VIMALA AUTONOMOUS COLLEGE
THRISSUR

SYLLABUS FOR THE M.Sc. (MATHEMATICS) PROGRAMME

UNDER CUCSS – PG – 2016
(Total Credits : 80)

EFFECTIVE FROM 2016 ADMISSIONS

Semester I

Course Code	Title of the Course	No. of Credits	Work Load Hrs.	Core/ Elective
VPMT1C01	Algebra 1	4	5	Core
VPMT1C02	Linear Algebra	4	5	Core
VPMT1C03	Real Analysis - I	4	5	Core
VPMT1C04	ODE and Calculus of Variations	4	5	Core
VPMT1C05	Number Theory	4	5	Core

Semester II

Course Code	Title of the Course	No. of Credits	Work Load Hrs.	Core/ Elective
VPMT2C06	Algebra II	4	5	Core
VPMT2C07	Real Analysis II	4	5	Core
VPMT2C08	Topology I	4	5	Core
VPMT2C09	PDE and Integral Equations	4	5	Core
VMT2C10	Discrete Mathematics	4	5	Core

Semester III

Course Code	Title of the Course	No. of Credits	Work Load Hrs.	Core/ Elective
VPMT3C11	Complex Analysis	4	5	Core
VPMT3C12	Functional Analysis I	4	5	Core
VPMT3C13	Topology II	4	5	Core
VPMT3C14	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
VPMT4C15	Functional Analysis II	4	5	Core
VPMT4C16	Differential Geometry	4	5	Core
VPMT4EO4	Elective I	4	5	Elective
VPMT4E06	Elective II	4	5	Elective
VPMT4C17	Project	5	5	Core
VPMT4V01	General Viva	3		Core

CREDITS

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

LIST OF ELECTIVES

VPMT4E01   COMMUTATIVE ALGEBRA
VPMT4E02   ALGEBRAIC NUMBER THEORY
VPMT4E03 MEASURE AND INTEGRATION
VPMT4E04 FLUID DYNAMICS
VPMT4E05 COMPUTER ORIENTED NUMERICAL ANALYSIS
VPMT4E06 PROBABILITY THEORY

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.

Significance and Relevance of the Project	Project Report	Presentation	Viva
Weightage - 1	Weightage- 2	Weightage- 1	Weightage-1

Total weightage for the project is 5.

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:
MT4E06 Computer Oriental Numerical Analysis

For the Elective Course MT4E06: 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

VPMT1C01 : 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)

4

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 & Brikhoff : Algebra
Macmillian

Contemporary Abstract Algebra $(4^{th}$

11. Joseph A. Gallian : Edition)

Narosa   1999

VPMT1C02 : LINEAR ALGEBRA

No. of Credits : 4

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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. Bikhrkhoff : 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)

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.

VPMT1C03 : 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 Topololgy – 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

VPMT1C04 : 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
Equtions 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. 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)

10

11

VPMT1C05 - 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 Beautelspacher	: 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.

VPMT2C06 - 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

The Field of Quotients of an Integral Domain, 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)

VPMT2C07 - 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   : 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, 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

VPMT2C08 - 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   :   Introduction   to   Topology   and   Modern
. G.F. Simmons   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   Principles of Topology, Cengage Learning
. Fred H. Croom   : Asia

VPMT2C09 - 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   : Partial Differential Equations
   Renuka Ravindran   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)

VPMT2C10 : DISCRETE MATHEMATICS

No. of Credits 4

Number of hours of Lectures / week: 5

TEXTS:
1) **DOUGLAS B**. **WEST**, INTODUCTION TO GRAPH THEORY (Second Edition) Pearson Education
2) **K.D.JOSHI**, FOUNDATIONS OF DISCRETE MATHEMATICS, New Age International (P) Ltd. New Delhi 1989

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

Matching and Covers – Maximum matchings, Hall's Matching conditions , Min-Max Theorems, Independent sets and Covers, Dominating Sets , Matching in general graphs, Coloring of graphs.
[Chapter 3 (sections 3.1& 3.3); Chapter 5 (section 5.1) from text 1]

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.

VPMT3C11 : 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)

VPMT3C12 : 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

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 Tsolomitis : Functional analysis An Introduction, Graduate Studies in Mathematics

Vol. 66 American Mathematical Society 2004.

VPMT3C13 : 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

VPMT3C14 : 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

QUICK REVIEW OF LINEAR PROGRAMMING PROBLEMS UP TO TRANSPORTATION PROBLEMS.
FLOW   AND   POTENTIAL   IN   NETWORKS
ADDITIONAL TOPICS IN LINEAR PROGRAMMING

[Chapter 5 (all sections);Chapter 7 (sections 1 to 15)]

UNIT II

INTEGER LINEAR PROGRAMMING
THEORY OF GAMES

[Chapter 6 (sections 1 to 6) and Chapter 12 (all sections) from the text]

UNIT III

QUADRATIC PROGRAMMING
DYNAMIC PROGRAMMING

[Chapter 8 (sections 1 to 6);Chapter 10 (sections 1 to10)]

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. Philiphs & 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

VPMT4C15 : 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 : Functional analysis An Introduction,
    and Antonis Tsolomitis   Graduate Studies in Mathematics
                             Vol. 66 American Mathematical Society 2004.

VPMT4C16 : 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	:	Elements of Differential

.   and G. Parker   Geometry

                    Prentice Hall Inc Englewood Cliffs NJ (1977)

7   I. Singer and   :   Lecture Notes on Elementary
J.A. Thorpe   Topology and Geometry
                    UTM, Springer Verlag, NY (1967)

27

28

29

ELECTIVES

VPMT4E01 :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).

Module – I

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

Module – II

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

Module – III

Integral Dependence and Valuation, Chain conditions, Noetherian rings, Artinian 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

VPMT4E02 :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)

Module – 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.
[Chapter1, 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]

Module – II
Historical background, Trivial Factorizations, Factorization into Irreducibles, Examples of Nonunique Factorization into Irreducibles, Prime Factorization, Euclidean Domains, Eucidean 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.]

Module – III
Lattices, The Quotient Torus, Minkowski theorem, The Space Lst, 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,

VPMT4E03 : 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, ∞]; 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
Blaidsell Publishing Co NY (1965)

5. G. De Barra : Measure Theory and Integration
Wiley Eastern Ltd. Bangalore (1981)

VPMT4E04 : 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.]

31

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.

STKOKES' 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 William L Haberman	:	Introduction to Fluid Mechanics (2nd Edn.) 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.

VPMT4E05 :COMPUTER ORIENTED NUMERICAL ANALYSIS

No. of Credits : 4
No. of hours of Lectures/week : 5

Programming Language: Python

Texts:

1. A Byte of Python, Swaroop C H

2. Numerical Methods, E Balagurusamy, Tata McGraw-Hill Publishing Company

Limited, New Delhi.

THEORY PART

Module – I

(Text Book 1, Text Book 2)
A quick review of preliminaries of computers, numerical computing, programming
languages, Algorithms, flow charts, computer codes based on chapter 1, 2 and 3
of text book 2 Approximations and errors in computing: Significant Digits, Numerical Errors,
Absolute and relative errors, convergence of iterative processes and error estimation. (Sections
4.2, 4.4, 4,
7, 4.11 and 4.12 of text book 2)
A quick review of chapters 1, 2 and 3 of Text Book 1
Chapter 4: The Basics: Literal Constants, Numbers, Strings, Variables, Identifier, Data types
Chapter 5: Operators, Operator Precedence, Expressions
Chapter 6: Control flow: If, while, for, break, continue statements
Chapter 7: Functions: Defining a function, function parameters, local variables, default
arguments, keywords, return statement, Doc-strings
Chapter 8: Modules: using system modules, import statements, creating modules
Chapter 9: Data Structures: Lists, tuples, sequences.
Chapter 10: Writing a python script
Chapter 12: Files: Input and output using file and pickle module
Chapter 13: Exceptions: Errors, Try-except statement, raising exceptions, try-finally
statement

Module – II

(Text Book 2)
Chapter 6: Roots of Nonlinear Equations: Evaluation of Polynomials, Bisection method,
Newton-Raphson Method, Complex roots by Bairstow method. (Sections 6.5, 6.6, 6.8 and 6.15)

Chapter 7: Direct Solution of Linear Equations: Solution
by elimination, Gauss Elimination method, Gauss Elimination with Pivoting,

Triangular Factorisation method (Dolitle Algorithm). (Sections 7.3, 7.4, 7.5 and 7.7)
Chapter 8: Iterative Solution of Linear Equations: Jacobi Iteration method, Gauss-
Seidel method. (Sections 8.2 and 8.3)

<u>**Module – III**</u>
  (Text Book 3)

Chapter 9: Curve Fitting-Interpolation: Lagrange Interpolation Polynomial, Newton Interpolation
Polynomial, Divided Difference Table, Interpolation with Equidistant points

(Sections 9.4, 9.5, 9.6 and 9.7)

Chapter 11: Numerical Differentiation: Differentiating Continuous functions, Differentiating Tabulated functions. (Sections 11.2 and 11.3)

Chapter 12: Numerical Integration: Trapezoidal Rule, Simpson's 1/3 rule. (Sections 12.3 and 12.4)

Chapter 13: Numerical Solution of Ordinary Differential Equations: Euler's Method, Rung-Kutta method (Order 4) (Sections 13.3 and 13.6).

Chapter 14: Eigenvalue problems: Polynomial Method, Power method. (Sections 14.5 and 14.6)

PRACTICAL PART

The following programs in Python have to be done on a computer and a record of algorithm, Printout of the program and printout 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)

GCD of two numbers

To Check an integer prime

Evaluation of Totient Function

Writing of Fibonacci sequence

Listing of prime numbers

Average and maximum of a set of numbers

Programs (Compulsory)

Part A

Lagrange Interpolation

Newton's Interpolation

Bisection Method

Newton-Raphson Method

Numerical Differentiation of continuous function

Numerical Differentiation of tabulated function

Trapezoidal rule of Integration

Simpson's rule of Integration

Part B

Euler's method
Runge – Kutta method of order 4
Gauss elimination with pivoting
Bairstow Method of finding complex root
Runge – Kutta method of order 4
Gauss – Seidal iteration
Eigen value evaluation
Triangular Factorisation

REFERENCES

SD Conte and Carl De Boor : Elementary Numerical Analysis (An algorithmic approach) –3rd edition, McGraw-Hill, New Delhi

K. Sankara Rao : Numerical Methods for Scientists and Engineers – Prentice
Hall of India, New Delhi.

Carl E Froberg : Introduction to Numerical Analysis, Addison Wesley Pub Co, 2ndEdition

Knuth D.E. : The Art of Computer Programming: Fundamental Algorithms(Volume I),
 Addison Wesley, Narosa Publication, New Delhi.

Python Programming, wikibooks contributors
Programming Python, Mark Lutz,
Python 3 Object Oriented Programming, Dusty Philips, PACKT Open source Publishing
Python Programming Fundamentals, Kent D Lee, Springer
Learning to Program Using Python, Cody Jackson, Kindle Edition
Online reading

http://pythonbooks.revolunet.com/

VPMT4E06 : 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)

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.