

UNIVERSITY OF CALICUT

(Abstract)

MSc programme in Mathematics under Credit Semester System (PG)-Scheme and Syllabus -approved –implemented with effect from 2010 admn onwards-Orders issued

GENERAL & ACADEMIC BRANCH-IV 'J' SECTION

No. GA IV/J2/ 4477/10

Dated, Calicut University PO, 02.08.2010

Read:1. U.O.No. GAIV/J1/1373/08 dated, 23.07.2010.

2. Item no.2 of the minutes of the meeting of the Board of Studies in Mathematics (PG) held on 22.06.2010
3. Orders of the Vice-Chancellor in file of even no.dtd 02.08.2010

ORDER

As per University Order read as first, Credit Semester System was implemented to PG programmes in affiliated Arts and Science Colleges and Self Financing Centres of the University with effect from 2010 admission onwards.

The Board of Studies in Mathematics (PG),vide paper read as second, discussed the implementation of Credit Semester System at PG level in the affiliated colleges and the Board decided to implement the same and approved the syllabus of the first Semester of the Programme and resolved that the programme will have a total of 80 credits.

The Vice Chancellor approved the minutes subject to ratification by the Academic Council,vide paper read as 3 above.

Sanction has therefore been accorded for implementing the Syllabus of Ist Semester of MSc programme in Mathematics under CSS for affiliated Colleges with effect from 2010 admission.

Orders are issued accordingly. Scheme and Syllabus appended.

Sd/-

ASSISTANT REGISTRAR (G & A-IV)

For

REGISTRAR

To

The Principals of affiliated Colleges offering MSc programme in Mathematics

Copy to:

PS to VC/PA to Registrar/Chairman,B/S in Mathematics/CE/EX/DRIII/DR-PG/EGI/Enquiry/System Administrator(with a request to upload in the University website)/Information Centres/GAI`F``G`Sections GAI/III

Forwarded/By Order

Sd/-

SECTION OFFICER.

APPENDIX - I

UNIVERSITY OF CALICUT

**SYLLABUS FOR THE M.Sc. (MATHEMATICS) PROGRAMME
UNDER CUCSS – PG – 2010
(Total Credits : 80)**

EFFECTIVE FROM 2010 ADMISSIONS

Semester I

Course Code	Title of the Course	No. of Credits	Work Load Hrs.	Core/ Elective
MT1C01	Algebra 1	4	5	Core
MT1C02	Linear Algebra	4	5	Core
MT1C03	Real Analysis - I	4	5	Core
MT1C04	ODE and Calculus of Variations	4	5	Core
MT1C05	Discrete Mathematics	4	5	Core

Semester II

Course Code	Title of the Course	No. of Credits	Work Load Hrs.	Core/ Elective
MT2C06	Algebra II	4	5	Core
MT2C07	Real Analysis II	4	5	Core
MT2C08	Topology I	4	5	Core
MT2C09	PDE and Integral Equations	4	5	Core
MT2C10	Number Theory	4	5	Core

Semester III

Course Code	Title of the Course	No. of Credits	Work Load Hrs.	Core/ Elective
MT3C11	Complex Analysis	4	5	Core
MT3C12	Functional Analysis I	4	5	Core
MT3C13	Topology II	4	5	Core
MT3C14	Linear Programming and its Applications	4	5	Core
	Project		5	Core

Semester IV

Course Code	Title of the Course	No. of Credits	Work Load Hrs.	Core/ Elective
MT4C15	Functional Analysis II	4	5	Core
MT4C16	Differential Geometry	4	5	Core
	Elective I	4	5	Elective
	Elective II	4	5	Elective
MT4C17	Project	5	5	Core
MT4V01	General Viva	3		Core

CREDITS

Accumulated minimum credit required for successful completion of course shall be 80.

LIST OF ELECTIVES

MT4E01	COMMUTATIVE ALGEBRA
MT4E02	ALGEBRAIC NUMBER THEORY
MT4E03	MEASURE AND INTEGRATION
MT4E04	FLUID DYNAMICS
MT4E05	OPERATIONS RESEARCH
MT4E06	PROBABILITY THEORY
MT4E07	COMPUTER ORIENTED NUMERICAL ANALYSIS

PROJECT

The Project in this Programme is to be done in the III & IV Semesters with a total credit of 5 including Project Viva. (The general viva is given 3 credits). The work load of the Project is 5 hours each in III & IV Semesters.

The Project Report (Dissertation) should be self contained. It should contain an introduction, necessary background and a reference list in addition to the main content. The main content may be of length not less than 30 pages in the A4 format with one and half line spacing.

Evaluation and Grading

The evaluation scheme for each course shall contain two parts.

(a) Internal Evaluation – 25% Weightage

(b) External Evaluation – 75% Weightage

Both Internal and External evaluation shall be carried out using direct grading system as per the general guidelines.

In the case of the Elective Course MT4E07: Computer Oriental Numerical Analysis, the external examination will consist of a written examination and a practical examination each of duration one and half hours. Each will carry a weightage of 18. Thus the total weightage is 36 as in the case of other courses. The details are appended to the syllabus of the course.

Question Paper Pattern for the written examination of the Elective Course:

MT4E07 Computer Oriental Numerical Analysis

For the Elective Course MT4E07: Computer Oriental Numerical Analysis there will be a Theory written examination and a practical examination each of duration one and half hours. The valuation will be done by Direct Grading System. The question paper for the written examination will consists of 6 short answer questions, each of weightage 1, 6 paragraph type questions each of weightage 2 and 2 essay type questions, each of weightage 4. All short answer questions are to be answered while 4 paragraph type questions and 1 essay type questions are to be answered with a total weightage of 18. The questions are to be evenly distributed over the entire syllabus.

Question Paper Pattern for the written examinations of all other courses

For each course there will be an external examination of duration 3 hours. The valuation will be done by Direct Grading System. Each question paper will consists of 14 short answer questions, each of weightage 1, 10 paragraph type questions each of weightage 2 and 4 essay type questions, each of weightage 4. All short answer questions are to be answered while 7 paragraph type questions and 2 essay type questions are to be answered with a total weightage of 36. The questions are to be evenly distributed over the entire syllabus.

DETAILED SYLLABI

SEMESTER I

MT1C01 : ALGEBRA - I

No. of Credits : 4

No.of hours of Lectures/week : 5

TEXT : FRALEIGH, J.B. : A FIRST COURSE IN ABSTRACT ALGEBRA.

(Fifth edn.) Narosa (1999.)

UNIT I

Plane Isometries (page 113), Direct products & finitely generated Abelian Groups, Binary Linear Codes, Factor Groups, Factor-Group Computations and Simple Groups, Series of groups.

[§§ 2.2(only Plane Isometries) 2.4, 2.5, 3.3, 3.4, 3.5]

UNIT II

Group action on a set, Applications of G-set to counting, Isomorphism theorems: Proof of the Jordan-Holder Theorem (Omit Butterfly Lemma and Proof of the Schreier Theorem), Sylow theorems, Applications of the Sylow theory, Free Groups (Omit Another look at Free abelian groups).

[§§ 3.6, 3.7, 4.1, 4.2, 4.3, 4.5]

UNIT III

Group Presentations, Rings of polynomials, Factorization of polynomials over a field, Non commutative examples, Homomorphism and factor rings.

[§§ 4.6, 5.5, 5.6, 5.7, 6.1]

REFERENCES

1. I.N. Herstein : Topics in Algebra
Wiley Eastern (Reprint)
2. N.H. McCoy and R.Thomas : Algebra.
Allyn & Bacon Inc. (1977).
3. J. Rotman : The Theory of Groups
Allyn & Bacon Inc. (1973)
4. Hall, Marshall : The Theory of Groups.
Chelsea Pub. Co. NY. (1976)
5. Clark, Allan : Elements of Abstract Algebra
Dover Publications (1984)
6. L.W. Shapiro : Introduction to Abstract Algebra
McGraw Hill Book Co. NY (1975)

7. N. Jacobson : Basic Algebra , Vol. I.
Hindustan Publishing Corporation (India),
Delhi 110 007 Reprint (1991)
8. T.W. Hungerford : Algebra
Springer Verlag GTM 73 (1987) 4th Printing.
9. D.M. Burton : A First Course in Rings and Ideals
Addison Wesley 1970
10. Mac Lane & Birkhoff : Algebra
Macmillan
11. Joseph A. Gallian : Contemporary Abstract Algebra (4th Edition)
Narosa 1999

MT1C02 : LINEAR ALGEBRA

No. of Credits : 4

No. of hours of Lectures/week : 5

TEXTS : 1. **HOFFMAN, K., and KUNZE, R.**, LINEAR ALGEBRA,
(2nd Edn.) , Printice-Hall of India, 1991.

UNIT I

Vector Spaces & Linear Transformations

[Chapter 2 Sections 2.1 – 2.4; Chapter 3 Sections 3.1 to 3.3 from the text]

UNIT II

Linear Transformations (continued) and Elementary Canonical Forms

[Chapter 3 Sections 3.4 – 3.7; Chapter 6 Sections 6.1 to 6.4 from the text]

UNIT III

Elementary Canonical Forms (continued), Inner Product Spaces

[Chapter 6. Sections 6.6 & 6.7; Chapter 8 Sections 8.1 & 8.2 from the text]

REFERENCES

1. P.R. Halmos : Finite Dimensional Vector spaces
Narosa Pub House, New Delhi (1980)
2. S. Lang : Linear Algebra
Addison Wesley Pub.Co.Reading, Mass (1972)
3. I.N. Herstein : Topics in Algebra
Wiley Eastern Ltd Reprint (1991)
4. N.H. McCoy and R. Thomas : Algebra
Allyn Bacon Inc NY (1977)
5. S. Mac Lane and G. Birkhoff : Algebra
Macmillan Pub Co NY (1967)
6. R.R. Stoll and E.T. Wong : Linear Algebra
Academic Press International Edn (1968)
7. G.D. Mostow and J.H. Sampson : Linear Algebra
McGraw-Hill Book Co NY (1969)
8. T.W. Hungerford : Algebra
Springer Verlag GTM No 73 (1974)
9. S. Kumaresan : Linear Algebra-A Geometric Approach
Prentice Hall of India (2000)
10. J. B. Fraleigh & R.H. Beauregard : Linear Algebra
Addison Wesley

11. Henry Helson : Linear Algebra (Second Edition) Hindustan Book Agencies, 1994.
12. E.D. Nering : Linear Algebra and Matrix Theory Wiley International Edition 1963
13. Sheldon Axler : Linear Algebra Done Right (Second Edition) Springer 1997
14. David C. Lay : Linear Algebra and its Application, Pearson Education 2003.

MT1C03 : REAL ANALYSIS - I

No. of Credits : 4

No.of hours of Lectures / week : 5

TEXT: **RUDIN, W.**, PRINCIPLES OF MATHEMATICAL ANALYSIS
(3rd Edn.) Mc. Graw-Hill, 1986.

UNIT – I

Basic Topology – Finite, Countable and Uncountable sets Metric Spaces, Compact Sets, Perfect Sets, Connected Sets.

Continuity - Limits of function, Continuous functions, Continuity and compactness, continuity and connectedness, Discontinuities, Monotonic functions, Infinite limits and Limits at Infinity.

[Chapter 2 & Chapter 4]

UNIT – II

Differentiation – The derivative of a real function, Mean Value theorems, The continuity of Derivatives, L Hospital's Rule, Derivatives of Higher Order, Taylor's Theorem, Differentiation of Vector – valued functions.

The Riemann – Stieltjes Integral, - Definition and Existence of the integral, properties of the integral, Integration and Differentiation.

[Chapters 5 & Chapter 6 up to and including 6.22]

UNIT – III

The Riemann – Stieltjes Integral (Continued) - Integration of Vector vector-valued Functions, Rectifiable curves.

Sequences and Series of Functions - Discussion of Main problem, Uniform convergence, Uniform convergence and continuity, Uniform convergence and Integration, Uniform convergence and Differentiation. Equicontinuous Families of Functions, The Stone – Weierstrass Theorem.

[Chapters 6 (from 6.23 to 6.27) & Chapter 7 (upto and including 7.27 only)]

REFERENCES

1. a) R.G. Bartle : Element of Real Analysis
Wiley International Edn
(Second Edn) (1976)
- b) R.G. Bartle and : Introduction to Real Analysis
 D.R. Sherbert : John Wiley Bros (1982)
2. L.M. Graves : The theory of functions of a real variable
Tata McGraw-Hill Book Co (1978)
3. M.H. Protter & C.B. Moray : A first course in Real Analysis
Springer Verlag UTM (1977)
4. S.C. Saxena and SM Shah : Introduction to Real Variable Theory
Intext Educational Publishers
San Francisco (1972)
5. I.K.Rana : An Introduction to Measure and Integration,
Narosa Publishing House, Delhi, 1997.
6. Hewitt and Stromberg K : Real and Abstract Analysis
Springer Verlag GTM 25 (1975) Reprint
7. S.R. Ghorpade & B.V. Limaye : A course in Calculus and Real Analysis, Springer 2006
8. Terence Tao : Analysis I &II
Hindustan Book agency

MT1C04 : ODE AND CALCULUS OF VARIATIONS

No. of Credits : 4.

No.of hours of Lectures / week : 5

TEXT: **SIMMONS, G.F.**,: DIFFERENTIAL EQUATIONS WITH APPLICATIONS
AND HISTORICAL NOTES,
TMH Edition, New Delhi, 1974.

UNIT I

Power Series Solutions and Special functions; Some Special Functions of Mathematical Physics.

[Chapter 5: Sections 26, 27, 28, 29, 30, 31 ; Chapter 6: Sections 32, 33]

UNIT II

Some special functions of Mathematical Physics (continued)

Systems of First Order Equations; Non linear Equations

[Chapter 6 : Sections 34, 35 : Chapter 7 :Sections 37, 38, Chapter 8 : Sections 40, 41, 42, 43, 44]

UNIT III

Oscillation Theory of Boundary Value Problems, The Existence and Uniqueness of Solutions,
The Calculus of Variations.

[Chapter 4 : Sections 22, 23 & Appendix A. (Omit Section 24) ; Chapter 11 : Sections 55,
56,57: Chapter 9 : Sections 47, 48, 49]

REFERENCES

1. G. Birkhoff & G.C. Rota : Ordinary Differential Equations
Edn. Wiley & Sons 3rd Edn (1978)
2. E.A. Coddington : An Introduction to Ordinary Differential
Equations Printice Hall of India, New Delhi (1974)
3. P. Hartman : Ordinary Differential Equations
John Wiley & Sons (1964)
4. L.S. Pontryagin : A course in ordinary Differential Equations
Hindustan Pub. Corporation, Delhi (1967)
5. Courant R and Hilbert D : Methods of Mathematical Physics , vol I
Wiley Eastern Reprint (1975)
6. W.E. Boyce & R.C. Deprima : Elementary Differential Equations
and boundary value problems
John Wiley & Sons NY 2nd Edn (1969)
7. A. Chakrabarti : Elements of ordinary Differential
Equations and special functions
Wiley Eastern Ltd New Delhi (1990)
8. Ian Sneddon : Elements of Partial Differential Equations
McGraw-Hill International Edn., (1957)

MT1C05 : DISCRETE MATHEMATICS

No. of Credits 4

Number of hours of Lectures / week: 5

TEXTS:

- 1) **DOUGLAS B. WEST**, INTRODUCTION TO GRAPH THEORY (Second Edition) Pearson Education
- 2) **K.D.JOSHI**, FOUNDATIONS OF DISCRETE MATHEMATICS, New Age International (P) Ltd. New Delhi 1989
- 3) **PETER LINZ**, AN INTRODUCTION TO FORMAL LANGUAGES AND AUTOMATA. (Second Edition) Narosa Publishing House, New Delhi, 1997.

UNIT I

Order Relations, Lattices; Boolean Algebra – Definition and Properties, Boolean Functions.
[Chapter 3 (section.3 (3.1-3.11), chapter 4 (sections 1& 2) from text 2]

UNIT II

What is a graph? Graphs as Models, Matrices and Isomorphism, Paths, Walks, Connected Graphs, Bipartite Graphs, Eulerian circuits, Vertex Degrees, Degree sum formula. Directed Graphs – Definitions and examples. Trees-Basic Properties. Connectivity. Planar Graphs. Embedding and Eulers formula – Restricted Jordan Curve Theorem (Statement only), Dual Graphs, Eulers formula. [Chapter 1: section 1.1 (up to and including 1.1.40), 1.2 (Up to and including 1.2.27), 1.3 (Up to and including 1.3.6), 1.4 (Up to and including 1.4.13)
[Chapter 2: section 2.1 (Up to and including 2.1.5, 2.1.9 to 2.1.11)]
[Chapter 4; section 4.1 (4.1.1, 4.1.2, 4.1.7 to 4.1.11)]
[Chapter 6: section 6.1 (Up to and including 6.1.13, 6.1.21 to 6.1.24) from text 1]

UNIT III

Automata and Formal Languages: Introduction to the theory of Computation, Finite Automata, Regular Expressions.
[Chapter 1 (sections 1.2 & 1.3); Chapter 2 (sections 2.1, 2.2 & 2.3); Chapter 3 (section 3.1) from Text 3]

REFERENCES

1. J.A. Bondy and U.S.R.Murty : Graph Theory with applications.
Macmillan
2. F. Harary : Graph Theory, Narosa publishers
3. John Clark and Derek Allan Holton : A First look at Graph Theory,
Prentice Hall
4. K.R. Parthasarathy : Basic Graph Theory, Tata-Mc Graw Hill
5. R. Balakrishnan & K. Ranganathan : A Text Book of Graph Theory,
Springer Verlag.
6. C.L. Liu : Elements of Discrete Mathematics (Second
Edition) Mc Graw Hill Book Company 1985.
7. K.H. Rosen : Discrete Mathematics and its Applications
(5th Edition) MC Graw Hill 2003.

SEMESTER II

MT2C06 - ALGEBRA – II

No. of Credits :4

No.of hours of lectures/week : 5

TEXTS : FRALEIGH, J.B. : A FIRST COURSE IN ABSTRACT ALGEBRA
(Fifth Edn.) Narosa (1999)

UNIT I

Prime and Maximal Ideals, Introduction to Extension Fields, Algebraic Extensions (Omit Proof of the Existence of an Algebraic Closure), Geometric Constructions.
[§§ 6.2, 8.1, 8.3, 8.4]

UNIT II

Finite Fields, Automorphisms of Fields, The Isomorphism Extension Theorem, Splitting Fields, Separable Extensions.
[§§ 8.5, 9.1, 9.2, 9.3, 9.4 from Text]

UNIT III

Galois Theory, Illustration of Galois Theory, Cyclotomic Extensions, Insolvability of the Quintic.
[§§ 9.6, 9.7, 9.8, 9.9]

REFERENCES

- 1 . N.H. McCoy and R.Thomas : Algebra, Allyn & Bacon Inc. (1977).
- 2 J. Rotman : The Theory of Groups Allyn & Bacon Inc. (1973)
3. Hall,Marshall : The Theory of Groups,Chelsea Pub. Co. NY. (1976)
4. Clark, Allan : Elements of Abstract Algebra
Dover Publications (1984)
5. L.W. Shapiro : Introduction to Abstract Algebra
McGraw Hill Book Co. NY (1975)
6. C. Musili : Introduction to Rings and Modules
Narosa Publishing House, New Delhi (1992)

7. N. Jacobson : Basic Algebra , Vol. I.
Hindustan Publishing Corporation (India),
Delhi 110 007 Reprint (1991)
8. P.B. Bhattacharya and S.K. Jain : First Course in Rings, Fields and Vector Spaces
Wiley Eastern Ltd., New Delhi (1976)
9. T.W. Hungerford : Algebra
Springer Verlag GTM 73 (1987) 4th Printing
10. I.N.Herstein : Topics in Algebra. New York, Blaisdell. 1964
11. F Lorenz : Algebra: Volume I: Fields and Galois Theory,
Univesitext, Springer
12. P. Morandi : Fields and Galois Theory, Graduate Text in Mathematics,
Springer

MT2C07 - REAL ANALYSIS - II

No. of Credits : 4

No.of hours of Lectures / week : 5

TEXTS: 1 **RUDIN, W.**, PRINCIPLES OF MATHEMATICAL ANALYSIS
(3rd Edn.) Mc. Graw-Hill, 1986.
2 **ROYDEN,H.L.**, REAL ANAYLSIS
(3rd Edn.) Macmillan Publishing company.

UNIT – I

Functions of Several Variables – Linear Transformations, Differentiation, The Contraction Principle, The Inverse Function Theorem, the Implicit Function Theorem, Determinants.

[Chapter 9 – Sections 1-29, 33-38 from Text – 1]

UNIT – II

Set Theory - Algebras of Sets.

Lebesgue Measure – Introduction, Outer Measure, Measurable Sets and Lebesgue Measure. A Non Measurable Set, Measurable Functions, Little Wood’s Three Principles.

The Lebesgue Integral - The Riemman Integral, The Lebesgue Integral of a Bounded Function Over a Set of Finite Measure, The Integral of a Non Negative Function, The General Lebesgue Integral, Convergence in Measure.

[Chapter 1 Section –4, Chapter 3 – All Sections & Chapter 4 – Sections 1,2,3 from Text 2]

UNIT – III

The Lebesgue Integral - The General Lebesgue Integral, Convergence in Measure.

Differentiation of Monotone Functions, Functions of Bounded Variations.
Differentiation of an Integral. Absolute Continuity.

[Chapter 4 – Sections 4,5 & Chapter 5, Sections 1,2,3, 4 from Text 2]

REFERENCES

1. a) R.G. Bartle : Elements of Real Analysis
Wiley International Edn
(Second Edn) (1976)
- b) R.G. Bartle and D.R. Sherbert : Introduction to Real Analysis
John Wiley Bros. (1982)

2. L.M. Graves : The Theory of Functions of a Real Variable
Tata McGraw-Hill Book Co (1978)
3. M.H. Protter & C.B. Moray : A First course in Real Analysis
Springer Verlag UTM (1977)
4. S.C. Saxena and SM Shah : Introduction to Real Variable Theory
Intext Educational Publishers
San Francisco (1972)
5. I.K.Rana : An Introduction to Measure and Integration,
Narosa Publishing House, Delhi, 1997, 2nd Edn.
6. E.Hewitt and K. Stromberg : Real and Abstract Analysis
Springer Verlag GTM 25 (1975) Reprint
7. P. R. Halmos : Measure Theory, Graduate Texts in Mathematics,
Springer
8. R. G. Bartle : The Elements of Integration and Lebesgue Measure,
Wiley (1995)
9. K.B. Athreya & S. Lahiri : Measure Theory, TRIM 36, Hindustan Book Agency

MT2C08 - TOPOLOGY – I

No. of Credits : 4

No.of hours of Lectures / week : 5

TEXT: JOSHI, K.D., INTRODUCTION TO GENERAL TOPOLOGY
(Revised Edition) Wiley Eastern Ltd., New Delhi, 1984

UNIT I

A Quick Revision of Chapter 1,2 and 3. Topological Spaces, Basic Concepts
[Chapter 4 and Chapter 5 Sections 1, Section 2 (excluding 2.11 and 2.12) and Section 3 only]

UNIT II

Making Functions Continuous, Quotient Spaces, Spaces with Special Properties
[Chapter 5 Section 4 and Chapter 6]

UNIT III

Separation Axioms: Hierarchy of Separation Axioms, Compactness and Separation Axioms, The Urysohn Characterization of Normality, Tietze Characterisation of Normality.
[Chapter 7: Sections 1 to 3 and Section 4 (up to and including 4.6)]

REFERENCES

1. J .Dugundji : Topology
Prentice Hall of India (1975)
2. S.Willard : General Topology
Addison Wesley Pub Co., Reading Mass (1976)
3. G.F. Simmons : Introduction to Topology and Modern Analysis
McGraw-Hill International Student Edn. (1963)
4. M. Gemignani : Elementary Topology
Addison Wesley Pub Co Reading Mass (1971)
5. M.G. Murdeshwar : General Topology (Second Edition)
Wiley Eastern Ltd (1990)
6. M.A. Armstrong : Basic Topology, Springer Verlag
New York 1983
7. J. R. Munkres : Topology- a First Course, PHI
8. Fred H. Croom : Principles of Topology, Cengage Learning Asia

MT2C09 - PDE AND INTEGRAL EQUATIONS

No. of Credits : 4

No. of hours of Lectures / week : 5

TEXTS : 1. **AMARNATH, M.,** : PARTIAL DIFFERENTIAL EQUATIONS

Narosa , New Delhi (1997)

2. **HILDEBRAND, F.B.:** METHODS OF APPLIED MATHEMATICS

(Second Edn.) Prentice-Hall of India, New Delhi, 1972.

UNIT I

First Order PDE .

[Sections 1.1 – 1.11. from the Text 1]

Omit the Proof of Theorem 1.11.1

UNIT II

Second Order PDE

[Sections 2.1 – 2.5. from the Text 1]

UNIT III

Integral Equations.

[Sections 3.1 – 3.3, 3.6 – 3.11 from the Text 2]

REFERENCES

1. G. Birkhoff & G.C. Rota : Ordinary Differential Equations
Edn. Wiley & Sons 3rd Edn (1978)
2. E.A. Coddington : An Introduction to Ordinary Differential Equations
Printice Hall of India, New Delhi (1974)
3. P. Hartman : Ordinary Differential Equations
John Wiley & Sons (1964)
4. L.S. Pontriyagin : A Course in Ordinary Differential Equations
Hindustan Pub. Corporation, Delhi (1967)
5. F. John : Partial Differential Equations
Narosa Pub. House New Delhi (1986)
6. Phoolan Prasad & Renuka Ravindran : Partial Differential Equations
Wiley Eastern Ltd New Delhi (1985)
7. R. Courant and D.Hilbert : Methods of Mathematical Physics , Vol I
Wiley Eastern Reprint (1975)
8. W.E. Boyce & R.C. Deprima : Elementary Differential Equations
and Boundary Value Problems
John Wiley & Sons, NY, 9th Edition
9. A. Chakrabarti : Elements of Ordinary Differential
Equations and Special Functions
Wiley Eastern Ltd New Delhi (1990)
10. Ian Sneddon : Elements of Partial Differential Equations
McGraw-Hill International Edn., (1957)

MT2C10 - NUMBER THEORY

No. of Credits : 4

No.of hours of Lectures / week : 5

TEXTS :

1. **APOSTOL, T.M.;** INTRODUCTION TO ANALYTIC NUMBER THEORY , Narosa Publishing House, New Delhi 1990.
2. **KOBLITZ , NEAL:**A COURSE IN NUMBER THEORY AND CRYPTOGRAPHY, Springer–Verlag , New York (1987).

UNIT I

Arithmetical Functions and Dirichlet Multiplication ; Averages of Arithmetical Functions; Some Elementary Theorems on the Distribution of Prime Numbers.
[Chapter 2 Sections 2.1 to 2.14, 2.18, 2.19 ; Chapter 3 Sections 3.1 to 3.4, 3.9 to 3.12; Chapter 4 Sections 4.1 to 4.10 of Text 1]

UNIT II

Congruences, Quadric Residues and Quadratic Reciprocity Law.
[Chapters 5 (All Sections) and Chapter 9 Sections 9.1 to 9.7 of Text 1]

UNIT III

Cryptography, Public Key.
[Chapter 3 and 4 of Text 2.]

REFERENCES

1. W.W Adams & L.J. Goldstein : Introduction to Number Theory
Printice Hall Inc.,Engelwoods, (1976)
2. W.J. Le Veque : Topics in Number Theory ,Vols. I & II
Addison Wesley Pub. Co. Readings Mass (1961).
3. A.Hurwitz & N.Kritiko : Lectures on Number Theory
Springer Verlag ,Universitext (1986)
4. H. Davenport : The Higher Arithmetic
Cambridge Univ.Press, Sixth Edn. (1992)
5. Kenneth H. Rosen : Elementary Number Theory and its Applications
Addison Wesley Pub Co., 3rd Edn. (1993)
6. G.H. Hardy & E. M.Wright : An Introduction to the Theory of Numbers
Oxford International Edn (1985)
7. D.P.Parent : Exercises in Number Theory
Springer Verlag,(Problem Books in Math) 1984
8. Don Redmond : Number Theory
Monographs & Texts in Mathematics No: 220
Marcel Dekker Inc (1994).
9. Thomas Koshy : Elementary Number Theory with Applications
Harcourt / Academic Press 2002

10. Douglas R Stinson : Cryptography- Theory and Practice (2nd edn.)
Chapman & Hall / CRC (2002)
11. Simon Singh : The Code Book
The Fourth Estate, London (1999)
12. Song Y. Yan : Number Theory for Computing (2nd Edition)
Springer – Verlag 2002
13. Oystein Ore : Number Theory and its History –
Mc Graw – Hill Book Company 1948
14. Paulo Ribenboim : The Little Book of Big Primes
Springer-Verlag (New York 1991)
15. Albrecht Beutelspacher : Cryptology Mathematical Association of America
(Incorporated),1994
16. G. Everest and T.Ward : An Introduction to Number Theory, GTM 232, Springer.
17. Erickson & Vazzana : Introduction to Number Theory, Chapman & Hall,
Indian Edition.

SEMESTER III

MT3C11 : COMPLEX ANALYSIS

No. of Credits : 4

Number of hours of Lectures/week : 5

TEXTS : **AHLFORS, L.V.** : COMPLEX ANALYSIS
3rd Edn. Mc Graw Hill International Student Edn. (1979)

UNIT I

Conformality, Linear Transformations, Elementary Conformal Mappings, Fundamental Theorems.

[§§ 3.2, 3.3, 3.4, 4.1]

UNIT II

Cauchy's Integral Formula, Local Properties of Analytic Functions, The General Form of Cauchy's Theorem, Calculus of Residues.

[§§ 4.2, 4.3, 4.4, 4.5]

UNIT III

Harmonic functions, Power series Expansions, Simply Periodic Functions, Doubly Periodic Functions, The Weierstrass Theory.

[§§ 4.6, 5.1, 7.1, 7.2, 7.3]

REFERENCES

1. Cartan, H. : Elementary Theory of analytic functions of one or several variables, Addison - Wesley Pub. Co. (1973).
2. Conway, J.B. : Functions of One Complex Variable, Narosa Pub. Co., New Delhi (1973).
3. Moore, T.O., & Hadlock, E.H. : Complex Analysis, Series in Pure Mathematics - Vol. 9. World Scientific (1991).
4. Pennisi, L. : Elements of Complex Variables, Holf, Rinehart & Winston, 2nd Edn. (1976).
5. Rudin, W. : Real and Complex Analysis, 3rd Edn. Mc Graw - Hill International Editions. (1987).
6. Sliverman, H. : Complex Variables Houghton Mifflin Co. Boston (1975)
7. Remmert, R. : Theory of Complex Functions UTM, Springer-Verlag, NY, (1991)

MT3C12 : FUNTIONAL ANALYSIS I

No. of Credits : 4

Number of hours of Lectures/week : 5

TEXT : LIMAYE , B.V : FUNCTIONAL ANALYSIS
(2nd Edn.) New Age International Ltd, Publishers
New Delhi, Bangalore (1996)

UNIT 1

Metric spaces and Continuous Functions (section 3, 3.1 to 3.3 & 3.4(without proof), 3.11 to 3.13) Lp spaces , Fourier series and Integrals (section 4.5 to 4.11), Normed spaces (section 5).

UNIT II

Continuity of linear maps (section 6), Inner product spaces , Orthonormal sets (Sections 21 and 22), Approximation and Optimization(section 23 , except 23.6)

UNIT III

Hahn-Banach Theorems (section 7, omit Banach limits), Banach spaces (section 8) Uniform Boundedness Principle (section 9, omit Quadrature Formulae and Matrix Transformations and Summability Methods).

REFERENCES

1. R. Bhatia. : Notes on Functional Analysis TRIM series, Hindustan Book Agency
2. Kesavan S, : Functional Analysis TRIM series, Hindustan Book Agency
3. S David Promislow : A First Course in Functional Analysis Wiley Interscience, John wiley & Sons, INC., (2008).
4. Sunder V.S, : Functional Analysis TRIM Series, Hindustan Book Agency
5. George Bachman & Lawrence Narici : Functional Analysis Academic Press, NY (1970)
6. Kolmogorov and Fomin S.V. : Elements of the Theory of Functions and Functional Analysis. English Translation, Graylock Press Rochester NY (1972)
7. W. Dunford and J. Schwartz : Linear Operators Part 1, General Theory John Wiley & Sons (1958)
8. E.Kreyszig : Introductory Functional Analysis with Applications John Wiley & Sons (1978)

9. F. Riesz and B. Nagy : Functional Analysis
Frederick Unger NY (1955)
10. J.B.Conway : Functional Analysis
Narosa Pub House New Delhi (1978)
11. Walter Rudin : Functional Analysis
TMH edition (1978)
12. Walter Rudin : Introduction to Real and Complex Analysis
TMH edition (1975)
13. J.Dieudonne : Foundations of Modern Analysis
Academic Press (1969)
14. Yuli Eidelman, Vitali Milman and Antonis Tzolomitis : Functional analysis An Introduction,
Graduate Studies in Mathematics
Vol. 66 American Mathematical Society 2004.

MT3C13 : TOPOLOGY II

No. of Credits : 4

No. of hours of Lectures / week : 5

- TEXT 1 : K.D. JOSHI** : INTRODUCTION TO GENERAL TOPOLOGY
(Revised Edition) Wiley Eastern Ltd 1984
- TEXT 2 : JAMES. R. MUNKRES:** Topology – A First Course, Prentice Hall of India
Private Ltd., New Delhi.

UNIT I

Tietze Characterisation of Normality, Products and Co products
[Chapter 7 Section 4 (4.7 & 4.8 only), Chapter 8, Section 1,2,3 and Section 4 up to and including 4.2 only]

UNIT II

Embedding and Metrization, The Fundamental Groups and Covering Spaces
[Chapter 9 of Text 1 and Chapter 8 Sections 8.1 to 8.5 of Text 2.]

UNIT III

Compactness, Complete Metric Spaces
[Chapter 11 Sections 1,2 (up to and including 2.7), 3 and 4 (up to and including 4.14 only),
Chapter 12 Section 1 (up to and including 1.6 only), Section 2 up to and including 2.6 only ,
Section 4 up to and including 4.5 only]

REFERENCES

1. Dugundji. J. : Topology
Prentice Hall of India (1975)
2. Willard. S. : General Topology
Addison Wesley Pub Co., Reading Mass (1976)
3. Simmons G.F. : Introduction to Topology and Modern Analysis
McGraw-Hill International Student Edn (1963)
4. M. Gemignani : Elementary Topology
Addison Wesley Pub Co Reading Mass (1971)
5. Fred H. Croom : Basic Concepts of Algebraic Topology
UTM, Springer Verlag, NY(1978)
6. M.G. Murdeshwar : General Topology (Second Edition)
Wiley Eastern Ltd (1990)
7. M.A. Armstrong : Basic Topology, Springer Verlag
New York 1983
ISBN 0-387-90839-0

MT3C14 : LINEAR PROGRAMMING AND ITS APPLICATIONS

No. of Credits : 4

No. of hours of Lecture/week: 5

**TEXT : K.V.MITAL; C. MOHAN : OPTIMIZATION METHODS IN
OPERATIONS RESEARCH AND
SYSTEMS ANALYSIS
(3rd. Edn.) New Age International (P) Ltd. Pub.**

UNIT I

1. CONVEX SETS
2. EXTREMA OF FUNCTIONS
3. LINEAR PROGRAMMING

[Chapter 1 (section 11 to 19); Chapter 2 (all sections); Chapter 3 (sections 1 to 8) from the text]

UNIT II

4. MORE ON LINEAR PROGRAMMING (Omit Revised Simplex method)
5. TRANSPORTATION PROBLEM

[Chapter 3 (sections 9 to 15, 17 to 22); Chapter 4 (sections 1 to 10) from the text]

UNIT III

6. ASSIGNMENT PROBLEM
7. INTEGER LINEAR PROGRAMMING
8. THEORY OF GAMES

[Chapter 4 (sections 11 to 16); Chapter 6 (sections 1 to 6) and Chapter 12 (all sections) from the text]

REFERENCES

1. G. Hadley : Linear Programming
Addison-Wesley Pub Co Reading, Mass (1975)
2. G. Hadley : Non-linear and Dynamic Programming
Wiley Eastern Pub Co. Reading, Mass (1964)
3. S.S. Rao : Optimization – Theory and Applications
(2nd Edn.) Wiley Eastern (P) Ltd. New Delhi.
4. Russel L Ackoff and Maurice W.Sasioni : Fundamentals of Operation Research
Wiley Eastern Ltd. New Delhi. (1991)
5. Charles S. Beightler, D.T. Philipps & D.J. Wilde : Foundations of Optimization
(2nd Edn.) Prentice Hall of India, Delhi (1979)
6. Hamdy A. Taha : Operations Research: An Introduction
(4th Edn.) Macmillan Pub Co. Delhi (1989)

SEMESTER IV

MT4C15 : FUNCTIONAL ANALYSIS II

No. of Credits : 4

Number of hours of Lectures/week : 5

TEXT : LIMAYE , B.V : FUNCTIONAL ANALYSIS
(2nd Edn.) New Age International Ltd, Publishers
New Delhi, Bangalore (1996)

UNIT I

Closed Graph and Open Mapping Theorems (section 10) , Bounded Inverse Theorems (section 11) , Spectrum of a Bounded Operator (section 12), Duals and Transposes (section 13, upto and including 13.6).

UNIT II

Reflexivity (section 16, Omit 16.3 and the proof of 16.5 and 16.6), Definition of Compact Linear Map, Projection and Riesz Representation Theorems (section 24).

UNIT III

Bounded Operators and Adjoints (section 25), Normal, Unitary and Self Adjoint Operators (section 26, omit Fourier-Plancherel Transform), Spectrum and Numerical Range (section 27), Compact self Adjoint Operators (section 28 , omit 28.7 and 28.8(b)).

REFERENCES

1. R. Bhatia. : Notes on Functional Analysis TRIM series, Hindustan Book Agency
2. Kesavan S. : Functional Analysis TRIM series, Hindustan Book Agency
3. S David Promislow : A First Course in Functional Analysis
Wiley Interscience, John wiley & Sons, INC., (2008.)
4. Sunder V.S. : Functional Analysis TRIM Series, Hindustan Book Agency
7. George Bachman & Lawrence Narici : Functional Analysis
Academic Press, NY (1970)
8. Kolmogorov and Fomin S.V. : Elements of the Theory of Functions and Functional Analysis. English Translation, Graylock Press
Rochaster NY (1972)
7. W. Dunford and J. Schwartz : Linear Operators Part 1, General Theory
John Wiley & Sons (1958)

8. E.Kreyszig : Introductory Functional Analysis with Applications
John Wiley & Sons (1978)
9. F. Riesz and B. Nagy : Functional Analysis
Frederick Unger NY (1955)
10. J.B.Conway : Functional Analysis
Narosa Pub House New Delhi (1978)
11. Walter Rudin : Functional Analysis
TMH edition (1978)
12. Walter Rudin : Introduction to Real and Complex Analysis
TMH edition (1975)
13. J.Dieudonne : Foundations of Modern Analysis
Academic Press (1969)
14. Yuli Eidelman, Vitali Milman
and Antonis Tzolomitis : Functional analysis An Introduction,
Graduate Studies in Mathematics
Vol. 66 American Mathematical Society 2004.

MT4C16 : DIFFERENTIAL GEOMETRY

No. of Credits : 4

No. of hours of Lectures/week : 5

TEXT: **J.A.THORPE** : ELEMENTARY TOPICS IN DIFFERENTIAL GEOMETRY
Springer – Verlag, New York.

UNIT I

Graphs and Level Set, Vector fields, The Tangent Space, Surfaces, Vector Fields on Surfaces, Orientation. The Gauss Map.
[Chapters : 1,2,3,4,5,6 from the text.]

UNIT II

Geodesics, Parallel Transport, The Weingarten Map, Curvature of Plane Curves, Arc Length and Line Integrals.
[Chapters : 7,8,9,10,11 from the text].

UNIT III

Curvature of Surfaces, Parametrized Surfaces, Local Equivalence of Surfaces and Parametrized Surfaces.
[Chapters 12,14,15 from the text]

REFERENCES

1. W.L. Burke : Applied Differential Geometry
Cambridge University Press (1985)
2. M. de Carmo : Differential Geometry of Curves and Surfaces
Prentice Hall Inc Englewood Cliffs NJ (1976)
3. V. Grilleman and A. Pollack : Differential Topology
Prentice Hall Inc Englewood Cliffs NJ (1974)
4. B. O'Neil : Elementary Differential Geometry
Academic Press NY (1966)
5. M. Spivak : A Comprehensive Introduction to Differential
Geometry, (Volumes 1 to 5)
Publish or Perish, Boston (1970, 75)
6. R. Millmen and G. Parker : Elements of Differential Geometry
Prentice Hall Inc Englewood Cliffs NJ (1977)
7. I. Singer and J.A. Thorpe : Lecture Notes on Elementary Topology and Geometry
UTM, Springer Verlag, NY (1967)

ELECTIVES

MT4E01 : COMMUTATIVE ALGEBRA

No. of Credits : 4

No. of hours of Lectures/week : 5

TEXT : **ATIYAH, M.F., & MACDONALD, I.G.** : INTRODUCTION TO COMMUTATIVE ALGEBRA
Addison Wesley, N.Y, (1969).

UNIT I

Rings and Ideals
Modules
[Chapters I and II from the text]

UNIT II

Rings and Modules of Fractions
Primary Decomposition
[Chapters III & IV from the text]

UNIT III

Integral Dependence and Valuation
Chain conditions
Noetherian rings :
Artin rings
[Chapters V, VI, VII & VIII from the text]

REFERENCES

1. N. Bourbaki : Commutative Algebra
Paris - Hermann, 1961
2. D. Burton : A First Course in Rings and Ideals,
Addison - Wesley , 1970.
3. N.S. Gopalakrishnan : Commutative Algebra
Oxonian Press, 1984.
4. T.W. Hungerford : Algebra
Springer - Verlag, 1974
5. D.G. Northcott : Ideal Theory
Cambridge University Press, 1953
6. O. Zariski & P. Samuel : Commutative Algebra, Vols. I & II
Van Nostrand, Princeton, 1960

MT4E02 : ALGEBRAIC NUMBER THEORY

No. of Credits : 4

No. of hours of Lectures/week : 5

TEXT : I. N. STEWART & D.O. TALL : ALGEBRAIC NUMBER THEORY
(2nd Edn.), Chapman & Hall, (1987)

UNIT I

Symmetric polynomials, Modules, Free abelian groups, Algebraic Numbers, Conjugates and Discriminants, Algebraic Integers, Integral Bases, Norms and Traces, Rings of Integers, Quadratic Fields, Cyclotomic Fields.

[Chapter 1, Sections 1.4 to 1.6; Chapter 2, Sections 2.1 to 2.6; Chapter 3, Sections 3.1 and 3.2 from the text]

UNIT II

Historical background, Trivial Factorizations, Factorization into Irreducibles, Examples of Nonunique Factorization into Irreducibles, Prime Factorization, Euclidean Domains, Euclidean Quadratic fields

Ideals – Historical background, Prime Factorization of Ideals, The norm of an ideal
[Chapter 4, Sections 4.1 to 4.7, Chapter 5, Sections 5.1 to 5.3.]

UNIT III

Lattices, The Quotient Torus, Minkowski theorem, The Space L^{st} , The Class-Group An Existence Theorem, Finiteness of the Class-Group, Factorization of a Rational Prime, Fermat's Last Theorem – Some history, Elementary Considerations, Kummer's Lemma, Kummer's Theorem.

[Chapter 6, Chapter 7, Section 7.1 Chapter 8, Chapter 9, Sections 9.1 to 9.3, Chapter 10. Section 10.1, Chapter 11: 11.1 to 11.4.]

REFERENCES

1. P. Samuel : Theory of Algebraic Numbers
Herman Paris Houghton Mifflin, NY, (1975)
2. S. Lang : Algebraic Number Theory
Addison Wesley Pub Co., Reading, Mass, (1970)
3. D. Marcus : Number Fields
Universitext, Springer Verlag, NY, (1976)
4. T.I.FR. Pamphlet No: 4 : Algebraic Number Theory (Bombay, 1966)
5. Harvey Cohn : Advanced Number Theory
Dover Publications Inc., NY, (1980)
6. Andre Weil : Basic Number Theory
(3rd Edn.), Springer Verlag, NY, (1974)
7. G.H. Hardy and E.M. Wright : An Introduction to the Theory of Numbers,
Oxford University Press.
8. Z.I. Borevich & I.R. Shafarevich : Number Theory
Academic Press, NY 1966.
9. Esmonde & Ram Murthy : Problems in Algebraic Number Theory
Springer Verlag 2000.

MT4E03 : MEASURE AND INTEGRATION

No. of Credits : 4

No. of hours of Lectures/week : 5

TEXT : **WALTER RUDIN** : REAL AND COMPLEX ANALYSIS
(3rd Edn.) McGraw- Hill International Edn.
New Delhi (1987)

UNIT I

The concept of measurability ; Simple Functions ; Elementary Properties of measures ; Arithmetic in $[0, \infty]$; Integration of positive functions ; Integration of complex functions ; The role played by sets of measure zero.

Positive Borel Measures: Topological preliminaries (upto 2.13 – a quick review) ; The Riesz Representation Theorem.

[Chapter 1 and Chapter 2 Sections 2,3 from the text]

UNIT II

Positive Borel Measures: Regularity properties of Borel measures ; Lebesgue measure; Continuity properties of measurable functions.

Complex Measures: Total variation ; Absolute continuity ; Consequences of the Radon-Nikodym theorem; Bounded linear functionals on L^p ; The Riesz representation Theorem.

[Chapter 2 ,Sections 4, 5, 6 and Chapter 6 from the text]

UNIT III

Differentiation: Derivatives of measures; the fundamental theorem of Calculus.

Integration on Product Spaces: Measurability on Cartesian products; Product measures The Fubini's Theorem ;Completion of product measures, Convolutions.

[Chapter 7, Sections 1, 2 and Chapter 8, Sections 1, 2, 3, 4,5 from the text]

REFERENCES

1. P.R. Halmos : Measure Theory
Narosa Pub House New Delhi (1981) 2nd Reprint
2. H.L. Royden : Real Analysis
Macmillan International Edition (1988) 3rd Edition.
3. E. Hewitt and K. Stromberg : Real and Abstract Analysis
Narosa Pub House New Delhi (1978)
4. A.E. Taylor : General Theory of Functions and Integration
Blaisell Publishing Co NY (1965)
5. G. De Barra : Measure Theory and Integration
Wiley Eastern Ltd. Bangalore (1981)

MT4E04 : FLUID DYNAMICS

No. of Credits : 4

No. of hours of Lectures/week : 5

TEXT : L.M. MILNE-THOMSON : THEORETICAL HYDRODYNAMICS
(Fifth Edition) Mac Millan Press, London, 1979.

UNIT I

EQUATIONS OF MOTION : Differentiation w.r.t. the time, The equation of continuity Boundary condition (Kinematical and Physical), Rate of change of linear momentum, The equation of motion of an invicid fluid, Conservative forces, Steady motion, The energy equation, Rate of change of circulation, Vortex motion, Permanence of vorticity, Pressure equation, Connectivity, Acyclic and cyclic irrotational motion, Kinetic energy of liquid, Kelvin's minimum energy theorem.

TWO-DIMENSIONAL MOTION : Motion in two-dimensions, Intrinsic expression for the vorticity; The rate of change of vorticity; Intrinsic equations of steady motion; Stream function; Velocity derived from the stream-function; Rankine's method; The stream function of a uniform stream; Vector expression for velocity and vorticity; Equation satisfied by stream function; The pressure equation; Stagnation points; The velocity potential of a liquid; The equation satisfied by the velocity potential.

[Chapter III: Sections 3.10, 3.20, 3.30, 3.31, 3.40, 3.41, 3.43, 3.45, 3.50, 3.51, 3.52, 3.53, 3.60, 3.70, 3.71, 3.72, 3.73. Chapter IV : All Sections.]

UNIT II

STREAMING MOTIONS : Complex potential; The complex velocity stagnation points, The speed, The equations of the streamlines, The circle theorem, Streaming motion past a circular cylinder; The dividing streamline, The pressure distribution on the cylinder, Cavitation, Rigid boundaries and the circle theorem, The Joukowski transformation, Theorem of Blasius.

AEROFOILS: Circulation about a circular cylinder, The circulation between concentric cylinders, Streaming and circulation for a circular cylinder, The aerofoil, Further investigations of the Joukowski transformation Geometrical construction for the transformation, The theorem of Kutta and Joukowski.

[Chaper VI : Sections 6.0, 6.01, 6.02, 6.03, 6.05, 6.21, 6.22, 6.23, 6.24, 6.25, 6.30, 6.41.
Chapter VII: Sections 7.10, 7.11, 7.12, 7.20, 7.30, 7.31, 7.45.]

UNIT III

SOURCES AND SINKS: Two dimensional sources, The complex potential for a simple source, Combination of sources and streams, Source and sink of equal strengths Doublet, Source and equal sink in a stream, The method of images, Effect on a wall of a source parallel to the wall, General method for images in a plane, Image of a doublet in a plane, Sources in conformal transformation Source in an angle between two walls, Source outside a circular cylinder, The force exerted on a circular cylinder by a source.

STOKES' STREAM FUNCTION: Axisymmetrical motions Stokes' stream function, Simple source, Uniform stream, Source in a uniform stream, Finite line source, Airship forms, Source and equal sink - Doublet; Rankin's solids.
[Chapter VIII. Sections 8.10, 8.12, 8.20, 8.22, 8.23, 8.30, 8.40, 8.41, 8.42, 8.43, 8.50, 8.51, 8.60, 8.61, 8.62. Chapter XVI. Sections 16.0, 16.1, 16.20, 16.22, 16.23, 16.24, 16.25, 16.26, 16.27]

REFERENCES

1. Von Mises and K.O. Friedrichs : Fluid Dynamics
Springer International Edition. Reprint, (1988)
2. James EA John : Introduction to Fluid Mechanics (2nd Edn.)
William L Haberman : Prentice Hall of India ,Delhi,(1983). Reprint.
3. Chorlten : Text Book of Fluid Dynamics
CBS Publishers, Delhi 1985
4. A. R. Patterson : A First Course in Fluid Dynamics
Cambridge University Press 1987.

MT4E05 : OPERATIONS RESEARCH

No. of Credits : 4

No. of hours of Lecture/week : 5

**TEXT : K.V.MITAL; C. MOHAN : OPTIMIZATION METHODS IN
OPERATIONS RESEARCH AND
SYSTEMS ANALYSIS
(3rd. Edn.) New Age International (P) Ltd. Pub.**

UNIT I

FLOW AND POTENTIAL IN NETWORKS
ADDITIONAL TOPICS IN LINEAR PROGRAMMING
[Chapter 5 (all sections);Chapter 7 (sections 1 to 15)]

UNIT II

QUADRATIC PROGRAMMING
GEOMETRIC PROGRAMMING
[Chapter 8 (sections 1 to 6);Chapter 9 (omit section 5)]

UNIT III

DYNAMIC PROGRAMMING
DIRECT SEARCH AND GRADIENT METHOD
[Chapter 10 (sections 1 to 10); Chapter 11 (sections 1 to 14)]

REFERENCES

1. G. Hadley : Linear Programming
Addison-Wesley Pub Co Reading, Mass (1975)
2. G.Hadley : Non-linear and Dynamic Programming
Wiley Eastern Pub Co.Reading, Mass (1964)
3. S.S. Rao : Optimization - Theory and Applications
(2nd Edn.)Wiley Eastern (P)Ltd. New Delhi
4. Russel L Ackoff and : Fundamentals of Operation Research
Maurice W.Sasioni Wiley Eastern Ltd. New Delhi (1991)
5. Charles S. Beightler, : Foundations of Optimization
D.T. Philipps & D.J. Wilde (2nd Edn.) Prentice Hall of India, Delhi (1979)
6. Hamdy A. Taha : Operations Research : An Introduction
(4th Edn.)Macmillan Pub Co. Delhi (1989)

MT4E06 : PROBABILITY THEORY

No. of Credits : 4

No. of hours of Lectures/week : 5

TEXT : **B.R. BHAT** : MODERN PROBABILITY THEORY
(2nd Edn.) Wiley Eastern Limited, Delhi (1988)

UNIT I

1. SETS AND CLASSES OF EVENTS : The event; (A quick review of Algebra of sets & Fields and σ - fields); Class of events.
2. RANDOM VARIABLES: (Review of Functions and inverse functions); Random variables; Limits of random variables.
3. PROBABILITY SPACE : Definition of probability; Some simple properties; Discrete probability Space; General Probability space; Induced probability space
4. DISTRIBUTION FUNCTIONS: Distribution function of a random variable; Decomposition of D.F; Distribution functions of vector random variables; Correspondence theorem.
[Chapters 1 to 4 from the text]

UNIT II

1. EXPECTATION AND MOMENTS: Definition of expectation; Properties of expectation; Moments, inequalities.
2. CONVERGENCE OF RANDOM VARIABLES: Convergence in probability; Convergence almost surely; Convergence in Distribution; Convergence in r^{th} mean; Convergence theorems for expectations; Fubini's theorem.
3. CHARACTERISTIC FUNCTIONS: Definition and simple properties; Some more properties; Inversion formula; Characteristic functions and moments; Bochner's theorem
4. CONVERGENCE OF DISTRIBUTION FUNCTIONS : Weak convergence; Convergence of distribution functions and characteristic Functions; Convergence of moments.
[Chapters 5 to 8, from the text]

UNIT III

1. INDEPENDENCE : Definition; Multiplication properties; Zero-one law.
2. LAWS OF LARGE NUMBERS: Convergence of a series of independent random variables; Kolmogorov Inequalities and A.S. Convergence; Stability of independent R.V's.
3. CENTRAL LIMIT THEOREM: Introduction; I.I.D. Case; Variable distributions
[Chapters 9, 10, 11 (sections 11.1 to 11.3)]

REFERENCES

1. P. Billingsley : Probability and Measure- John Wiley & Sons NY (1979)
2. K.L. Chung : Elementary Probability Theory with Stochastic Processes
Narosa Pub House, New Delhi (1980)
3. W. Feller : An Introduction to Probability Theory and its Applications
Vols I & II- John Wiley & Sons, NY (1968) and (1971)
4. E. Parzen : Modern Probability Theory and its Applications
Wiley Eastern Limited, New Delhi (1972)
5. H.G. Tucker : A Graduate Course in Probability- Academic Press NY (1967)

MT4E07 : COMPUTER ORIENTED NUMERICAL ANALYSIS

No. of Credits : 4

Number of hours per/week: 5

Programming Language : C++
Text Books : 1. Object Oriented Programming in Turbo C++ By Robert Lafore (Galgotia Publication Pvt. Ltd., Ansari Road, New Delhi)
2. Computer Oriented Numerical Methods – V. Rajaraman, Prentice Hall of India, New Delhi (3rd Edition)

THEORY

UNIT I

A quick review of preliminaries of computers, programming languages, Algorithms and flow charts.

(Following lessons as in the Text Book No. 1 mainly focusing on)

- Chapter 3 : C++ Programming Basics:
Input/Output statements – escape sequences – endl and setw manipulators-variables and constants (int, long, float, double, long double and char) – Operators (Arithmetic, remainder, increment) – Library functions.
- Chapter 4 : Loops and Decisions:
Relational operators – For, While, Do loops – if, if else, nested if else – switch statements – conditional operator – logical operators – other control statements like break, continue, goto.
- Chapter 5 : Structures: (A quick view)
Defining structures, accessing structure members, other features of structures, structures within structures.
- Chapter 6 : Functions:
Declarations and calling of functions – passing of constants and variables to and fro through functions (by value and by reference) – return statement – recursion.
- Chapter 8 : Arrays:
Defining arrays – accessing and initializing arrays-multi dimensional arrays passing of arrays to function – strings and arrays of strings.
- Chapter 14 : Files and Streams:
Streams- String I/O (Reading and Writing strings) – of stream and ifstream classes – open function – Redirection of output and input.

UNIT II

(Chapters 1,3,5 of Text No. 2)

Algorithms, Flow chart and C++ Programs for various numerical methods like Gcd of two numbers, Totient function, Fibonacci sequence, finding maximum of numbers, Area of a triangle, sum of a numerical series, polynomial evaluation, Checking a number prime, real root of a transcendental equation (Newton Raphson Method and Bisection Method), Interpolation.

UNIT III

(Chapters 4,5,8,9 of Text No. 2)

Algorithms, C++ Programs and solution for numerical methods like solving simultaneous algebraic equations. Tridiagonal system of equations, Differentiation of tabulated functions, Integration by simpson's rule and Trapezoidal rule, Solving differential equations using Eulers method and Runge Kutta Method, Finding Inverse of Matrix (Gauss elimination technique), Eigen values.

PRACTICALS

The following programs in C++ have to be done on a computer and a record of algorithm, print out of the program and print out of solution as shown by the computer for each program should be maintained. These should be bound together and submitted to the examiners at the time of practical examination.

Sample Programs (Recommended)

1. GCD of two numbers
2. To Check an integer prime
3. Evaluation of Totient Function
4. Writing of Fibonacci sequence
5. Listing of prime numbers
6. Average and maximum of a set of numbers

Programs (Compulsory)

Part A

1. Lagrange Interpolation
2. Newton's Interpolation
3. Newton-Raphson Method
4. Bisection Method
5. Numerical Differentiation
6. Simpson's rule of Integration
7. Trapezoidal rule of integration

Part B

1. Euler's method
2. Runge-Kutta method of order 2
3. Runge – Kutta method of order 4
4. Gauss elimination with pivoting
5. Solving a tridiagonal system of equations
6. Gauss – Seidal iteration
7. Inverse of matrix
8. Eigen value evaluation

REFERENCES

1. SD Conte and Carl De Boor : Elementary Numerical Analysis (An algorithmic approach) – Third edition Mc Graw Hill book company – New Delhi
2. K. Sankara Rao : Numerical Methods for Scientists and Engineers- Prentice hall of India – New Delhi
3. Carl E Froberg : Introduction to Numerical Analysis Addison Wesley Pub. Co. 2nd Edition
4. A Ralston : A First Course in Numerical Analysis. Mc Graw Hill Book Company
5. John H Mathews : Numerical methods for Mathematics, Science and Engg. Prentice Hall of India – New Delhi
6. Knuth D.E. : The Art of Computer Programming Vol I Fundamental Algorithms – Addison Wesley Narosa, New Delhi
7. Herbert Schildt : C++: The Complete reference (3rd edition) Mc Graw-Hill Pub. Co. Ltd. New Delhi
8. Yashavant P Kanetkar : Let us C++, BPB Publications, New Delhi
9. E Balagurusami : Object Oriented Programming with C++ Tata Mc Graw – Hill Publishing Co. Ltd., New Delhi
10. Schaum Series : Programming in C++ Tata Mc Graw-Hill Publishing Co. Ltd., New Delhi

PATTERN OF EXAMINATION

The External examination will consist of a written paper and a practical examination of one and half hours duration each. The written paper will carry a weightage of 18 and the practical examination will also carry a weightage of 18. Thus the total weightage is 36 as in the case of other courses. The valuation will be done by Direct Grading System. The question paper for the written examination will consists of 6 short answer questions, each of weightage 1, 6 paragraph type questions each of weightage 2 and 2 essay type questions, each of weightage 4. All short answer questions are to be answered while 4 paragraph type questions and 1 essay type questions are to be answered with a total weightage of 18. The questions are to be evenly distributed over the entire syllabus.

A candidate appearing for the practical examination should submit his/her record to the examiners. The candidate is to choose two problems from part A and three problems from part B by lots. Let him/her do any one of the problems got selected from each section on a computer. The examiners have to give data to check the program and verify the result. A print out of the two programs along with the solutions as obtained from the computer should be submitted by the candidate to the examiners. These print outs are to be treated as the answer sheets of the practical examination.

The part A of the practical examination will carry a weightage of 6, Part B a weightage of 9 and the practical record carries a weightage 3.

Procedure for conducting the Practical Examination

Those colleges offering CONA should inform the Controller of examinations, University of Calicut, well in advance of the number of candidates likely to appear for the practical examination at their college. They should also indicate the number of batches required for completing the practical examination on the basis that only two candidates are to do practicals on one computer a day.

In case, due to some technical problems like power failure or system break down, practicals could not be conducted on the specified day, the examiners can choose an alternate day to conduct the examination in fresh. But the matter along with the new dates for the conduct of examination at the center should be brought to the notice of the Controller of Examinations.