M.Sc. Mathematics

SRI CHANDRASEKHARENDRA SARASWATHI VISWA MAHAVIDYALAYA

(University u/s 3 of UGC Act 1956) Accredited

with "A" Grade by NAAC) Enathur,

Kanchipuram – 631 561. Tamilnadu,

www.kanchiuniv.ac.in

DEPARTMENT OF MATHEMATICS

M.Sc., Mathematics Syllabus

With effect from 2018-2019

SRI CHANDRASEKHARENDRA SARASWATHI VISWA MAHAVIDYALAYA

Enathur, Kanchipuram-631561

Department of Mathematics
Faculty of Science

Minutes of Board of Studies in Mathematics

Date: 25-01-2018 **Time: 9:30 A.M** **Venue: Seminar Hall**

The Board of studies meeting in Mathematics held on 25.01.2018 by 9.30 am at the faculty of science seminar hall, SCSVMV campus. The following members attended the meeting.

S.No.	Name and Designation	Position
1.	Dr.K. Srinivasa Rao, Professor & Head, Dept of Mathematics, SCSVMV	Chairman
2.	Mrs.D. Vijayalakshmi, Assistant Professor of Mathematics,SCSVMV	Member
3.	Dr. E. Geetha Assistant Professor of Mathematics, SCSVMV	Member
4.	Dr. Gnanaraj Thomas (Rtd) Associate Professor of Mathematics Madras Christian College, Chennai	Co-opted Member
5.	Dr. S.J.Venkatesan Associate Professor of Mathematics Government Arts College for Men Nandanam, Chennai	Co-opted Member
6.	Dr.S. Balaji Dean(Faculty of Science) SCSVMV	Member

Minutes of the meeting

- The syllabus of Dynamics and Abstract Algebra offered to III B.Sc., (Mathematics) are revised and updated with effect from the academic year 2018-19 onwards.
- The syllabus of M.Sc Mathematics is scrutinized and accepted with minor changes by the committee for implementation with effect from the academic year 2018-19 onwards.

- Proposal for the change in exam pattern for M.Phil Mathematics from annual to semester is discussed and approved by the committee.

- Proposal for common Mathematics syllabus from I semester to V semester for B.E(ECE,EEE,EIE and Mechatronics) and B.E (Mechanical, Civil Engineering and Civil & Structural Engineering) is approved by the members for implementation with effect from the academic year 2018-19 onwards

- A minor change in Operations Research paper offered for VII semester B.E (Mechanical) and VI semester B.E (E&I , Mechatronics) is accepted and approved for implementation with effect from the academic year 2018-19 onwards

Attendance Sheet

S.No.	Name and Designation	Position	Signature
1.	Dr.K. Srinivasa Rao, Professor & Head, Dept of Mathematics, SCSVMV	Chairman	K Srinivasa Rao 25/1/18
2.	Mrs.D. Vijayalakshmi, Assistant Professor of Mathematics,SCSVMV	Member	D.Vijayalakshmi 25/1/18
3.	Dr. E. Geetha Assistant Professor of Mathematics, SCSVMV	Member	E. Geetha 25/1/18
4.	Dr. Gnanaraj Thomas (Rtd) Associate Professor of Mathematics Madras Christian College, Chennai	Co-opted Member	D. Gnanaraj Thomas 25/01/18
5.	Dr. S.J.Venkatesan Associate Professor of Mathematics Government Arts College for Men Nandanam, Chennai	Co-opted Member	S.J.Venkatesan 25/1/18
6.	Dr.S. Balaji Dean(Faculty of Science) SCSVMV	Member	S. Balaji 25/1/18

Choice Based Credit System for M.Sc (Mathematics) Programme

Credits

Each course is normally assigned one credit per lecture / tutorial per week and one credit for two periods or part thereof for laboratory or practical per week.Each semester curriculum shall normally have a blend of theory and practical course.

Duration of the Programme

A student is normally expected to complete M.Sc., (Mathematics) Programme in two years but in any case not more than seven years from the time of admission.

Registration for Courses

A newly admitted student will automatically be registered for the entire course prescribed for the first year without any option.

Every other student should submit a completed registration form indicating the list of course intended to be credited during the next semester. This registration will be done a week before the last working day of the current semester. Late registration with the approval of the department along recommendation of the head of the department along with a late fee will be done up to the last working day. Registration for the project work shall be done only for the final semester.

Assessment

The break – up of assessment and examination marks for the theory subjects is as follows:

First Assessment	: 15 Marks
Final Assessment	: 15 Marks
Assignment/Attendance	: 10 Marks
Examination	: 60 Marks

The break – up of assessment and examination marks for the Practical subjects is as follows:

First Assessment	: 15 Marks
Final Assessment	: 15 Marks
Maintenance of Record Book	: 10 Marks
Examination	: 60 Marks

The project work will be assessed for 80 marks by the committee, consisting of the guide and a minimum of two members nominated by the head of the department.

One of the committee members will be nominated as the chairman by the head of the department. The head of the department may himself be a member or the chairman. 120 marks are allotted for the project work and viva voice examination at the end of the semester.

Student Counsellor

To help the students in planning the course of study and for general advice on the academic programme, the head of the department will attach a certain number of students to a member of faculty who shall function as student counsellor for those students throughout their period of study, Such student counsellor shall advice the student, preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the head of the department.

Class Committee

For each of the semester, separate class committees will be constituted by the head of the department.The composition of the class committees from first to eighth semesters will be follows.

Course co-coordinators are appointed by the head of the department from among the staff members teaching the course.

A project co- ordinator (in the fourth semester committee only) who shall be appointed by the head of the department from among the project supervisors.

All the student counsellors of the class and the head of the department (if not already a member) or any staff member nominated by the head of the department may opt to bespecial invitees.

The meeting will be held within a week after the completion the first assessment to review the performance and for follow – up action.

The second meeting will be held within a week after the final assessment is completed to review the performance and for the follow – up action.

The third meeting will be held after all the assessments are completed for all the courses, and at least one week before on the commencement of the examinations. During the meeting assessment in a maximum, of 40 marks will be finalized for every student and tabulated and submitted to the head of the department for approval and transmission to the controller of examinations.

Withdrawal from a Course

A student can withdraw from a course at any time before a date fixed by the head of the department prior to the final assessment, with the approval of the dean of the faculty on the recommendation of the head of the department.

Temporary Break of Study

A student can take a one – time temporary break of study covering the current year/ semester and /or the next semester with the approval of the head of the department, not later than after completion of the mid – semester test. However, the student must complete the entire programme within the maximum period of years.

Substitute Arrangement

A student, who has missed, for genuine reasons accepted by the head of the department, one or more of assessments of a course other than the examination, may take a substitute

Assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the fourth meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the head of the department within a week from the date of the missed assessment.

Attendance Requirements

To be eligible to appear for the examination in a particular course, a student must get minimum of 80% in the course. However, if the attendance is 70% or above but less than 80% in any course, the authorities can permit the student to appear for the examination in the course on payment of the prescribed condition fees.

A student who withdraws from or does not meet the minimum attendance requirement in course must re-register for and repeat the course.

Passing and Declaration of Examination Results

All assessments of all the courses on absolute marks basis will be considered and passing by the results passing board in accordance with the rules of the university. Thereafter, the controller of examinations shall convert marks for each course to the corresponding letter grade as follows to compute the grade point average and cumulative grade point average, and prepare the grade cards.

90-100 Marks	: S Grade
80-89 Marks	: A Grade
70-79 Marks	: B Grade
60-69 Marks	: C Grade
55-59 Marks	: D Grade
50-54 Marks	: E Grade
Less than 50 Marks	: F Grade
Insufficient Attendance	: I Grade
Withdrawn from Course	: W Grade

A student who obtains less than 24 marks out of 60 in the examination or is absent for the examination will be awarded grade “F”.

A student who earns a grade of S, A, B, C, D, or E for a course is declared to have successfully completed that course and earned credits for that course. Such a course cannot repeat by the student.

A student who obtains letter grade F in a course has to reappear for the examinations in that course.

A student who obtains letter grade I or W in a course has to re -register for and repeat the course.

The following grade points are associated with each letter grade for and repeat the point average and cumulative grade point average.

S - 10; A - 09; B - 08; C - 07; D - 06; E - 05; F - 0.

Course with grades I and W is not considered for calculation of grade point average or cumulative grade point average. F grade will be considered for computing GPA and CGPA.

A student can apply for re - totalling for one or more of his examination answer papers within a week from the date of issue of the grade sheet to the students on payment of prescribed fee per paper. The application must be made to the controller of Examinations with therecommendation of the head of the department.

After results are declared, grade cards will be issued to the students. The grade cards will contain the list of courses registered during the year / semester, the grades scored and the grade point average (GPA) for the year / semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the year/ semester, divided by the sum of the number of credits for all courses taken in that year / semester. CGPA is similarly calculated considering all the courses taken from the time of admission.

After successful completion of the programme, the degree will be awarded with the following classification based on CGPA.

For First Class with Distinction the student must pass all the courses in the first attempt and obtain a CGPA of 8.25 or above.

For First Class the student must pass all the courses in the first attempt and obtain a CGPA of 6.5 or above.

For Second Class the student must pass all the courses in the first attempt and obtain a CGPA of 5.0 or above.

Electives

Apart from the various elective courses offered in the curriculum of the branch of specification, a student can choose a maximum of two electives from any specialization under the faculty during the entire period of study, with the approval of the head of the department offering the course.

M.Sc .,(Mathematics) Curriculum and Syllabus

(Effective from 2020-2021)

Subject Code	Title of the Paper	CIA	Ext. Exam	Total Marks	Credits
SEMESTER- I					
MMAF181T10	Abstract Algebra	40	60	100	5
MMAF181T20	Real Analysis	40	60	100	5
MMAF181T30	Ordinary Differential Equations	40	60	100	5
MMAF181T40	Programming with Python	40	60	100	5
MMAF181P50	Software Lab-I (MATLAB programming)	40	60	100	3
MMAF181T60	Software Lab-II (Python Lab)	40	60	100	3
MMAF181T70	Awareness course-1 (Ancient Mathematics)	50	-	50	1
SEMESTER- II					
MMAF182T10	Linear Algebra	40	60	100	5
MMAF182T20	Topology	40	60	100	5
MMAF182T30	Partial Differential Equations	40	60	100	5
MMAF182T40	Complex Analysis	40	60	100	5
MMAF182P50	Software Lab-III (Numerical computations using MATLAB)	40	60	100	3
MMAF182P60	Software Lab-IV (Statistics Using Mega Stat)	40	60	100	3
MMAF182T70	Awareness Course 2(Quantitative Aptitude-I)	50	-	50	1

SEMESTER III					
MMAF183T10	Discrete Mathematics	40	60	100	5
MMAF183T20	Operation Research	40	60	100	5
MMAF183T30	Functional Analysis	40	60	100	5
MMAF183T40	Fluid Dynamics	40	60	100	5
MMAF183P50	Software Lab-V (Operations Research Lab)	40	60	100	3
MMAF183P60	Software Lab-VI(Applied Mathematics Using SAGE)	40	60	100	3
MMAF183T70	Awareness Course 3(Quantitative Aptitude-II)	50	-	50	1
SEMESTER IV					
	Elective I	40	60	100	5
	Elective II	40	60	100	5
MMAF184Z30	Project Work and Viva Voce	80	120	200	8
MMAF184T40	Awareness course 4 (Teaching Methodology)	50	-	50	1
	Total	**1000**	**1200**	**2200**	**100**

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SL. NO	LIST OF ELECTIVES
1.	Advanced Applied Mathematics
2.	Applied Graph Theory
3.	Advanced Discrete Mathematics
4.	Formal language and Automata theory
5.	Probability and Stochastic processes
6.	Applied Abstract Algebra
7.	Classical Mechanics
8.	Bioinformatics
9.	Fuzzy Mathematics
10.	Mathematics Modelling
11.	Differential Geometry
12.	Analytical Number Theory
13.	Financial Mathematics
14.	Mathematical Social Sciences
15.	Mathematical Statistics

SEMESTER-1

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF181T10	**Abstract Algebra**	5/5	3 hours	40	60	100

Course Objectives:

- To study group theory and ring theory
- To introduce the field of quotients of integral domain.
- To study the Sylow's theorems and polynomials rings.

Course Outcomes:

At the end of the course, the students are able to

- Understand Normal subgroups and Quotient Groups and its homomorphism relations
- Analyze the Cauchy's theorem for Abelian Group and Sylow's theorem
- Compute the Permutation groups and its Conjugacy
- Perform the Homomorphism's, Ideals, Quotient rings in ring theory
- Design the Polynomial rings and polynomial over the rational field

Unit-I

Normal subgroups and Quotient Groups-Homomorphism-Cauchy's theorem for Abelian Group-Sylow's theorem for Abelian Group-Automorphism-Cayley's theorem

Unit-II

Permutation groups- Conjugacy- Normalizer-Centre-Cauchy theorem-Sylow's theorem-Direct products

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Unit-III

Rings-Homomorphism-Ideals-Quotient rings-Maximal ideal-Field of Quotients of integral domain

Unit-IV

Euclidean rings-Polynomial rings- polynomial over the rational field-polynomial rings over commutative rings

Unit-V

Vector spaces-elementary basic concepts-Extension fields-The Transcendence of e - roots of polynomials-Construction with straightedge and compass-Finite fields

Chapter-5: (5.1- 5.4) and Chapter-7: 7.1

Text Book:

Topics in Algebra, I.N.Heristein, Wiley india Pvt.Ltd, Second edition, 2006.

Reference Books:

1. Contemporary Abstract Algebra, Joseph A.Gallian, Brooks/Cole, Ninth edition, 2017.
2. A first course in abstract algebra, Fraleigh J.B, Narosa publications, Seventh edition, 2013.
3. Algebra, Serge Lang, Springer-Verlag New York, Third edition, 2002.
4. Algebra, Artin M, Prentice-Hall, New Jersey, Second edition, 1991.
5. Abstract Algebra, David. S. Dummit, Richarad M. Foote, John-Wiley & sons, Third edition, 2004

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF181T20	**Real Analysis**	5/5	3 hours	40	60	100

Course Objectives:

- To learn some of the basic concepts in limits, continuity, derivatives,
- To learn the Riemann Stieltjes – integrals, Sequence and Series of functions.
- To Measure on the real line, Integration of functions of a Real variable,
- To learn Abstract Measure space, Signed measures and derivatives.

Course Outcomes:

At the end of the course, the students are able to

- Understand the limits and continuity of functions, connectedness and compactness, convergent sequences, complete spaces, compactness, connectedness and the Riemann-Stieltjes Integral, Integration and Differentiation.
- Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability and integrability. Recognize the difference between point wise and uniform convergence of a sequence of functions.
- Know about Measure on Real line and measurable functions and understand how measures may be used to construct integrals.
- Explain the concepts of Measures and outer measures, Integration with respect to a measure.
- Describe the Signed measures , Hahn Decomposition, Jordan Decomposition and the Radon-Nikodym Theorem and its applications.

Unit I

Limits of Functions – Continuous Functions – Continuity and Connectedness – Continuity and Compactness. Definition and existence of the Integral – Properties of the integral – Integration and Differentiation

Unit II

Discussion of Main Problem – Uniform convergence – Uniform convergence and continuity Uniform convergence and Integration, Uniform Convergence and differentiation – Equicontinuous Families of Functions – Stone-Weierstrass theorem.

Unit III

Lebesgue Outer Measure – Measurable Sets – Regularity – Measurable Functions – Integration of Non-Negative Functions – The General Integral – Integration of Series – Riemann and Lebesgue Integrals.

Unit IV

Measures and Outer Measures – Extension of a Measure – Uniqueness of the Extension – Completion of a Measure – Measure Spaces – Integration with respect to a Measure.

Unit V

Signed measures and Hahn Decomposition – The Jordan Decomposition Theorem – Radon-Nikodym Theorem – Lebesgue Decomposition Theorem – Riesz Representation Theorem for L^1 and L^p .

Text Books:

1. Principles of Mathematical Analysis, Rudin, W., Mc Graw–Hill, Third Edition, International Edition, 1976.

Unit – I: Chapter 4 (Four Sections) and Chapter 6 (Three Sections)

Unit – II: Chapter 7 (All Sections)

2. Measure Theory and Integration, G. De Barra, New Age International Pvt. Ltd, First edition 1981, Reprint 2004.

Unit – III: Chapter 2.1, 2.2, 2.3, 2.4 and Chapter 3 (3.1 to 3.4),

Unit – IV: Chapter 5 (5.1 to 5.6)

Unit – V: Chapter 8.1, 8.2, 8.3, Named Theorems in 8.4 and 8.5

References:

1. Foundations of Modern Analysis, Avner Friedman, Holt Rinehart Winston, 1970.
2. An Introduction to Measure and Integration, Rana I. K., Narosa Publishing House Pvt. Ltd., Second Edition, 2007.
3. Real Analysis, Royden H. L., Prentice Hall of India Pvt. Ltd., Third Edition, 1995.
4. Mathematical analysis, Tom M. Apostol, Addison-Wesley, Second Edition, 1981.
5. Mathematical Analysis, V. Ganapathy Iyer, Tata McGraw Hill Publishing House, 1977.
6. Elements of Real Analysis, Bartle, R.G., John Wiley and Sons Inc., First edition, 1976.
7. The Lebesgue Integral, Burkill,J.C., Cambridge University press, 2004.

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF181T30	**Ordinary Differential Equations**	5/5	3 hours	40	60	100

Course Objective

- To give an in depth knowledge of differential equations and their applications
- To study the existence of uniqueness
- To study the stability behavior of the solutions of the ordinary differential equations.

Course outcome

At the end of the course, the students are able to

- Solve the differential equation and their applications
- Find series solution of first order equation and second order linear equation
- Solve linear system and homogeneous linear system with constant coefficient
- Find the existence and uniqueness solutions
- Understand the method of successive approximations

Unit I

Qualitative Properties of Solutions – The Sturm Comparison Theorem – Eigen Values and Eigen Functions – Vibrating String.

Unit II

Series Solutions of First Order Equations – Second Order Linear Equations – Ordinary Points – Regular Singular Points – Gauss Hyper Geometric Equations.

Unit III

Legendre Polynomials – Properties of Legendre Polynomials – Bessel Functions – The Gamma Function – Properties of Bessel Function.

Unit IV

Linear Systems – Homogeneous Linear System with Constant Coefficients.

Unit V

The Existence and Uniqueness of Solutions – The Method of Successive Approximations – Picards's Theorem.

Text Book

Treatment as in Differential Equations with Applications and Historical Notes, G.F.Simmons, Mc Graw Hill Book Company, Second edition, 1991.

References:

1. Advanced Differential Equations, M.D. Raisinghania, S. Chand Publications, Revised Edition, 1988.
2. Differential Equations, Shepley. L. Ross, Wieley India Pvt LTD, Second edition, 1984.
3. A Text book of Engineering Mathematics, NP. Bali, Bhavanari Satyanarayana, Indrani Promod Kelkar, University Science Press, New Delhi 2012.
4. An introduction to ordinary differential equations, E.A.Coddington, (3rd Printing) Prentice-Hall of India Ltd.,New Delhi, 1987.
5. Elementary differential equations and boundary value problems, Williams E. Boyce and Richard C. DI Prima, John Wiley and sons, New York, Seventh Edition, 2001.

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Subject code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF181T40	**Programming with Python**	5/5	3 Hours	40	60	100

PYTHON PROGRAMMING FOR MATHEMATICS

Learning Objectives :

- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to write loops and decision statements in Python.
- To learn how to identify Python object types.
- To learn how to use Matplotlib to draw graphs
- To work with differential equations and calculus

Course Outcomes :

On completion of the course, the students will be able to:

- demonstrate the fundamental concepts of python programming
- manipulate object oriented programming concepts in python
- demonstrate plotting the graph using Matplotlib.
- solve equations using the SciPy package
- find optimal solutions using Python.

SYLLABUS

UNIT – I :

Python Basics: Introduction to Python – Datatypes in Python – Sequences – Sets – Literals - Operators – Mathematical functions – Command Line Window - Input and Output Statements – Command Line Arguments.

[10 hours]

UNIT – II :

Control Statements : if - if…else – if... elif...else – While Loop – for Loop - Infinite Loops - Nested Loops – Break – Continue – Pass – Assert – Return – Arrays in Python – Strings and Characters – Functions.

[12 hours]

UNIT – III: List – Methods to process Lists – List comprehensions – Basic operations on Tuple – Functions to process Tuples – Dictionaries : Dictionary methods – Introduction to OOPs : Class and Objects – Inheritance and Polymorphism – Exceptions

[12 hours]

UNIT – IV: Basic Mathematical functions - Basic plotting with Matplotlib - Changing the plotting style - Adding labels and legends to plots - Adding subplots - Surface and contour plots - Customizing three-dimensional plots, Calculus and Differential Equations : Working with polynomials and calculus - Differentiating and integrating symbolically using SymPy - Integrating functions numerically using SciPy - Solving simple differential equations numerically .

[14 hours]

UNIT – V : Finding Optimal Solutions : Minimizing a simple linear function - Minimizing a non-linear function - Using gradient descent methods in optimization - Using least squares to fit a curve to data - Analyzing simple two-player games

[12 hours]

REFERENCE BOOKS :

1. NageswaraRao R., "Core Python Programming", 2nd Edition, Dreamtech Press, New Delhi, 2018. [UNIT – I to UNIT – III]
2. Kenneth A. Lambert, "Fundamentals of Python – First Programs", 2nd Edition, Cengage Publication, New Delhi, 2019.
3. Paul Barry, "Head First Python", 2nd Edition, O'Reilly Media, Beijing, 2016.
4. Sam Morley, "Applying Math with Python" Packt Publishing Ltd., UK, 2020. [UNIT – IV and UNIT –V]
5. Peter Farrell, "Math Adventures With Python", No Starch Press, Inc., San Francisco, 2019.

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Additional topics which may be included in the syllabus :

- Geometric Problems : Working with Data and Statistics

Draft Course syllabus prepared by :

Dr.V.Ramesh, Assistant Professor, Dept. of CSA, SCSVMV, Kanchipuram

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Subject Code	Subject	Credit/ Hrs. per week	Duration of Univ. Exam	Marks		Total Marks
				CIA	External Exam	
MMAF181P50	**Software Lab-I (MATLAB Programming)**	3/3	3	40	60	100

Course Objective:

- To build the basics of MATLAB and programming logic and thereby developing skills in problem solving using MATLAB programming.
- To build basics of MATLAB, programming logic and thereby developing skills in problem solving using MATLAB programming.

Course Outcomes:

At the end of the course, the students are able to:

- Understand the main features of the MATLAB program development environment to enable their usage in the higher learning.
- Implement simple mathematical functions/equations in numerical computing environment
- Interpret and visualize simple mathematical functions and operations thereon using plots
- Write simple programs in MATLAB to solve scientific and mathematical problems

Getting started with MATLAB-Arrays-Matrix algebra-Polynomials-System of linear equations-Complex numbers

Plotting-2D-subplot-3D plotting-Histograms-Pie charts-Bar graphs

MATLAB Programming-M-files-Script files

Numerical solutions to algebraic and transcendental equations-MATLAB programs - Bi-section method-Newton Raphson method-Regula falsi method

Solution of Simultaneous Algebraic Equations- MATLAB programs-Gauss Elimination method-Gauss Jordan method-Gauss Jacobi method.

Reference:

1. Getting Started with MATLAB, Rudra Pratab, Oxford Univ. press, Seventh Edition, 2016.
2. Introduction to MATLAB, K.Srinivasa Rao, IMRF International Publications
3. Numerical Methods with Programs in MATLAB, P.Nagarajan, K.Srinivasa Rao, University Press, SCSVMV
4. Practical MATLAB-Basics for Engineers, Misza Kalechman, CRC Press, 2008
5. Engineering Problems Solving with MATLAB, D.M.Etter, Prentice Hall, 1997.

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF181P60	**Software Lab-II (Python Lab)**	3/3	3	40	60	100

LIST OF EXERCISES

1. Write a Python Program to Convert Celsius to Fahrenheit and vice versa.
2. Write a Python Program to Calculate the Area of a Triangle, circle and square.
3. Write a Python Program to Solve Quadratic Equation
4. Write a Python Program to Generate a Random Number
5. Write a Python Program to Print the Fibonacci sequence
6. Write a Python Program to Find the Factorial of a Number
7. Write a Python Program to Check Armstrong Number
8. Write a Python Program to Check Prime Number
9. Write a Python Program to Check Whether a String is Palindrome or Not
10. Write a Python Program to Display the multiplication Table
11. Write a Python Program to Convert Decimal to Binary, Octal and Hexadecimal
12. Write a Python Program to Make a Simple Calculator
13. Write a Python Program to Add Two Matrices
14. Write a Python Program to Multiply Two Matrices
15. Write a Python Program to Transpose a Matrix

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks	Total Marks
				Internal Exam	
MMAF181T70	**Awareness Course-I**	1/2	3	100	100

Ancient Mathematics

Multiplication- Finding square- Sum of last two digits zero-By one less than the previous-By Nikhilam-Vertical and cross wise-three digit and four digit numbers – Product of three numbers.

Division- Single, two and three digit divisors- Paravartya sutra (change the sign and add). Squaring and cubing-Duplex method.

Finding square root, solving simultaneous equation in 2 and 3 variables.

Reference

1. Vedic Mathematics Part I, S.Haridas, Bhavan's Book University, 2000.
2. Discover Vedic Mathematics, Kenneth R Williams, Motilal Banarsidass Publishers, ISBN: 81-208-3097-0, 2002.
3. Vedic Mathematics for Schools, J.T.Glover, Motilal Banarsidass Publishers, ISBN: 81-208-1670-6, 1999.

SEMESTER-II

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF182T10	**Linear Algebra**	5/5	3	40	60	100

Course Objectives

- To study the matrix vector and scalar multiplication
- To study the Algebraic nature concerning linear transformation
- To study the basic concept of linear algebra

Course Outcomes

At the end of the course, the students are able to

- Understand the Matrices interpret existence and uniqueness of solution geometrically
- Understand the Matrix representation of a linear transformation
- Understand the Bilinear form, symmetric bilinear form

Unit I

Linear Transformations-Null spaces and Ranges-The Matrix Representation of a Linear Transforms-Composition of Linear Transformations and Matrix Multiplication-Inevitability and Isomorphism- The Change of Coordinate Matrix

Unit-II

System of Linear Equations- Theoretical and Computational Aspects- Determinant of Order n-Eigen values and Eigen vectors-Diagonlizability

Unit III

Inner Products and Norms- The Gram-Schmidt Orthogonalization Process- The Adjoint of a Linear Operator-Normal and Self-Adjoint Operatros-Unitary and Orthogonal operators and their matrices-Orthogonal Projections and the Spectral Theory

Unit IV

The Jordan Canonical Form-I – Jordan Canonical Form-II-The minimal polynomial

Unit V

Bilinear forms – Symmetric bilinear forms – Skew–symmetric bilinear forms – Group preserving bilinear forms

TEXT BOOKS

1. Linear Algebra, Friedberg, Arnold J. Insel, Lawrence E.Spence (Unit I-IV), Prentice –Hall of India, Fourth Edition, 2002
2. Linear Algebra, Kenneth Hoffman & Ray Kunze, (Unit-V), Prentice–Hall of India, Second Edition, 1971.

REFERENCES

1. Algebra, M. Artin, Prentice–Hall of India, United States Edition, 1991.
2. Applied Linear Algebra, Ben Noble, James W. Daniel, Prentice–Hall of India, Third Edition, 1987.
3. Elementary Linear Algebra - A Matrix Approach, Lawrence Spence, Arnold Insel, Stephen Friedberg, Prentice Hall, Second Edition, 2007.
4. Linear Algebra Done Right , Sheldon Axler, Springer, Second Edition, 1997

M.Sc. Mathematics

Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF182T20	**Topology**	5/5	3	40	60	100

Course Objectives:

- To learn basic concepts in Sets,
- To study the Topological Spaces, different types of topology,
- To study the compact spaces and connected spaces,
- To study the count ability and separation axioms, T
- To study the Tychonoff theorem and Stone Cech compactification.

Course Outcomes:

At the end of the course, the students are able to

- Understand the definitions and theorems related to finite, countable, and uncountable sets and well ordered sets.
- Demonstrate knowledge and understanding of concepts such as open and closed sets, interior, closure and boundary. Continuous functions and homeomorphisms to understand structure of topological spaces. New topological spaces by using subspace, product and quotient topologies.
- Know the definition and basic properties of connected spaces, path connected spaces, compact spaces, and locally compact spaces.
- Understand to concepts of Countability Axioms , Separation Axioms and Normal spaces. Familiar with the Urysohn lemma and the Tietze extension theorem and characterize metrizable spaces.
- Describe the Tychonoff theorem and Stone Cech Compatification. Apply theoretical concepts in topology to understand real world applications.

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Unit- I

Countable and uncountable sets – Infinite sets and The Axiom of Choice – Continuum Hypothesis – Well–ordered sets – The maximum principle.

Unit - II

Basis for a topology – Order topology – Product topology – Subspace topology – Closed sets and limits – Continuous functions – Metric topology – Quotient topology.

Unit- III

Connected spaces – Components and local connectedness – Compact spaces – Limit point compactness – Local compactness

Unit- IV

The Countability Axioms – Separation Axioms – Normal spaces – The Urysohn Lemma – The Urysohn metrization theorem – The Tietze extension theorem

Unit V

The Tychonoff theorem – Stone Cech Compatification

TEXTBOOK

1. Topology , James R. Munkres, Prentice Hall of India, Second Edition, 2000.

REFERENCES

1. Topology , J. Dugundji, Allyn and Bacon, Boston, First Edition, 1966.
2. Introduction to General Topology, K. D. Joshi, Wiley Eastern Limited, 1983.
3. Introduction to topology and Modern Analysis, G.F.Simmons, McGraw Hill International Book Company, New York, 1963
4. General Topology , J.L. Kelly, Springer - Verlag, 1975.
5. General Topology, S.Willard, Addison - Wesley, Mass., 1970

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF182T30	**Partial Differential Equations**	5/5	3	40	60	100

Course Objectives:

- To learn how to solve linear Partial Differential with different methods.
- To derive heat and wave equations in 2D and 3D.
- To learn the solutions of PDEs determined by conditions at the boundary of the spatial domain and initial conditions at time zero.
- To study the technique of separation of variables to solve PDEs and analyze the behavior of solutions in terms of Eigen function expansions.
- To learn Green's functions which are useful for multidimensional spaces and general curvilinear coordinates as well as Cartesian coordinates.

Course Outcomes

After the completion of the course, Students will be able to

- Classify partial differential equations and transform into canonical form
- Solve linear partial differential equations of higher order
- Apply partial derivative equation to predict the behavior of certain phenomena.
- Apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of specialization.
- Extract information from partial derivative models in order to interpret reality.
- Identify real phenomena as models of partial derivative equations.

M.Sc. Mathematics

Unit- I

Formation of Partial Differential Equations – Lagrange's equation – Integral surfaces passing through a given curve – Surfaces orthogonal to a given system of surfaces – Compatible system of equations Charpit's method.

Unit- II

Classification of second order Partial Differential Equations – Reduction to canonical form – Adjoint operators.

Unit -III

One–dimensional wave equation – Initial value problem – D'Alembert's solution – Riemann – Volterra solution – Vibrating string – Variables Separable solution – Forced vibrations – Solutions of Nonhomogeneous equation – Vibration of a circular membrane.

Unit -IV

Diffusion equation – Method of Separation of variables: Solution of one and two dimensional Diffusion equations in cartesian coordinates and Solution of Diffusion equation in cylindrical and spherical polar coordinates.

Unit -V

Boundary value problems – Properties of harmonic functions – Green's Function for Laplace Equation – The Methods of Images – The Eigenfunction of Method.

M.Sc. Mathematics

TEXTBOOKS

1. Elements of Partial Differential Equations, Sneddon I.N., Tata Mc–Graw Hill Book Company, Illustarted Edition, 1985. (For Units I to IV)
2. Introduction to Partial Differential Equations, Sankara Rao K., Prentice Hall of India, Third Edtion, 2007. (For Unit V)

References

1. Introduction to Partial Differential Equations and Boundary Value Problems, Dennemeyer R., Tata McGraw Hill Book Company, 1968.
2. Partial Differential Equations and Boundary Value Problems, Pinsky M.A., Tata McGraw Book Company, Third Edition, 1998.
3. An Introduction to Partial Differential Equations with MAT LAB, Mathew P. Coleman, Chapman & Hall , CRC press, Second Edition, 2005.
4. Ordinary and Partial Differential Equations, M.D. Raisinghania, S.Chand and Co., New Delhi, Fifteenth revised Edition, 2013.

M.Sc. Mathematics

Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF182T40	**Complex Analysis**	5/5	3	40	60	100

Course Objectives:

- To study the basic concept related to limit, continuity, differentiability in complex system.
- To create familiarity with analyticity and power series.
- To study the complex integral using residue theorem.

Course Outcomes:

At the end of the course, the students are able to

- Understand the stronger implications of differentiability for complex function.
- Use the Cauchy's Theorem, and Cauchy's integral formulae to solve problems.
- Develop Taylyor's and Laurent Series.
- Find the residues and integrals using the residue theorem.
- Use theorems and its results correctly to solve problems.

Unit -I

Line integrals – Rectifiable arcs – Line integrals as functions of arcs – Cauchy's theorem for a rectangle – Index of a point with respect of a closed curve – The integral formula – Higher derivatives – Morera's theorem – Liouville's theorem.

Unit -II

Removable singularities – Zeros and poles – The local mapping – Chains and cycles – Simple connectivity – Homology – The general statement of Cauchy's theorem – Locally exact differentials

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Unit -III

The calculus of residue-The argument principle-Evaluation of definite integrals-Harmonic functions

Unit -IV

Power series expansions- Taylor series- Laurent series- Partial Fractions-Infinite Products- Canonical Products-The Gamma Function-Stirling's Formula

Unit -V

Entire Functions- Jensen's Formula-Hadamard's Theorem-Riemann Zeta function-The Product Development- Extension of $\varsigma(s)$ to the Whole Plane-The Functional Equation-The Zeros of the Zeta Function.

PRESCRIBED TEXT BOOK:

Complex Analysis, Lars V.Ahlfors, Third edition, McGraw-Hill, 1979

REFERENCES:

1. Functions of one complex variable, J.B. Conway, Springer Intl. Second Edition, 1995.
2. Introduction to Theory of Functions of a complex variable, Copson, E.T., Oxford University Press, 1962.
3. Analytic Function Theory, Hille. E., Chelsea, New York, Second Edition, 1959.
4. Theory of Functions of a complex variable, Markushewich, A.I., vol. I, II &III, Chelsea, New York, Second Edition, 1977.
5. Complex Variables and Applications, R.V.Churchill and J.W.Brown, McGraw Hill International Book Co.,Singapore., Seventh Edition, 2003.

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Subject Code	Subject	Credit /Hrs per week	Duration of University Exam	Marks		Total Marks
				CIA	Ext.Exam	
MMAF182P50	**Software Lab III (Numerical Computations using MATLAB)**	3/3	3	40	60	100

Course Objective

- To build the knowledge of solving differential equations using MATLAB and its programming logic thereby developing their programming ability skills
- To build the knowledge of performing interpolation, solving differential equations, non-linear equations using MATLA.

Course Outcomes:

At the end of the course, the student are able to:

- Solve ordinary differential equations
- Perform one dimensional and two dimensional interpolation.
- Solve non-linear equations and system of non-linear equations
- Do data analysis using curve fitting tool box

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Solution of first orders ordinary differential equations-simultaneous ODE-Second and higher orders ODE using ODE solvers.

Solution of nonlinear equations –single variable using *fzero* function

Solution of system of nonlinear equations using *fsolve* function

Interpolation: One dimensional interpolation using *interp1* function- Two dimensional interpolation using *inter2* function.

Data Analysis using *curve fitting tool box*

Reference:

1. Getting Started with MATLAB, Rudra Pratab, Oxford Univ. press, Seventh Edition, 2016.
2. Introduction to MATLAB, K.Srinivasa Rao, IMRF International Publications
3. Numerical Methods with Programs in MATLAB, P.Nagarajan, K.Srinivasa Rao, University Press, SCSVMV
4. Practical MATLAB-Basics for Engineers, Misza Kalechman, CRC Press, 2008
5. Engineering Problems Solving with MATLAB, D.M.Etter, Prentice Hall, 1997.

M.Sc. Mathematics

Subject Code	Subject	Credit/Hrs per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF182P60	**Software Lab-IV (Statistics Using Mega Stat)**	3/3	3	40	60	100

Course Objectives:

- To performs statistical analyses with an Excel workbook and solving basic functions, such as descriptive statistics, frequency distributions, and probability calculations as well as hypothesis testing and more by using Megastat.

Course Outcomes:

- At the end of the course, the student will apply appropriate statistical concepts and processes using Megastat software in solving various conceptual and real-world problems.

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Descriptive Statistics: Measures of Central tendency, Measures of deviations, Skewness, Kurtosis

Frequency Distribution: Quantitative- Histogram, Polygon and Ogive, Qualitative
Probability: Discrete Probability distribution, Continuous Probability distribution
Hypothesis test: t test, F-test, Chi-square test
Analysis of Variance: One-factor anova, Two-factor anova, randomized block design
Correlation/Regression: Correlation, Scatter Plot, Regression
Chi-Square test: Contingency table, Cross tabulation, Goodness of fit

Non-Parametric test: Runs test for random sequence, Mann-Whitney U test, Wilcoxon Matched-Pairs signed rank test, Kruskal-Wallis test, Friedman test, Spearman's Rank correlation.

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks	Total Marks
				Internal Exam	
MMAF181T70	**Awareness Course-II**	1/2	3	100	100

Quantitative Aptitude-I

Average-Problems on Ages-Percentages-Profit and Loss- Ratio & Proportion
Partnership-Chain Rule-Time & Work –Pipes & Cisterns
Time & Distance-Boats & Streams

TEXT BOOK

1. Quantitative Aptitude, Dr. R.S. Aggarwal, S. Chand and Company Ltd., New Delhi, Re Print 2013.
2. Quantitative Aptitude, Abhijit Guha, Tata McGraw Hill Publishing Company Limited, New Delhi, Fourth edition, 2010.

III -Semester

M.Sc. Mathematics

Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF183T10	**Discrete Mathematics**	5/5	3	40	60	100

Course Objectives:

- To study the basic topics of Discrete Mathematics
- To study the Induction and Recursion, Counting techniques,
- To study the Boolean algebra and Computation that will help them to develop and analyze algorithms.

Course Outcomes:

At the end of the course, the students are able to

- Understand and apply the principles of Mathematical Induction, Strong Induction and Structural Induction
- Solve any recurrence relations and form new recurrence relations
- Understand and apply Inclusion – Exclusion principle
- Apply the properties of Relations in the relevant area.
- Understand the machine language and able to design new machines.

Unit -I

Mathematical Induction – Strong Induction and Well Ordering – Recursive Definitions and structural Induction – Recursive Algorithms – Program Correctness.

M.Sc. Mathematics

Unit -II

Recurrence Relations – Solving Linear Recurrence Relations – Divide and Conquer Algorithms and Recurrence Relations – Generating Functions – Inclusion-Exclusion – Applications of Inclusion-Exclusion.

Unit:-III

Relations and Their Properties – n-array Relations and Their Applications – Representing Relations – Closures of Relations – Equivalence Relations – Partial Orderings.

Unit: IV

Partial Orderings-Introduction-Lexicographic order- Hasse Diagrams-Maximal and minimal elements-Lattices-Topological Sorting.

Unit: V

Languages and Grammars – Finite-State Machines with Output - Finite-State Machines with No Output – Language Recognition – Turing Machines

Prescribed Text Book:

Discrete Mathematics and its Applications, Kenneth H.Rosen, Tata McGraw-Hill Company Limited, New Delhi, Sixth Edition, 2007

Reference Books:

1. Discrete Mathematical Structures for Computer Science, Kolman B., Busby R.C. and Ross S., Prentice Hall of India, New Delhi, Fourth Edition, 1999.

2. Discrete Mathematics and its Applications, Susanna S. Epp, Brookes/Cole Publishing Company, Fourth Edition, 2011.

3. Discrete and Combinatorial Mathematics, Ralph P. Grimaldi, Pearson Education, Fourth edition, 2003.

4. Discrete Mathematical Structure with Applications to Computer Science, J.P. Tremblay, R. Manohar, McGraw Hill, New York, International Edition, 1987.

5. Discrete Mathematics for Computer Scientists & Mathematicians, Joe L. Mott, A. Kandel, T.P. Baker, Prentice Hall New Delhi, Second Edition, 2008.

M.Sc. Mathematics

Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF183T20	**Operation Research**	5/5	3	40	60	100

Course Objectives

- Provide students to apply mathematical techniques to model and analysis decision problems with effective applications
- Solving Operational questions
- Solving questions related to resources operation
- Solving decision making questions

Course Outcomes

At the end of the course, the students are able to

- Understand the Importance of operational research
- Understand how operational research is useful in management and administration
- Provide better quantitative information for making decision

Unit- I

Types of Integer Linear Programming Problems – Gomory's All Integer Cutting Plane Method – Gomory's mixed Integer Cutting Plane method –Branch and Bound Method. Dynamic Programming: Dynamic Programming Terminology –Optimal Decision Policy

Unit - II

Introduction – Computational procedure for Standard form I – Alternative Approach to Revised simplex Method. Bounded Variables LP problem: **S**implex method for Bounded Variable.

Unit- III

Relevant Inventory Costs – Steps of Inventory Model Building – Deterministic Inventory Models.

Unit- IV

Basic Difference between PERT and CPM – PERT/CPM Network Components and Precedence relationships – Critical Path Analysis – Probability in PERT Analysis. Decision Theory and Decision Tree Analysis: Decision-Making Environments – Posterior Probabilities and Bayesian Analysis – Decision Tree Analysis.

Unit- V

Unconstrained Optimization – Constrained Optimization – Kuhn-Tucker Conditions – Graphical solution – Quadratic Programming – Wolfe's modified Simplex Methods – Beale's Method.

Prescribed Book:

Operations Research, J.K.Sharma, Macmillan Publishers (India) New Delhi, Third Edition, 2001

Unit 1: Chapter 11, 25

Unit II: Chapter 5, 7

Unit III: Chapter 18

Unit IV: Chapter 17, 15

Unit V: Chapter 26

References:

1. Operations Research, Hamdy A. Taha, Prentice Hall, Eighth Edition, 2007.

2. Operations Research, Gupta P.K. and Hira , D.S., S. Chand and Co. Ltd., New Delhi, Fifth Edition, 2001.

3. Operations Research, Manmohan P.K. and Gupta, S.C, Sultan Chand and Co. New Delhi, Seventh Edition, 2001.

4. Introduction to Operations Research, Fredrich. S. Hillier and Gerald . J. Liberman, Mc Graw Hill, Seventh Edition, 2001.

5. Operations Research – Principle and Practice, Ravindran, Philips and Soleberg, John Wiley and sons, Second Edition, 1987.

M.Sc. Mathematics

Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF183T30	**Functional Analysis**	5/5	3	40	60	100

Course Objectives:

- To study the properties of bounded linear maps between topological linear spaces of various kinds.
- To provides the basic tools for the development of areas such as quantum mechanics, harmonic analysis and stochastic calculus.
- To study certain topological-algebraical structures and the methods by which the knowledge of these methods can be applied to analytic problems.
- To study the basic results associated to different types of convergences in normed spaces and some of it sapplications.
- To study the main properties of bounded operators between Banach and Hilbert spaces.

Course Outcomes:

At the end of the course, the students are able to

- Test the knowledge of Algebra and Analysis along with topological structures.
- Recognize the fundamental properties of Normed Spaces and of the transformations between them.
- Understand the designs and usage of operators between two spaces along with their applications.
- Find the way to establish the existence of a solution to a set of equations with the interest of Fixed-Point Theory.
- Understand the functional Analysis to problems arising in Partial Differential Equations, Measure Theory and other branches of Mathematics.

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Unit -I

Normed Linear Spaces – Examples of Sequence and Function Spaces including c_0 , l_p and L_p [a, b] for 1 □ p □ □ – Linear transformations –Continuity – Dual Spaces – Product and Quotient of Normed Linear Spaces – Completeness of Product and Quotient of Normed Linear Spaces – Completeness of the space of all bounded, linear transformations.

Unit– II

Equivalent norms –Completeness of finite dimensional normed linear spaces – Riesz's lemma – Characterization of finite dimensional normed linear spaces as those with compact unit sphere – Continuity of linear maps defined on finite dimensional normed linear spaces.

Unit–III

Hahn–Banach theorem for real vector spaces – Hahn–Banach theorem for real and complex normed linear spaces – Corollaries to Hahn–Banach theorem – The Principle of Uniform Boundedness – Banach – Steinhauss Theorem – Weakly Bounded Sets are bounded.

Unit–IV

Closed and open maps – Maps with closed graph – Example of discontinuous, linear map with closed graph – Open mapping theorem and the closed graph theorem – Applications – Inner product spaces – Examples – Inner product spaces and parallelogram law for norm – Orthonormal sets – Bessel's inequality – Gram–Schmidt orthonormalization – Orthonormal basis–Examples.

Unit– V

Separable Hilbert spaces and countable orthonormal basis – Linear isometry ontol2 – Example of a non–separable Hilbert space – Uncountable orthonormal basis and definition of convergence of Fourier series – Riesz–Fisher's theorem Orthogonal projections – Closed subspaces are Chebychev – Riesz's representation theorem.

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Text Book :

1. Functional Analysis, M. Thamban Nair, Prentice Hall of India Private Limited, New Dellhi, Eastern Economy Edition, First Edition, 2004.
2. Functional Analysis, Rudin, W., Tata McGraw-Hill, Second Edition, 2006.

References:

1. Functional Analysis and Infinite Dimensional Geometry, M. Fabian, P. Habala, P. Hakek, V. M Santalucia, J. Pelant and V. Zizler, CMS Books in Mathematics, Springer, First Edition, 2001.
2. Functional Analysis, B.V.Limaye, Wiley Eastern, New Delhi, 1981.
3. Introductory functional analysis with applications**,** Kreyszig Erwin, New York: Wiley, 1978.
4. First Course in Functional Analysis, Goffman, C. and Pedrick, G., Prentice-Hall of India, First Edition, 1995.
5. A Course in Functional Analysis, Conway, J. B., Springer, New York, 1985.
6. Functional Analysis, Yosida, K., Springer, Sixth Edition, 1988.

M.Sc. Mathematics

Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF183T40	**Fluid Dynamics**	5/5	3	40	60	100

Course Objectives:

- To study the basic techniques and results of fluid dynamics
- To gain the familiarity with the properties of fluid dynamics
- To study the concept of fluid measurement, types of flows and dimensional analysis
- To learn the mapping and use of conformal transformation
- To formulate important results and theorems

Course Outcomes:

At the end of the course, the students are able to

- Understand the basic ideas of fluid velocity, streamlines and irrotational flows
- Grasp the concepts of viscosity and its effect in fluid flow
- Develop special mathematical methods involving images and complex variables for incompressible fluids
- Analyze the fluid flow using its generalized mathematical model – the Navier stokes equation
- Model a fluid flow phenomena using Navier – stokes equation under ideal situations

Unit I

Real and Ideal fluids – Velocity - Acceleration – Streamlines – Pathlines – Steady & unsteady flows – Velocity potential – Vorticity vector – Local and particle rates of change – Equation of continuity – Conditions at a rigid boundary.

Unit II

Pressure at a point in a fluid – Boundary conditions of two inviscid immiscible fluids – Euler's equations of motion – Bernoulli's equation – Some potential theorems – Flows involving axial symmetry

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Unit III

Two-Dimensional flows – Use of cylindrical polar co-ordinates – Stream function, complex potential for two-dimensional flows, irrotational, incompressible flow – Complex potential for standard two-dimensional flows –Two dimensional image systems – Milne-Thomson circle theorem – Theorem of Blasius.

Unit IV

Use of conformal transformations – Hydrodynamical aspects of conformal mapping – Schwarz Christoffel transformation – Vortex rows.

Unit V

Stress – Rate of strain – Stress analysis – Relation between stress and rate of strain – Coefficient of viscosity – Laminar flow – Navier-Stokes equations of motion – Some solvable problems in viscous flow. Dimensional Analysis.

Text Book:

Textbook of Fluid Dynamics, Frank Chorlton, CBS Publishers, New Delhi, First Edition,1985.(Sections: 2.1 - 2.10, 3.1 – 3.9, 5.1 – 5.9, 5.10 – 5.12, 8.1 – 8.11, 8.15)

References:

1. An Introduction to Fluid Dynamics, Batchelor G.K., Cambridge University Press, 1973.
2. Fluid Mechanics, White F.M., McGraw-Hill, Seventh edition, 2000.
3. Theoretical Hydrodynamics, Milne Thomson L.M., Macmillan, Fourth Edition, 1962.
4. Viscous Fluid Flow, White F.M., McGraw-Hill, Second Edition,1991.
5. Fluid Mechanics, Schaum's Outline series, Mc-Graw Hill.

M.Sc. Mathematics

Sub. Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF183P50	**Software Lab- V (Operations Research Lab)**	3/3	3	40	60	100

COURSE OBJECTIVES:

The objective of this course is

- To introduce the idea to the students to solve real life problems using Microsoft Excel withSolver Add-in or Open Solver.
- To study about an optimal (maximum or minimum) value for a formula in one cell using solver.
- To study the iinclusion of separate cells for both the values and objective coefficients of the decision variables.
- To study the inclusion of one cell in which profit is computed from the decision variable values and objective coefficients (easiest with a sum-product function).
- To understand how to apply appropriate analytical techniques in approaching decision making problems.
- To learn about the best outcome in many situations.

COURSE OUTCOMES:

At the end of the course, the students are able to

- Understand how to add solver add-in in MS Excel as well as they understood an optimization tool used to determine the desired outcome
- To learn the solver which help in finding optimization of transportation problems.
- To learn the solver which help in finding optimization of assignment problems.
- To learn how to use MS Excel to find the critical path for network problems and they used tree plan add-in to find the decision making problems

M.Sc. Mathematics

Linear and Non-Linear Programming – Simplex method, Revised Simplex method, Integer Programming, Bounded variables, Dynamic programming, Non – Linear Programming.

Transportation Problem – Maximization Problem, Minimization Problem, Unbalanced problem.

Assignment Problem - Maximization Problem, Minimization Problem, Unbalanced problem, Travelling Salesman Problem.

Network Scheduling – PERT and CPM. Decision Theory – Decisions under Uncertainty, Decisions under Risk, Decision Tree.

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF183P60	**Software Lab-VI (Applied Mathematics using SAGE)**	3/3	3	40	60	100

COURSE OBJECTIVES:

- To study the basics of SAGE, WINMAT, WINPLOT and thereby developing skills in problem solving using open source software.

COURSE OUTCOMES

At the end of the course, the students are able to

- Understand the basic concept of Factorial, Prime numbers,divisibiity, solution using SAGE
- Understand the matrix formulation, inverse of matrix, rank, Eigen value and vectors, canonical form using SAGE.
- Find the solution of differential equation, partial differential equation using SAGE
- Understand the Fourier expansion for function as curve plot, Half rang lot and Laplace transform of continuous function, Inverse Laplace transform using SAGE.
- Familiar with WINMAT with Matrix menu, View menu, Calc menu and WINPLOT to do 2-D plot , 3-D plot

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Basic Mathematical Operations : Basic operators , Factorial, Prime numbers, Divisibility, Solution of equation.

M.Sc. Mathematics

Matrix Algebra : Inverse of matrix, rank, characteristics equations, Eigen value, Eigen vectors, Canonical form .

Calculus : Differentiation, First order derivative, partial derivative, integration.

Fourier series: Fourier expansion of function as curve plot, Half rang plot.

Laplace Transform: Laplace Transform of continuous function, Inverse Laplace Transform.

WINMAT: Matrix menu, View menu, Calc menu.

WINPLOT: 2-D plot , 3-D plot.

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks Internal Exam	Total Marks
MMAF183T70	**Awareness Course-III**	1/2	3	100	100

Quantitative Aptitude-II

Problems on Trains- Boats and Streams – Alligation or Mixture.
Simple Interest-Compound Interest-Calendar – Clocks-Stocks & Shares
Odd man out and series- Tabulation- Bar graphs- Pie charts

TEXT BOOKS

1. Quantitative Aptitude for Competitive Examinations, R.S. Aggarwal, S. Chand co. Ltd., Reprint, 2013.
2. Quantitative Aptitude, Abhijit Guha, Tata Mc Graw-Hill, Fourth Edition, 2010.

SEMESTER- IV

M.Sc. Mathematics

Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF184T10	**Elective 1 (Advanced Applied Mathematic**s)	5/5	3	40	60	100

Course Objectives:

- To determine the solution function that minimizes an integral.
- To stress the importance of both theory and applications of differential equations.
- To study the simple harmonic motion
- To study integral equation and its solving technique
- To study the Z-transform and its solution methods

Course Outcome:

At the end of the course, the students are able to

- Solve Euler's equation-Geodesics isometric problems.
- Solve one dimensional wave and hear flow equations, also two dimensional heat flow
- Understand the simple harmonic motion and its applications
- Solve integral equation of different types
- Understand the method of solving difference equation using Z-transform

Unit -I

Calculus of variation-Euler's equation - Solutions of Euler's equation-Geodesics-Isometric problem-several independent variables-Functionals involving higher order derivatives-Approximate solution of boundary value problem.

Unit -II

Application of partial differential equations-Method of separation of variables –Vibration of a stretched string: Wave equation –solution of wave equation –D'Alembert's solution of wave equation-One dimensional heat flow-Solution of heat equation-Two dimensional heat flow-Solution of Laplace equation: temperature distribution in long plaes,Temperature distribution in long plates,Temperature distribution in finite plates.

Unit -III

Application of Linear differential equations-Simple harmonic motion-Simple pendulum-Gain and loss of oscillations-Oscillations of a spring: Free oscillations, Damped oscillations, forced oscillations (without damping)-Forced oscillations (with damping)-Oscillatory electrical circuits-Electro-Mechanical analogy-Deflection of beams-Whirling of shafts-Application of simultaneous equations.

Unit -IV

Integral Equations- Relation to a system of algebraic equations-Fredhom equation-Method of successive approximations Volterra Equation.

Unit -V

Z-transforms- Standard forms-Linear property-Damping rule-Shifting rules-Multiplication by n-initial and final value theorem-inverse Z transforms –Convolution theorem-Convergence of Z-transforms-evaluation of inverse Z-transforms: Power series method-Partial fraction method-inversion integral method-Application to difference equation.

Text Books:

1. B.S.Grewal Higher Engineering Mathematics, Khanna Publishers, New Delhi, Fourth Edition, 2012.
2. Sankara Rao K., Introduction to Partial Differential Equations, Prentice Hall of India, Third Edition, 2007.

Reference Books

1. M.K. Venkataraman, Higher Engineering Mathematics for Engineers, National Publishing Company, Second Edition, 2001.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Publishers, Ninth Edition, 2006.
3. N.D. Raisighania, Integral Transforms and Boundary Value Problems, S. Chand & Co., New Delhi, Sixth edition revised, 2013.
4. Pinsky M.A., "Partial Differential Equations and Boundary Value Problems", Tata McGraw Book Company, Third Edition, 1998.
5. Murray R.Spiegel, Schaum's Outline of Advanced Mathematics for Engineers and Scientists, McGraw Hill.

M.Sc. Mathematics

Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
MMAF184T20	**Elective-2 (Applied Graph theory)**	5/5	3	40	60	100

Course Objectives:

- To provides a professional sandbox for the exploration of new terminology and results in discrete mathematics, and its results have applications in many areas of the computing, social, and natural sciences.
- To learn how to apply the fundamental concepts in graph theory and graph theory-based tools in solving practical problems.
- To understand the structure of graphs and the techniques used to analyze the problems, thus solidifying the basics that learners can later expand on.
- To focuses on the traditional graph theory knowledge and analysis of simple graphs that model simple systems, preceding the complex networks course that model complex systems.

Course Outcomes:

At the end of the course, the students are able to

- Use the definitions in graph theory to identify and construct examples and to distinguish examples from non-example.
- Apply theories and concepts to test and validate intuition and independent mathematical thinking in problem solving.
- Use of graph theory in the fields of Science and Engineering.
- Emphasize the structure and structural properties of the graph modeled by the data.

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Unit-I

Graphs and simple graphs-Graph isomorphism- The Incidence and Adjacency matrices-Subgraphs – Vertex Degrees - Paths and Connection - Cycles – Trees – Cut Edges and Bonds – Cut Vertices.

Unit-II

Connectivity – Blocks – Euler tours – Hamilton Cycles

Unit-III

Matchings –Matchings and coverings in Bipartite Graphs – Edge Chromatic Number – Vizing's Theorem.

Unit – IV

Independent sets – Ramsey's Theorem – Chromatic Number – Brook's Theorem – Chromatic Polynomials.

Unit- V

Plane and Planar graphs – Dual graphs – Euler's Formula- The Five Colour Theorem and Four Colour Conjecture.

Text Book:

J.A. Bondy and U.S.R. Murthy, Graph Theory with Application, North Holland, 1976.

References:

1. F. Harary, Graph Theory, Addison –Wesley Pub. Co. The mass 1969.
2. R. Balakrishnan, K. Ranganathan, A textbook of Graph Theory, Springer International Edition, New Delhi, 2008.
3. S.A. Choudam, A First Course in Graph Theory, Macmillan India Ltd., 1999.
4. Douglas B.West, Introduction to Graph Theory, Prentice Hall of India, Second Edition, 2001.
5. R.J. Wilson, Introduction to Graph Theory, Pearson Education, Fourth Edition, 2004.

M.Sc. Mathematics

Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
	Elective-3 (**Advanced Discrete Mathematics**)	5/5	3	40	60	100

Course Objective

- To create the knowledge of coding theory,
- To study the basics of Logic, Lattices and Petri nets and understanding them.
- To learn about connectives, duality, Normal forms
- To learn the theory of inference for predicate calculus for more than one quantifier

Course Outcomes

At the end of the course, the students are able to

- Understand the coding and decoding and error correction.
- Understand the connectives and duality law, Normal forms
- Understand the theory of inference for predicate calculus for more than one quantifier.
- Understand the distributive lattice, Boolean algebra, polynomial-K-Map
- Understand the Petri nets and its properties

Unit: I

Introduction-Hamming distance-Encoding a message-Group Codes-Procedure for generating group codes-Decoding and error correction-An Example of simple Error correction codes

Unit: II

Introduction-true false statements-connectives-Atomic and compound statements-well formed formula-truth table of a formula-Tautology- Functionally complete set of connectives and duality law-Normal forms-Principle normal forms.

Unit: III

Theory of Inference and open statements and quantifiers-Valid formulae and equivalence-Theory of inference for predicate calculus-Statement involving more than one quantifier.

Unit: IV

Lattices-Properties of Lattices-New Lattices-Modular and Distributive Lattices- Boolean Algebras-Boolean,Polynomials-K-maps

Unit: V

Introduction-Modeling-Features of systems-The early development of Petri nets-applying Petri net theory-applied and pure Petri net theory-Structures, Graphs and markings of Petri nets-Execution rules for Petri nets-Petri net state spaces –alternative forms for defining Petri nets.

Text Books

1. Discrete Mathematics by Dr.M.K.Venkatraman, Dr.N.Sridharan, Dr.N.Chandrasekaran-The National publishing Company, Chennai. (Units I-IV), 2009.
2. Petri net theory and Modeling of Systems by James L Peterson, Prentice Hall,(Unit-V), 1981.

References:

1. Kenneth H.Rosen, Discrete Mathematics and its Applications, Tata McGraw-Hill Company Limited, New Delhi, Sixth Edition, 2007.
2. Kolman B., Busby R.C. and Ross S., Discrete Mathematical Structures for Computer Science, Prentice Hall of India, New Delhi, Fourth edition, 1999.
3. Susanna S. Epp, Discrete Mathematics and its Applications, Brookes/Cole Publishing Company, Fourth edition, 2011.
4. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics, Pearson Education, Fourth edition, 2003,
5. J.P. Tremblay, R. Manohar, Discrete Mathematical Structure with Applications to Computer Science, McGraw Hill, International edition, 1997.
6. Joe L. Mott, A. Kandel, T.P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, Prentice Hall New Delhi, Second Edition, 2008.

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
	Elective-4 (Formal Language and Automata Theory)		3	40	60	100

Course Objectives:

- To introduction the basic theory of Computer Science and formal methods of computation.
- To discussing the applications of finite automata towards text processing.
- To study the use of regular expression in UNIX, Lexical Analysis.
- To study about ambiguity in grammar and languages
- To learn about push down automata and context free grammars
- To learn the basic concepts of Turing machine and computers.

Course Outcomes:

At the end of the course, the students are able to

- Understand the basics of NFA and DFA
- Find pattern in text using regular expression.
- Construct the context free grammar and languages
- Construct the push down automata for the given language
- Use of Turing machine in computers.

M.Sc. Mathematics

Unit -I

An informal picture of finite automata - Deterministic finite automata – Non-deterministic finite automata – An application: Text search – Finite automata with epsilon transitions

Unit -II

Regular expressions – Finite automata and regular expressions – Applications of regular expressions: Regular expressions in UNIX, Lexical analysis, Finding patterns in a text – Algebraic laws for regular expressions

Unit -III

Context free grammars – Parse trees – Applications of context free grammars: Parsers, The YACC parser generator, Markup languages, XML and document type definitions – Ambiguity in grammars and languages.

Unit -IV

Pushdown automaton – The languages of a Pushdown automaton – Equivalence of Pushdown automaton and Context free grammars – Deterministic pushdown automata.

Unit -V

Problems that computers cannot solve – The Turing machine – Programming techniques for Turing machines – Extensions to the basic Turing machine – Restricted Turing machines – Turing machines and computers

Note: The second edition of the prescribed text book differs drastically in treatment (Application oriented) from the first edition (Theory oriented). Hence the treatment of the second edition is to be followed. Questions are to be set on problem solving and not on the theoretical aspects.

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Prescribed Text Book:

Hopcroft E.John, Motwani Rajeev, Ullman D. Jeffrey, Introduction to Automata theory, Languages and Computation, Pearson Education, Second Edition, 2001

Reference Books

Anderson. A.James, Automata theory with modern applications, Cambridge University press, 2006.

Linz Peter, An introduction to formal languages and automata, Narosa Publishing House, New Delhi, Fifth Edition, 2012.

M.Sc. Mathematics

Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
	Elective-5 (Probability and Stochastic process)		3	40	60	100

Course Objectives:

- To study basic concepts of probability theory
- To study the random variables and probability distributions
- To study the concept of stochastic processes, Markov process, Poisson process.
- To study the basics of queuing theory.

Course Outcomes:

At the end of the course, the students are able to

- Find the expectations of linear combination of random variables, variance, and Moment generating function.
- Understand the discrete and continuous probability distribution and its applications
- Find the auto correlation function and classify the states of Markov chains
- Know the use of Poisson process and its properties
- Analyze the basic model of queueing theory

Unit -I

Probability-Conditional Probability-Independent events - Bayes theorem – Random Variable - Discrete random Variable - Continuous random variable - Mathematical expectation - Properties of expectation -Expectation of linear combination of random variables - Properties of variance - Variance of linear combination of random variables -Moment generating function.

Unit -II

Special discrete distributions – Binomial distribution – Poisson distribution – Geometric distribution – Special Continuous distributions – Uniform distribution - Exponential distribution - Normal distribution.

Unit -III

Stochastic process – Classification of stochastic process – Average values of stochastic process – Auto correlation function and its properties – Cross correlation function and its properties – Markov process – Markov chain – Chapman Kolmogorov theorem(with out proof)- Classification of states of Markov chain.

Unit -IV

Poisson process – Probability law for Poisson process – Homogeneous poisson process- Second order probability function of a homogeneous Poisson process – Mean and auto correlation of the poisson Process – Properties of Poisson process.

Unit -V

Queuing theory-Symbolic representation of a Queuing model – Characteristics of Infinite capacity, single server Poisson queue model I- [(M/M/1): (□ / FIFO) model]-Characteristics of Infinite capacity, Multiple server Poisson queue model II- [(M/M/s): (□ / FIFO) model].

Text Books:

1. Fundamentals of Mathematical Statistics – A Modern approach, S.C. Gupta, V.K. Kapoor, Sultan Chand & Sons, Tenth Edition, 2000.
2. Stochastic Process , J. Medhi, New Age International (P) Ltd publications, Third Edition, 2009.
3. Probability, Statistics and Random process , T. Veerarajan, Tata Mc-Graw Hill Education Private Limited, Third edition, 2008.

Reference books

1. Gupta S.P, Statistical methods, Sultan Chand & Sons, 2005.
2. Gubner A. John, Probability and random process for electrical and computer engineers, Cambridge University Press, first edition, 2006.
3. A.K.Basu, Inttroduction to Stochastic Process, Narosa Publishing House, 2005.
4. Kishore S. Trivedi, Probability & Statistics with Reliability, queuing, and computer science applications, PHI learning private limited, 1984.
5. P.Kandasamy, K. Thilagavathi, K.Gunavathi, Probability Statistics and Queueing Theory, S.Chand Publications, First Edition, 2013.

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
	Elective 6 (Applied Abstract Algebra)		3	40	60	100

Course Objectives:

- To introduce the ubiquity of lattices in number theory, algebra,
- To study the arithmetic algebraic geometry,
- To study the cryptography and coding theory.

Course Outcomes:-

At the end of the course, the students are able to

- Understand the basic of lattices and Boolean algebra and polynomials
- Understand the application of Lattices in switching circuits.
- Understand the concepts of rings, fields, and factorization of polynomials
- Know coding and decoding BCH codes
- Know public key cryptosystem and other ciphers

Unit -I

Lattices - Properties and Examples of Lattices - Distributive Lattices - Boolean Algebras - Boolean Polynomials - Minimal Forms of Boolean Polynomials

Unit - II

Applications of Lattices - Switching Circuits - Applications of Switching Circuits - Applications of Boolean Algebras

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Unit - III

Revision of Groups, Rings and Fields – Rings and Polynomials - Finite Fields - Irreducible Polynomials over Finite Fields - Factorization of Polynomials over Finite Fields

Unit -IV

Coding Theory - Linear Codes - Cyclic Codes - Special Cyclic Codes - Decoding BCH Codes

Unit -V

Cryptology - Classical Cryptosystems - Public Key Cryptosystems - Discrete Logarithms and Other Ciphers

Text Book:

Rudolf Lidl Gunter Pilz, Applied Abstract Algebra, Springer, Second Edition, 1997.

Reference Books

1. Kolman B., Busby R.C. and Ross S., Discrete Mathematical Structures for Computer Science, Prentice Hall of India, Fourth Edition, 1999.
2. Garrett Birkhoff, G. & Thomas C. Bartee, Modern Applied Algebra, McGraw-Hill, Illustrated Edition, 1970.
3. I.N.Heristein, Topics in Algebra, Wiley india Pvt.Ltd, Second edition, 2012.
4. D. G. Hoffman, D. A. Lanonard, C. C. Lindroes, Coding Theory, M.Dekker Publishers, Illustrated Edition, 1991.
5. A.J.Menezes, P.C. Oorcht and S.A Vanstone, Handbook of Applied cryptography, CRC Press, Fifth Edition, 1996.

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
	Elective-7 (Classical Mechanics)		3	40	60	100

Course Objective:

- To study the concepts of coordinates and about the motion of the objects.
- To study the kinematics of particle and a rigid body
- To study the simple dynamical system and Hamilton's equation
- To study the natural motion and Liouvillies theorem

Course Outcomes

At the end of the course, the students are able to

- Find moments and product to inertial and angular momentum
- Understand the motion of rigid body in different aspects
- Understand the Lagrange's equation and Hamilton's equation
- Understand the Hamilton principle and Louville's theorem.

Unit - I

Kinematics of a particle and a rigid body – Moments and products of inertia – Kinetic energy Angular momentum.

Unit -II

Motion of a particle – Motion of a system – Motion of a rigid body.

Unit -III

Motion of a rigid body with a fixed point under no forces – Spinning top – General motion of top.

Unit -IV

Lagrange's equation for a particle – Simple dynamical system – Hamilton's equations.

Unit -V

Natural Motions – Space of events – Action – Hamilton's Principle –Phase space– Liouville's Theorem.

TEXTBOOK

1. John.L.Synge. and Byron.A.Griffith, Principles of Mechanics, Tata McGraw Hill, Second Edition, 1984.

REFERENCES

1. Rana N.C. and Joag P.S., Classical Mechanics, Tata McGraw Hill, 1991.
2. Berger V.D. and Olsson. M.G., Classical Mechanics – a modern perspective, Tata McGraw Hill College, Second Edition, 1994.
3. Bhatia V.B., Classical Mechanics with introduction to non–linear oscillations and chaos, Narosa Publishing House, 1997.
4. Sankara Rao K. Classical Mechanics, Prentice Hall of India Pvt. Ltd., New Delhi, 2005.
5. Greenwood D. T., Principles of Dynamics, Prentice Hall of India Pvt. Ltd., New Delhi, 1988.
6. David Morin, Introduction to Classical Mechanics with problems and solutions, Cambridge University Press, New Delhi, 2007.

M.Sc. Mathematics

Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
	Elective -8 Bioinformatics		**3**	**40**	**60**	**100**

Course Objectives:

- To study the concepts of Bioinformatics and its challenges and opportunities
- To study the importance of database
- To study the sequence analysis of biological data
- To study the prediction strategies of gene, protein and molecular visualization.
- To study the drugs and target identification and validation

Course Outcomes

At the end of the course, the students are able to

- Understand the challenges and opportunities in world wide web-browsers-EMB net-NCBI.
- Understand the bibliographic databases, virtual library and specialized analysis packages.
- Understand the models for sequence analysis and their biological motivation methods of alignment
- Understand the homology and similarity - phylogeny and relationships
- Understand the identification and optimization of lead compound

Unit - I

Important contributions - sequencing development - aims and tasks of Bioinformatics - applications of Bioinformatics - challenges and opportunities - Computers and programs – internet - world wide web – browsers - EMB net – NCBI.

Unit -II

Importance of databases - nucleic acid sequence databases - protein sequence data bases - structure databases - bibliographic databases and virtual library - specialized analysis packages

Unit - III

Sequence analysis of biological data- models for sequence analysis and their biological motivation methods of alignment - methods for optimal alignments; using gap penalties and scoring matrices multiple sequence alignment – introduction - tools for msa - application of multiple sequence alignment.

Unit -IV

Gene - predictions strategies - protein prediction strategies - molecular visualization-Homology - phylogeny and evolutionary trees - Homology and similarity - phylogeny and relationships

Unit -V

Discovering a drug - target identification and validation - identifying the lead compound - Optimization lead compound - chemical libraries.

Text Book:

S.C. Rastogi & others, Bioinformatics- Methods and Applications, PHI Learning India Pvt. Ltd, Delhi, Fourth Edition, 2013.

Reference Books:

1. S. Ignacimuthu, S.J., Basic Bioinformatics, Narosa Publishing House, Third Reprint, 2013.

T K Attwood, D J parry-Smith, Introduction to Bioinformatics, Pearson Education, First Edition, Eleventh Reprint, 2005.

2. C S V Murthy, Bioinformatics, Himalaya Publishing House, First Edition 2003.
3. Stephen A. Krawetz, David D. Womble, Introduction To Bioinformatics A Theoretical and Practical Approach, Humana Press, 2003.
4. Hooman H. Rashidi, Lukas K. Buehler, Bioinformatics Basics-Applications in Biological Science and Medicine, CRC press, Second Edition, 2005.

M.Sc. Mathematics

Subject code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
	Elective -9 Fuzzy Mathematics		**3**	**40**	**60**	**100**

Course Objectives:

Students will be able to

- Gain the knowledge of difference between crisp and fuzzy sets
- Study about union, intersection and complement of fuzzy sets
- Study the concepts of fuzzy relations, compatibility relations etc.,
- Determine fuzzy and possibility measures
- Study the types of fuzzy propositions and inferences from these types

Course Outcome

At the end of the course , students are be able to

- Know the need of fuzzy sets , understand the basic concepts of fuzzy sets, properties of α-cut sets and extension principle of fuzzy sets and handle the problems having uncertain and imprecise data.
- Gain familiarity in fuzzy complements, fuzzy intersections and fuzzy unions and perform arithmetic operations on fuzzy sets . Also construct the appropriate fuzzy numbers corresponding to uncertain and imprecise collected data.
- Understand the concepts of fuzzy relations, fuzzy compatibility relations and fuzzy ordering relations.
- Get deep knowledge about concepts of fuzzy measures and classify possibility and necessity measures.
- Gain the fundamental concepts of fuzzy logic, types of fuzzy propositions, fuzzy quantifiers and linguistic hedges.

UNIT I

Overview of crisp sets – Basic types of fuzzy sets – Concepts of fuzzy sets – Properties of alpha cuts – representations of fuzzy sets – Extension principle for fuzzy sets

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Unit -II

Operations on fuzzy sets – Fuzzy complements – Fuzzy intersections - Fuzzy unions – Fuzzy numbers – Arithmetic operations on fuzzy numbers – Fuzzy equations

Unit - III

Fuzzy relations – Fuzzy equivalence relations – Fuzzy compatibility relations – Fuzzy ordering relations – Fuzzy morphisms

Unit -IV

Fuzzy measures – Evidence theory – Possibility theory – Fuzzy sets and possibility theory

Unit -V

Overview of classical logic – Multi valued logics – Fuzzy propositions – Fuzzy quantifiers – Linguistic hedges – Inference from conditional fuzzy propositions – Inference from conditional and qualified propositions – Inference from quantified propositions

Text Book:

George J.Klir and Bo Yuan, Fuzzy sets and Fuzzy Logic, Prentice Hall of India, 1995.

Reference Books:

1. H. J. Zimmermann, Fuzzy Set Theory and its Applications, Yes Dee Publishing Pvt. Ltd, Fourth edition, 2001.
2. James J. Buckley, Esfandiar Eslami, An Introduction to Fuzzy Logic and FuzzySets, Springer – Verlag Berlin Heidelberg, 2002.
3. F. Martin McNeill, Ellen Thro, Fuzzy Logic A Practical Approach, AP Professional, 1994.

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Subject code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
	Elective -10 (Mathematical Modelling)	**5/5**	**3**	**40**	**60**	**100**

Course Objectives:

- Enable students to learn how mathematical models are formulated,
- Enable the students the power and limitations of mathematics in solving practical real-life problems.
- Enable the students to study the modeling change with difference equations
- To study modeling using proportionality, geometric similarity, ect.
- To study higher order polynomial like elapsed term of a tape recorder
- To Model an arms race in Stages – Managing Non Renewable Resources

Course Outcomes

At the end of the course, the students are able to

- Gain familiarity in mathematical modeling.
- Understand the limitation of mathematics in solving problem
- Analyze the model using proportionality, geometric similarity
- Understand the higher order polynomial like elapsed term of a tae recorder
- Understand the concept of managing non renewable resources.

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Unit -I

Modeling Change with Difference Equations - A Savings Certificate, Mortgaging a Home; Approximating Change with Difference Equations - Growth of a Yeast Culture, Growth of a Yeast Culture Revisited, Spread of a Contagious Disease, Decay of Digoxin in the Blood Stream, Heating of a Cooled Object; Solutions to Dynamical Systems - A Savings Certificate Revisited, Sewage Treatment, Prescription of Digoxin, An Investment Annuity Revisited, A Checking Account; Systems of Difference Equations - A Car Rental Company, The Battle of Trafalgar, Competitive Hunter Model, Voting Tendencies of the Political Parties.

Unit -II

Mathematical Models - Vehicular Stopping Distance; Modeling Using Proportionality - Kepler's Third Law; Modeling Using Geometric Similarity - Raindrops from a Motionless Cloud, Modeling a Bass Fishing Derby; Automobile Gasoline Mileage - Body Weight & Height, Strength & Agility – fitting Models to Data Graphically – Analytic Methods of Model Fitting – applying the Least Squares Criterion – Choosing a Best Model.

Unit - III

Harvesting in the Chesapeake Bay and Other One Term Models - Harvesting Bluefish, Harvesting Blue Crabs; High Order Polynomial Models - Elapsed Term of a Tape Recorder; Smoothing : Low Order Polynomials - Elapsed Time of a Tape Recorder Revisited, Elapsed Time of a Tape Recorder Revisited, Vehicle Stopping Distance, Growth of a Yeast Culture; Cubic Spline Models -Vehicle Stopping Distance Revisited.

Unit - IV

An Arms Race - Civil Defense, Mobile Launching Pads, Multiple Warheads, MIRVs Revisited: Counting Warheads; Modeling an arms race in Stages – Managing Non Renewable Resources – Effects of Taxation on the Energy Crisis – A Gasoline Shortage and Taxation.

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Unit - V

Population Growth – Prescribing Drug Dosage – Braking Distance Revisited; Graphical Solutions of Autonomous Differential Equations - Drawing a Phase Line and Sketching Solution Curves, Cooling Soup, Logistic Growth Revisited; Numerical Approximation Methods - Using Euler's Method, A Savings Certificate Revisited.

Prescribed Text Book:

1. Giardano, Weir & William, A First Course in Mathematical Modeling, Brookes & Cole, Thomson Learning, Fifth Edition, 2014.

Reference Books:

1. Edward. A. Bender, An Introduction to Mathematical Modeling, Dover publications Inc., 2000.
2 Caldwell. J., Ng, Douglas. K.S., Mathematical Modeling (Case Studies and Projects), Springer Netherlands, 2004 .
3 Michael D Alder, Introduction to Mathematical modeling, 2001.
4 Heinz, Stefan, Mathematical Modeling, Springer – Verlag, Berlin Heidelberg, 2011.

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
	Elective-11 (Differential Geometry)	**5/5**	**3**	**40**	**60**	**100**

Course Objective:-

- To study the key concepts and techniques of Differential Geometry
- To study the tangent, osculating plane and curvature
- To study about Evolute and involutes
- To study the Meusnier, Euler's Theorems, Dupin's Indicatrix and Geodesics
- To study the equations of Gauss , Weingarten and applications

Course Outcomes:-

At the end of the course, the students are able to

- Understand the basic concepts arc legth , osculating plane, curvature
- Find the general solution of the natural equation-Helics
- Find evolutes and involutes
- Understand the normal tangent plane and developable surfaces
- Gain knowledge on some simples problems related to geodesic
- Understand the fundamentals of surface theory.

Unit -I

Curves – Analytical representation – Arc length, tangent – Osculating plane – Curvature – Formula of Frenet.

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Unit -II

Contact – Natural equations – General solution of the natural equations – Helics – Evolutes and Involutes.

Unit- III

Elementary theory of Surfaces – Analytic representation – First Fundamental form – Normal, Tangent plane – Developable Surfaces.

Unit -IV

Second Fundamental form – Meusnier Theorem – Euler's Theorem – Dupin's Indicatrix – Some surfaces – Geodesics – Some simple problems.

Unit- V

Equations of Gauss and Weingarten – Some applications of Gauss and the Coddazi equations –

The Fundamental Theorem of Surface Theory.

Textbook

1. Dirk J. Struik, Lectures on Classical Differential Geometry, Addison Wesley Publishing Company, London, Second Edition, 1961.

References

1. Willmore, An Introduction to Differential Geometry, Oxford University Press, London, 1972.
2. Thorpe, Elementary Topics in Differential Geometry, Springer Verlag, New York, Second Edition, 1985.
3. Mittal, Agarwal, Differential Geometry, Krishna Prakashan, Meerut, Thirtieth Edition, 2003.
4. Somasundaram, Differential Geometry – A First course, Narosa publishing house, Chennai, 2005.

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
	Elective-12 (Analytical Number Theory)	**5/5**	**3**	**40**	**60**	**100**

Course Objective:

- To study the analytic number theory and the problems they attempt to solve.
- To study the multiplicative number theory which deals with the distribution of the prime numbers, such as estimating the number of primes in an interval,
- To study the prime number theorem and Dirichlet's theorem on primes in arithmetic progressions.
- To study the Chinese remainder theorem and polynomial congruence's with prime power moduli
- To study the basics of Quadratic Residues – Legendre's symbol and its properties
- Euler's pentagonal– number theorem – Euler's recursion formula for $p(n)$.

Course Outcomes:

At the end of the course, the students are able to

- Understand the Dirichlet product of arithmetical functions, Multiplicative functions and Inverse of a completely multiplicative function
- Understand the Euler's summation formula, elementary asymptotic formulae
- Understand the basics properties of complete residue class and complete residue system
- Understand the Gauss lemma and quadratic reciprocity law
- Understand the geometric representation of partition and generating function for partitions

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Unit-I

The Mobius function- The Euler Totient function, relation connecting, a product formula , the Dirichlet product of arithmetical function-Dirichlet invrses and Mobius inverstion formula- The manglodt funciton -Multiplicative function , Inverse of a completely multiplicative function.

Unit - II

The big oh notation – asymptotic equality of functions – Euler's summation formula elementary asymptotic formulas – Average order of $d(n)$, of divisor function .

Unit - III

Basic properties – Residue classes and complete residue systems – linear congruences – Reduced residue systems and Euler Fermat theorem – Polynomial congruences modulo p – Lagrange's theorem – Applications – Simultaneous linear congruences – The Chinese remainder theorem – Polynomial congruences with prime power moduli.

Unit -IV

Quadratic Residues – Legendre's symbol and its properties – Evaluation of $(-1 \mid p)$ and $(2 \mid p)$ – Gauss' lemma – The Quadratic Reciprocity law – Applications – The Jacobi symbol.

Unit - V

Geometric representation of partitions – Generating functions for partitions – Euler's pentagonal– number theorem – Euler's recursion formula for $p(n)$.

TEXT BOOK

Tom M.Apostol, Introduction to Analytic Number Theory, Springer Science and Business media, New Delhi, Illustrated Edition, 2013.

REFERENCES

1. Ivan Niven, Herbert S.Zuckermann, An Introduction to the Theory of Numbers, Wiley Eastern University Edition, Fifth Edition, 1989.
2. W.J.Leveque, Topics in Number Theory, Addison Wesley, 1956.
3. Bressoud, D., Wagon, S., A Course in Computational Number Theory, Key College Publishing, Illustrated Edition, 2000

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
	Elective-13 **Financial Mathematics**	5/5	3 hours	40	60	100

Course Objectives:

- To lay theoretical foundation with potential applications to financial problems
- To provide efficient introduction to theoretical skills that are genuinely used in financial institutions
- To study the Central limit theorem and geometric Brownian motion
- To study about varying interest rate, options pricing and pricing via arbitrage
- To study the Black Scholes formula and its properties
- To study the portfolio section problems
- To study the probabilistic, deterministic model and simulation

Course Outcomes:-

At the end of the course, the students are able to

- Understand the basic concepts in discrete and continuous random variables and its probabilities
- Know the present value analysis, rate of return pricing via arbitrage
- Understand multi period Binomial model, the delta Hedging arbitrage strategy.
- Know the limitations of arbitrage pricing, the capital asset pricing model.
- Understand investment allocation model and Monte Carlo simulation**.**

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Unit-I

Probability and Events - Conditional Probability - Random Variables and Expected Values - Covariance and Correlation - Continuous Random Variables - Normal Random Variables - Properties of Normal Random Variables - Central Limit Theorem - Geometric Brownian Motion as a limit of Simpler Models - Brownian Motion.

Unit-II

Interest Rates - Present Value Analysis - Rate of Return - Continuously Varying Interest Rates - Options pricing - pricing Via Arbitrage.

Unit-III

The Arbitrage Theorem - Multiperiod Binomial Model - Arbitrage Theorem - The Black Scholes Formula - Properties of Black Scholes Option Cost - The Delta Hedging Arbitrage Strategy.

Unit-IV

Call Options on Dividend Paying Securities - Pricing American Put Options - Estimating the Volatility Parameter - Limitations of Arbitrage Pricing - Valuing Investments by Expected utility - The Portfolio Selection Problem - Value at Risk and Conditional value at Risk - The Capital Assets Pricing Model - Mean variance Analysis of Risk, Neutral and Priced Call Options - Rates of Return.

Unit -V

Deterministic Optimization Models - Probabilistic Optimization Models - Investment Allocation Model - Barrier Options - Asian and Lookback Options - Monte Carlo Simulation - Pricing Exotic Options by Simulation.

TEXT BOOK:

Sheldon M.Ross, An Introduction To Mathematical Finance, Cambridge press – 1999.

REFERENCES:

1. Martin.Boxter and Andrew Rennie, Financial Calculus: An Introduction To Derivative Pricing, Cambridge University press, 1996.

2. Alison Etheridge, A Course in Financial Calculus, Cambridge University press, 2002.

3. Hull, Options, Futures and other Derivatives and Finance, Prentice hall, 6th edition.

4. Roman, Introduction to theMathematics of Finance, Springer verlag, 2004

5. Gerber, Life Insurance Mathematics, Springer, 3rd edition.

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Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
	Elective-14 **Mathematical Social Sciences**	5/5	3 hours	40	60	100

Course Objectives:

- To equip the students with a sample of available tools/techniques in Mathematics
- To study and analyze the social issues and to give a firsthand experience in using / experimenting with the techniques.
- To study the types of sampling techniques in statistics
- To study about LPP, Transportation and Assignment problems

Course Outcomes:-

At the end of the course, the students are able to

- Take survey and investigate by setting hypotheses and the social research question.
- Do the conversion of issue to graphs, weighted graphs.
- Gain thorough knowledge on sampling techniques
- Solve LPP, Transportation and Assignment problems
- Understand Neural network model using Fuzzy

Unit -I

Introduction to Social Sciences

Some fundamental concepts in social sciences – Research, survey, investigation and experiment. Hypothesis in social research Questionnaire, Experimental design in social research. Examples from case studies

M.Sc. Mathematics

Unit-II

Graph theoretic Tools / Techniques

Conversion of issues to graphs, weighted graphs, popular models, Examples from case studies. Techniques used in Numerical Methods, Examples from case studies.

Unit-III

Statistical Tools / Techniques

Sampling and types of sampling. Standard measures in statistics Examples from case studies

Unit-IV

OR Tools / Techniques

Formulating the Linear Programming Problem-Simplex method-Transportation Problem-North West Corner Rule- Least Cost Method-Mathematical Representation of assignment ProblemOptimal Solution to Assignment Problem -Necessity for maintaining inventory-E.O.Q Problems with Deterministic and Probabilistic Demand-Networks-Graphs-Spanning Tree problem-Shortest Route Problem-Maximal Flow problem - Examples from case studies.

Unit-V

Fuzzy Tools / Techniques

Fuzzy - Neural network models, Examples from case studies

Text Books:

1. Mojumdar, P.K., ResearchMethods in Social Sciences, Viva Books pvt ltd., (2005) chapters: 2.1– 2.3 and 3 (full), 4.5 and 8.1, 8.2, 8.8, 17.4-17.7and 8.11 General outlook from Chapters 9, 10, 11, 12 and 13.
2. Bart Kosko , Neural Networks and Fuzzy systems, Prentice Hall of India, New Delhi(2003). Chapters: 3, 4 and 8
3. Bondy andMurthy, Graph Theory with Applications(1976), Chapters 14,15

Reference Books:

1. Fundamentals of Mathematical Statistics – Gupta and Kapoor, Sultan Chand & Sons (2014)

2. Operations Research, Hamdy A. Taha, Prentice Hall, Eighth Edition, 2007.

3. Research methodology – CR Kothar, New Age International Publishers (2004)

4. Fuzzy sets and Fuzzy Logic- George J.Klir and Bo Yuan, Prentice Hall (1995)

5. Theory of Fuzzy subsets – A.Kauffmann, Academic Press, (1975)

M.Sc. Mathematics

Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks		Total Marks
				CIA	External Exam	
	Elective-15 Mathematical Statistics	5/5	3 hours	40	60	100

Course Objective

- To lay theoretical foundation with potential applications to Mathematical Statistics
- To study the fundamental theorem on probability and its applications
- To study some standard discrete and continuous probability distributions
- To study about correlation and regression.
- To study weak and strong law of large numbers and central limit theorem
- To study the estimation and interval estimation
- To study the hypothesis testing procedure

Course Outcomes:

At the end of the course, the students are able to

- Understand the addition, multiplication and Baye's theorem on probability and its use.
- Familiar with the different probability distributions and marginal distributions
- Find the correlation and regression
- Solve problems using central limit theorem
- Know in detail about estimation and interval estimation
- Form hypothesis for the given problem , use testing of hypotheses.

M.Sc. Mathematics

Unit-I

Classical and axiomatic approach to probability-Addition and Multiplication theorem-Conditional probability-Bayes theorem -Applications-random variables-Moments of random variables-Probability generating function and Moment generating function-Characteristic function and incursion formula .

Unit-II

Probability distributions-Binomial-Poisson-Multinomial, Geometric distribution , Normal, Exponential Beta, Gamma distribution-Bi variate normal distribution-conditional and marginal distribution-correlation and regression.

Unit-III

Models of Convergence-Weak and strong law of large numbers, central limit theorem, independent identically distributed case -Liaponon and havey Linde berg forms.

Unit-IV

Point and internal estimation criterion for the best estimator lower bound for variance of estimators, Crammer Rao inequality- M.L.E and moments method of estimation, interval estimation.

Unit-V

Testing of hypothesis simple and composite hypothesis type I and II error, neyman Pearson's fundamental lemma and its applications -UMP test and Unbiased test.

Text Book

Fundamentals Of Mathematical Statistics (A Modern Approach), S.C. Gupta & V.K. Kapoor, Sultan Chand & Sons Educational Publishers New Delhi, 2014.

Reference Books:

1. Hogg, R. V. and Craig, T. T. (1978) Introduction to Mathematical Statistics (Fourth Edition) (Collier-McMillan)

2. Rohatgi, V. K. (1988) Introduction to Probability Theory and Mathematical Statistics (Wiley Eastern)

3. J. D. Gibbons & S. Chakraborti (1992) Nonparametric statistical Inference (Third Edition) Marcel Dekker, New York

4. Loeve, M. (1978) Probability Theory (4th Edn) (Springer Verlag)

5. Rao, C. R. (1995) Linear Statistical Inference and Its Applications. (Wiley Eastern)

M.Sc. Mathematics

Subject Code	Subject	Credit/Hrs. per week	Duration of University Exam	Marks Internal Exam	Total Marks
MMAF181T70	**Awareness Course-IV**	1/2	3	100	100

Teaching Methodology

Fundamental elements in teaching – Levels of learning - Planning a course: trips and tips – Planning a class: no detail is too small – Experimental methods – Enhancing the conversation: audiovisual tools and techniques – Executive education: contributing to organizational competitive advantage.

Counseling students – Evaluating students: the twin tasks of certification and development – Teaching evaluations: feedback that can help and hurt – Research presentations – Managing yourself and your time.

Text Book:

James G.S. Clawson, Mark E.Haskins, Teaching Management, Cambridge University Press, First Edition, 2006.