normal – The general surfaces of revolution – Helicoids – Metric on a surface – Direction coefficients on a surface

(Chapter 2 : Sections 2.1 to 2.10)

Unit IV:

Local Intrinsic properties of surface and geodesic on a surface:

Families of curves – Orthogonal trajectories – Double family of curves – Isometric correspondence – Intrinsic properties – Geodesics and their differential equations – Canonical geodesic equations – Geodesics on surface of revolution.

(Chapter 2: Sections 2.11 to 2.15 and Chapter 3: Sections 3.1 to 3.4)

Unit V:

Geodesic on a surface:

Normal property of Geodesics – Differential equations of geodesics using normal property – Existence theorems – Geodesic parallels – Geodesic curvature – Gauss Bonnet Theorems – Gaussian curvature – Surface of constant curvature

(Chapter 3: Sections 3.5 to 3.8 and Sections 3.10 to 3.13)

Text Book:

D. Somasundaram, Differential Geometry, Narosa Publ. House, Chennai, 2005 .

References:

1. T. Willmore, An Introduction to Differential Geometry, Clarendan Press, Oxford, 1959.

2. D.T Struik, Lectures on Classical Differential Geometry, Addison – Wesely, Mass. 1950.

3. J.A. Thorpe, Elementary Topics in Differential Geometry, Springer – Verlag, New York, 1979.

ELECTIVE GROUP -III

Elective - V	M.Sc. Mathematics	2016 - 2017
M16PMAE05	DISCRETE MATHEMATICS	
Credit: 4		

Unit I:

Theory of inference:

Consistency of premises validity using truth table – Consistency of premises – Predicates – 15e statement function, Variables and quantifiers – Predicate formulae – Free and bound variables – Theory of inference for the predicate calculus .

(Chapter 1: Sections 1- 4.1, 1 - 4.2, 1 - 5.1, 1 - 5.2,1 - 5.3, 1 - 5.4, 1 - 6.4)

Unit II:

Set Theory:

Functions – Definition and introduction – Composition of functions – Inverse functions – Binary and n-ary Operations – Characteristic function of a set – Hashing functions – Peuno axioms and mathematical induction – Cardinality.

(Chapter 2: 2 - 4.1, 2 - 4.2, 2 – 4.3, 2 – 4.4,2 – 4.5, 2 – 4.6, 2 – 5.1, 2 – 5.2)

Unit III:

Algebraic Structures:

Groups: Definition and Examples – Subgroups and homomorphism - Cosets and Lagrange's Theorem – Normal subgroups – Algebraic systems with Two Binary Operations.

(Chapter 3 : Sections 3 – 5.1, 3 – 5.2, 3 – 5.3, 3 – 5.4, 3 – 5.5)

Unit IV:

Lattices and Boolean algebra:

Lattices as Algebraic Systems – Sub lattices, direct product and homomorphism – Boolean Algebra Definition and examples – Sub Algebra. Direct Product and homomorphism – Boolean functions, Boolean forms and free Boolean Algebras – Values of Boolean expression and Boolean functions.

(Chapter 4: Sections 4 – 1.3, 4 – 1.4, 4 – 2.2, 4 – 3.4, 4 – 3.2)

Unit V:

Graph Theory:

Basic definitions – Paths – Rechability and Connectedness – Matrix representation of Graphs – Trees – Finite state machine: Introductory special circuits – Equivalence of finite state machines.

(Chapter 5: 5 – 1.1, 5 - 1.2, 5 – 1.3, 5 – 1.4)(Chapter 4: Sections 4 – 6.1, 4 – 6.2)

Text Book:

J.P. Trembley and **R.Manohar**, Discrete Mathematical Structures applications to Computer Science, Tata McGraw Hills, New Delhi, 1997.

References:

1. James C.Abbott, Sets, Lattices and Boolean algebra, Allya and Bacon Boston, 1969. 2. H.G.Flegg Boolean Algebra and its applications, John Wiley and Sons, Inc, NewYork, 1974.

[OR]

Elective - VI	M.Sc. Mathematics	2016 - 2017
M16PMAE06	C++	
Credit: 4		

Unit I:

Software Evolution – Procedure oriented Programming – Object oriented programming paradigm – Basic concepts of object oriented programming – Benefits of oops – Object oriented Languages – Application of OOP – Beginning with C++ - what is C++ - Application of C++ - A simple C++ Program – More C++ Statements – An Example with class – Structure of C++ Program.

Unit II:

Token, Expressions and control structures: Tokens – Keywords – Identifiers and Constants – Basic Data types – User defined Data types – Derived data types – Symbolic Constants in C++ - Scope resolution operator – Manipulators – Type cost operator – Expressions and their types – Special assignment expressions – Implicit Conversions – Operator Overloading – Operator precedence – Control Structure.

Unit – III: Function in C++:

Main Function – function prototyping – Call by reference – Return by reference – Inline functions – default arguments – Const arguments – Function overloading – Friend and Virtual functions – Math library function.

Class and Objects:

Specifying a class – Defining member functions – A C++ program with class – Making an outside function inline – Nesting of member functions – Private member functions – Arrays within a class – Memory allocations for objects – Static data member – Static member functions – Array of the object – Object as function arguments – Friendly functions – Returning objects – Const member functions – Pointer to members – Local classes.

Unit IV: Constructors and Destructors:

Constructors – Parameterized Constructors in a Constructor – Multiple constructors in a class – Constructors with default arguments – Dynamic Initialization of objects – Copy constructors – Dynamic Constructors – Constructing Two-dimensional arrays – Const objects -– Destructors. Operator overloading and type conversions: Defining operator overloading – overloading unary operators – overloading binary operators - overloading binary operators using friends – Manipulation of strings using operators – Rules for overloading operators – Type conversions.

Unit V: Files:

Introduction – Class for file stream operations – opening and closing a file – detecting End-of file – More about open () File modes – File pointer and their manipulations – Sequential input and output operations. Exception Handling: Introduction – Basics of Exception Handling – Exception Handling Mechanism – Throwing Mechanism – Catching Mechanism – Rethrowing an Exception.

Text Book:

Object-Oriented Programming with C++ 2nd Edition, **E.Balagrurusamy**, Tata McGraw Hill Pub. 1999.

References:

1. Robert Lafore – "The Waite Group's Object Oriented Programming In Turbo C++ - Galgotia Publication Pvt. Ltd. 1998.

2. Allan Neibaver – Office 2000.

[OR]

Elective- VII	M.Sc. Mathematics	2016 - 2017
M16PMAE07	DIFFERENCE EQUATIONS	
Credit: 4		

Unit I:

Difference Calculus:

Difference operator – Summation – Generating function – Approximate summation.
(Chapter 2 Sections 2.1 to 2.3)

Unit II:

Linear Difference Equations:

First order equations – General results for linear equations.
(Chapter 3 Sections 3.1 to 3.2)

Unit III:

Linear Difference Equations(Contd.):

Equations with constant coefficients – Equations with variable coefficients – z – transform.
(Chapter 3 Sections 3.3,3.5 and 3.7)

Unit IV:

Initial value problems for linear systems – Stability of linear systems.
(Chapter 4 Sections 4.1 to 4.3)

Unit V:

Asymptotic analysis of sums – Linear equations
(Chapter 5 Sections 5.1 to 5.3)

Text Book:

W.G.Kelley and A.C.Peterson, Difference Equations, Academic press, New York,1991.

Reference:

1. S.N.Elaydi, An Introduction to Difference Equations, Springer – Verleg, NewYork,1990

2. R.Mickens, Difference Equations, Van Nostrand Reinhold, New York, 1990.

3. R.P.Agarwal, Difference Equations and Inequalities Marcelm Dekker, New York,1992.

Semester-IV

Core - XII	M.Sc. Mathematics	2016 - 2017
M16PMA12	FUNCTIONAL ANALYSIS	
Credit: 5		

Unit I:

Banach Spaces:

Banach Spaces – Definition and examples – Continuous linear transformations – Hahn Banach theorem

(Chapter 9 : Sections 46 to 48)

Unit II:

Banach Spaces and Hilbert Spaces:

The natural embedding of N in N** - Open mapping theorem – Conjugate of an operator – Hilbert space – Definition and properties.

(Chapter 9 : Sections 49 to 51, Chapter 10 : Sections 52)

Unit III:

Hilbert Spaces:

Orthogonal complements – Orthonormal sets – Conjugate space H* - Adjust of an operator

(Chapter 10 : Sections 53 to 56)

Unit IV:

Operations on Hilbert Spaces:

Self adjoint operator – Normal and Unitary operators – Projections.

(Chapter 10: Sections 57 to 59)

Unit V:

Banach Algebras:

Banach Algebras – Definition and examples – Regular and simple elements – Topological divisors of zero – Spectrum – The formula for the spectral radius – The radical and semi simplicity.

(Chapter 12 : Sections 64 to 69)

Text Book:

G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Inter. Book Co, New York, 1963.

References:

1. W. Rudin, Functional Analysis, Tata McGraw Hill Publ. Co, New Delhi, 1973.

2. H.C. Goffman and G.Fedrick, First Course in Functional Analysis, Prentice Hall of India , New Delhi, 1987.

3. D. Somasundaram, Functional Analysis S. Viswanathan Pvt.Ltd., Chennai,1994.

4.B.V.Limaye, Functional Analysis.

Core - XIII	M.Sc. Mathematics	2016 - 2017
M16PMA13	GRAPH THEORY	
Credit: 5		

Unit I:

Graphs and Subgraphs:

Graphs and simple graphs – Graph isomorphism – Incidence and Adjacency Matrices – Subgraphs – Vertex degrees – Paths and connection – Cycles – Application – The shortest path problem.

(Chapter 1 : Sections 1.1 to 1.8)

Unit II:

Trees and Connectivity:

Trees – Cut edges and bonds – Cut vertices – Cayley's formula - Application – Connector problem – Connectivity – Blocks – Application – Reliable Communication Networks.

(Chapter 2: Sections 2.1 to 2.5 and Chapter 3: Sections 3.1 to 3.3)

Unit III:

Euler Tours and Matchings:

Euler Tours – Hamilton cycles – Application – Chinese Postman Problem – Traveling salesman problem - Matchings – Matching and coverings in Bipartite Graphs – Perfect Matchings – Applications – Personal Assignment Problem – Optimal Assignment Problem.

(Chapter 4: Sections 4.1 to 4.4 and Chapter 5: Sections 5.1 to 5.5)

Unit IV:

Edge Colouring and Independent sets:

Edge Coloring – Edge Chromatic Number – Vizings Theorem – Application – Timetabling Problem – Independents sets – Ramsey's Theorem – Turan's Theorem.

(Chapter 6: Sections 6.1 to 6.3 and Chapter 7: Sections 7.1 to 7.3)

Unit V:

Vertex Colorings:

vertex Colorings – Chromatic Number – Brook Theorem – Hajos conjecture – Chromatic Polynomials – Girth and Chromatic Number – A storage problem.

(Chapter 8 : Sections 8.1 to 8.6)

Text Book:

J.A.Bondy and **U.S.R. Murty**, Graph Theory with Applications, North Holland, New York, 1982.

References:

1. Narasing Deo, Graph Theory with Application to Engineering and Computer Science, Prentice Hall of India, New Delhi. 2003.

2. F. Harary, Graph Theory, Addison – Wesely Pub. Co. The Mass. 1969.

3. L. R.. Foulds, Graph Theory Application, Narosa Publ. House, Chennai, 1933.

Core - XIV	M.Sc. Mathematics	2016 - 2017
M16PMA14	CALCULUS OF VARIATION AND INTEGRAL EQUATIONS	
Credit: 4		

Unit I:

Variational problems with fixed boundaries:

The concept of variation and its properties – Euler's equation- Variational problems for Functionals – Functionals dependent on higher order derivatives – Functions of several independent variables – Some applications to problems of Mechanics

(Chapter 1: Sections 1.1 to 1.7) of [1]

Unit II:

Variational problems with moving boundaries:

Movable boundary for a functional dependent on two functions – one-side variations – Reflectionand Refraction of extermals – Diffraction of light rays.

(Chapter 2: Sections 2.1 to 2.5) of [1]

Unit III:

Integral Equation:

Introduction – Types of Kernels – Eigen Values and Eigen functions – Connection with differential equation – Solution of an integral equation – Initial value problems – Boundary value problems.

(Chapter 1: Section 1.1 to 1.3 and 1.5 to 1.8) of [2]

Unit IV:

Solution of Fredholm integral equation:

Second kind with separable kernel – Orthogonality and reality eigen function – Fredholm Integral equation with separable kernel – Solution of Fredholm integral equation by successive substitution – Successive approximation – Volterra Integral equation – Solution by successive substitution.

(Chapter 2: Sections 2.1 to 2.3 and Chapter 4 Sections 4.1 to 4.5) of [2]

Unit V:

Hilbert – Schmidt Theory:

Complex Hilbert space – Orthogonal system of functions- Gram Schmit orthogonlization process – Hilbert – Schmit theorems – Solutions of Fredholm integral equation of first kind.

(Chapter 3: Section 3.1 to 3.4 and 3.8 to 3.9) of [2]

Text Books:

1. **A.S Gupta**, Calculus of Variations with Application, Prentice Hall of India, New Delhi, 2005.

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

References:

1. F.B. Hildebrand, Methods of Applied Mathematics, Prentice – Hall of India Pvt. New Delhi, 1968.

2. R. P. Kanwal, Linear Integral Equations, Theory and Techniques, Academic Press, New York, 1971.

3. L. Elsgolts, Differential Equations and Calculus of Variations, Mir Publishers, Moscow, 1973.

ELECTIVE GROUP -IV

Elective - VIII	M.Sc. Mathematics	2016 - 2017
M16PMAE08	NUMBER THEORY	
Credit: 4		

Unit : I

Divisibility_ greatest common divisor_ prime numbers_ The fundamental theorem of arithmetic _The series of reciprocals of the primes _The Euclidean algorithm _ The greatestcommon divisor of more than two numbers _The Mobius function_ The Euler totientfunction _A relation connecting Mobius and Euler totient _A product formula for Mobiusfunction.

Unit : II

The Dirichlet product of arithmetical functions _ Dirichlet inverses and the Mobiusinversion formula _ The Mangoldt function _ Multiplicative functions _ Multiplicativefunctions and Dirichlet multiplication _ The inverse of a completely Multiplicativefunctions_ Liouville's function _ The divisor functions_ generalized convolutions _Formalpower series _ The Bell series of an arithmetical function _Bell series and Dirichletmultiplication _ Derivatives of arithmetical functions _ The Selberg identity

Unit : III

The big oh notation,Asymptotic equality of functions _ Euler's summation formula _some elementary asymptotic formulas _The average order of d(n) _ The average order of thedivisor functions_ the average order of Euler totient function _ An application to thedistribution of lattice points visible from the origin _the average order of Mobius functionand Mangoldt function_The partial sums of a Dirichlet product _Applications to Mobiusfunctions and Mangoldt function_ Another identity for the partial sum of a Dirichlet product_ Chebyshev's functions.

Unit : IV

Definition and basic properties of congruences _Residue classes amd completeresidue systems_ linear congruences _Reduced residue systems and the Euler-Fermattheorem-Polynomial congruences_ Modulo of Lagrange's theorem _ Applications ofLagrange's theorem _ simultaneous linear congruences _

The Chinese remainder theorem _Applications of the Chinese remainder theorem _ Polynomial congruences with prime powerModuli

Unit : V

Quadratic residues _ Legendre's symbol and its properties _ Evaluation of (-1/p) and(2/p) _ Gauss lemma _ The quadratic reciprocity law _The Applications of the reciprocitylaw_ The Jacobi symbol _ Applications to Diophantine equations.

Text Books:

Introduction to Analytic Number theory by T.M.Apostol

CONTENTS:

Unit :-I
Chapter :1 – Section :1.1 to 1.8
Chapter :2 – Section :2.1 to 2.5
Unit :-II
Chapter :2 – Section :2.6 to 2.19
Unit :-III
Chapter :3 – Section :3.1 to 3.12
Chapter :4 – Section :4.1 and 4.2
Unit :-IV
Chapter :5 – Section :5.1 to 5.9
Unit :-V
Chapter :9 – Section :9.1 to 9.8

REFERENCE BOOKS:

1.Beginning Number Theory by Neville Robbins
2.Number Theory by Burton

[OR]

Elective - IX	M.Sc. Mathematics	2016 - 2017
M16PMAE09	OPTIMIZATION TECHNIQUES	
Credit: 4		

Unit I:

Integer linear programming: Introduction – Illustrative applications integer programming solution algorithms: Branch and Bound (B & B) algorithm – zero – One implicit enumeration algorithm – Cutting plane Algorithm.

(Sections 9.1,9.2,9.3.1.,9.3.2,9.3.3)

Unit II:

Deterministic dynamic programming: Introduction – Recursive nature of computations in DP – Forward and backward recursion – Selected DP applications cargo – Loading model – Work force size model – Equipment replacement model – Investment model – Inventory models.

(Sections 10.1,10.2,10.3,10.4.1,10.4.2,10.4.3,10.4.4,10.4.5)

Unit III:

Decision analysis and games: Decision environment – Decision making under certainty (Analytical Hierarchy approach) Decision making under risk – Expected value criterion – Variations of the expected value criterion – Decision under uncertainty Game theory – optimal solution of two – Person Zero – Sum games – Solution of mixed strategy games

(Sections 14.1,14.2,114.3.1,14.3.2,14.4,14.5.1,14.5.2)

Unit IV:

Simulation modeling: What is simulation – Monte carlo simulation – Types of simulation – Elements of discrete event simulation – Generic definition of events – Sampling from probability distributions. Methods for gathering statistical observations – Sub interval method – Replication method – Regenerative (Cycle) method – Simulation languages

(Sections 18.1,18.2,18.3,18.4.1,18.4.2,18.5,18.6,18.7.1,18.7.2,18.7.3,18.8)

Unit V:

Nonlinear programming algorithms: Unconstrained non linear algorithms – Direct search method – Gradient method Constrained algorithms: Separable programming – Quadratic programming – Geometric programming – Stochastic programming – Linear combinations method – SUMT algorithm

(Sections : 21.1.1, 21.1.2, 21.2.1, 21.2.2, 21.2.3, 21.2.4, 21.2.5, 21.2.6)

Text Book:

Operations Research an Introduction 6th Edison by Hamdy A. Taha, University of Arkansas Fayetteville.

Reference:

1. F.S. Hillier and G.J. Lieberman Introduction to Operation Research 4th edition, Mc Graw Hill Book Company, New York, 1989.

2. Philips D.T.Ravindra A. and Solbery.J. Operations Research, Principles and Practice John Wiley and Sons, New York.

3. B.E.Gillett, Operations research – A Computer Oriented Algorithmic Approach,TMH Edition, New Delhi, 1976.

[OR]

Elective - X	M.Sc. Mathematics	2016 - 2017
M16PMAE10	Pratical- C++	
Credit: 4		

1. Create two classes DM and DB, which store the value of distances. DM stores distances in meters and centimeters in DB in feet and inches. Write a program that can create the values for the class objects and add object DM with another object DB.

2. Create a class FLOAT that contains on float data member overload all the four arithmetic operators so that operates on the objects of FLOAT.

3. Design a class polar, which describes a part in a plane using polar coordinates radius and angle. A point in polar coordinates is as shown below. Use the overloads +operator to add two objects of polar. Note that we cannot add polar values of two points directly. The requires first the conversion points into rectangular coordinates and finally creating the result into polar coordinates.

[Where rectangle co-ordinates: x = r* cos(a); y = r* sin(a) Polar co-ordinates: a = atan (x/y) r = Sqrt (x*x + y*y)]

4. Create a class MAT of size m*m. Define all possible matrix operations for MAT type objects verify the identity. (A-B)^2+B^2-2*A*B.

5. Area computation using derived class.

6. Define a class for vector containing scalar values. Apply overloading concepts for vector additions, multiplication of a vector by a scalar quantity, replace the values in a position vector.

7. Integrate a function using Simson's 1/3 rule.

8. Solve the system of equations using Guass Sedel method.

9. Solve differential equations using Runge Kutta forth order method.

EXTRA DISCIPLINARY COURSE

EDC - I	M.Sc. Mathematics	2016 - 2017
M16PMAED1	QUANTITATIVE APTITUDE	
Credit: 4		

Unit I

Numbers, H.C.F. and L.C.M. of numbers .

Unit II

Simplification , Square roots and Cube Roots , Average.

Unit III

Problems on numbers , problems on Ages.

Unit IV

Percentage , Profit and Loss.

Unit V

Ratio and Proportion , Partnership.

Text Books:-

S.No	Tiltle of the Book	Author	Publishing Company	Year of Publication
1.	Quantitative Aptitude for competitive Examination	R.S.Aggarwal.	S.Chand and company Ltd,152,Anna salai,Chennai.	2001
2.	Quantitative Aptitude and Reasoning	Praveen	PHI P.Ltd	.

EDC - II	M.Sc. Mathematics	2016 - 2017
M16PMAED2	OPERATION RESEARCH	
Credit: 4		

Unit : I

Introduction - Definition of O.R. – Scope , phases and Limitations of O.R. – Linear Programming Problem – Definitions – Mathematical Formulation – Characteristic of a LPP – Matrix form of LPP – Graphical Method – Definitions of bounded , unbounded and optimal solutions – procedure of solving LPP by graphical method – problems – Simplex technique - Definitions of Basic , non basic variables – basic solutions – slack variables and optimal solution , simplex procedure of solving LPP – problems.

Unit : II

Introduction – Big – M method – Definitions of Big – M method , surplus variables and artificial variables – Procedure of solving an LPP by Big – M method – Pseudo optimal solution – Problems – Two – Phase Simplex method – Procedure of solving an LPP by two – phase simplex method – problems.

Unit : III

Introduction – Balanced and unbalanced T.P , Feasible solution – Basic feasible solution – Optimum solution – Degeneracy in a T.P. – Mathematical formulation – North – West Corner rule – Vogel's approximation method (unit penalty method) - Method of Matrix minima (Least cost Method) – problems – Algorithm of Optimality test (Modi Method) – Problems .

Unit : IV

Assignment problem – Definition – Mathematical formulation of the Assignment problem – Test for optimality by using Hungarian method - Unbalanced Assignment problem – Degeneracy in Assignment problem - Maximization case in Assignment problem – Restrictions on Assignment problem – Variations in Assignment problem –problems .

Unit : V

Introduction – Definition of network, event, activity, optimistic time, pessimistic time, the most likely time, critical path, total float and free float – Difference between slack and float – Phases of critical path in a PERT network – difference between CPM and PERT – Problems.

Text Book:-

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Operations Research, Ninth Edition	P.K.Gupta, Man Mohan and Kanti Swarup	Sultan Chand and Sons, New Delhi	2001

Reference Books:-

S.No	Title of the Book	Author	Publishing Company	Year of Publication
1.	Operations Research, Second Edition	S.Kalavathy	Vikas Publishing House, New Delhi	2002
2.	Operations Research, Second Edition	P.K.Gupta and D.S.Hira	S.Chand & Co, NewDelhi	2004
3.	Operations Research	Hamdy Taha	Prentice Hall Publications, NewDelhi	1996
4.	Operations Research	Nita Hshah Ravi M. Gor Hardiksoni	PHI, P,Ltd,	2010

Semester:I

Value Added Course

(For M.Sc Computer Science Students admitted on 2016-2017 onwards).

VAC-I		2016 - 2017
M16PCSS01	SOFT SKILL - QUANTITATIVE APTITUDE	
Credit: 2		

Unit: I

Profit & Loss – Partnership.

Unit: II

Chain rule - Time & Work.

Unit: III

Time and Distance – Clocks.

Unit: IV

Problems on trains – Boats & Streams.

Unit: V

Races & Games of skills – Calendar.

Text Book:

Quantitative Apptitude, Dr. R.S.Aggarwal,S.Chand & Company Ltd, New Delhi.

SEMESTER-II

(For M.Sc Computer Science Students admitted on 2016-2017 onwards).

Core -VII		2016 - 2017
M16PCS07	DISCRETE MATHEMATICS	
Credit: 4		

UNIT – I

Mathematical Logic – statements and Notations – connectives – Negation – Conjuction – Disjunction – Statemetn formulas and the truth value table – conditional and Diconditional – well formed formulas – Tautalogies. Equivalence of formulas-Duality Law-Tautological implications.

[sec : 1.1,1.2.1-1.2.4,1.2.6-1.2.11.]

UNIT – II

Normal forms – Disjunctive normal forms – conjunctive normal forms – principal Disjunctive normal forms – Principal conjunctive normal forms – Ordering and uniqueness of normal forms – theorey of inference for the statement calculus – validity using truth Tables – Rules of inference – consistency of premises and indirect method of proof.

[sec : 1.3.1 - 1.3.5, 1.4.1 - 1.4.3]

UNIT – III

Functions – Definition and Introduction – composition of function – Inverse function – Binary and n - ary operations – Characteristic Function of a set -Hashing function – Natural Numbers – peano Axioms and Mathematical induction – cardinality.

[sec : 2.4.1-2.4.6,2.5.1-2.5.2]

UNIT – IV

Lattices as partially ordered sets : Definition and Examples – some properties of Lattices – Lattices as Algebraic system – sub Lattices – Direct product and homomorphism-some special Lattices

[sec: 4.1.1-4.1.5]

UNIT : V

Boolean Algebra : Definintion and Examples – sub algebra Direct product and homomorphism – Boolean functions – Boolean forms and free Boolean Algebras – values of Boolean Expression and Boolean functions.

[sec : 4.2.1-4.3.2]

Text Books :

1. Discrete Mathematical structures with application to computer science. - J. P. Tremply and R. Manohar- Tata McGraw-Hill publishing company Limited, New Delhi.

Reference books:

2. Discrete Mathematics –T.Veerarajan-Tata McGraw-Hill publishing company Limited, New Delhi.
3. Discrete Mathematics- N. Subramaniam.

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