ST. JOSEPH'S COLLEGE (AUTONOMOUS), DEVAGIRI, CALICUT 8

Syllabus

for

M.Sc. MATHEMATICS PROGRAMME

(UNDER SJCCSS SYSTEM)

(Effective from 2016 Admission)

PROGRAMME -STRUCTURE

Semester I

Course Code	Course	Credits	Hours/week	Core/ Elective
DMAT1B01T	Algebra 1	4	5	Core
DMAT1B02T	Linear Algebra	4	5	Core
DMAT1B03T	Real Analysis - I	4	5	Core
DMAT1B04T	ODE and Calculus of Variations	4	5	Core
DMAT1B05T	Discrete Mathematics	4	5	Core
DMAT1B06V	Viva Voce	1		

Semester II

Course Code	Course	Credits	Hours/ week	Core/ Elective
DMAT2B07T	Algebra II	4	5	Core
DMAT2B08T	Real Analysis II	4	5	Core
DMAT2B09T	Topology I	4	5	Core
DMAT2B10T	PDE and Integral Equations	4	5	Core

DMAT2B11T	Number Theory	4	5	Core
DMAT2B12V	Viva Voce	1		

Semester III

Course Code	Course	Credits	Hours/ week	Core/ Elective
DMAT3B13T	Complex Analysis	4	5	Core
DMAT3B14T	Functional Analysis I	4	5	Core
DMAT3B15T	Topology II	4	5	Core
DMAT3B16T	Linear Programming and its Applications	4	5	Core
DMAT3B17V	Viva Voce	1		
	Project		5	Core

Semester IV

Course Code	Course	Credits	Hours/ week	Core/ Elective
DMAT4B18T	Functional Analysis II	4	5	Core
DMAT4B19T	Differential Geometry	4	5	Core
	Elective I	4	5	Elective
	Elective II	4	5	Elective
DMAT4B20V	Viva Voce	1		
DMAT4B21D	Project	4	5	Core

CREDITS

Minimum credit required for successful completion of course shall be 80.

LIST OF ELECTIVES

DMAT4E01T	MEASURE AND INTEGRATION
DMAT4E02T	COMPUTER ORIENTED NUMERICAL ANALYSIS
DMAT4E03T	COMMUTATIVE ALGEBRA
DMAT4E04T	FLUID DYNAMICS
DMAT4E05T	OPERATIONS RESEARCH
DMAT4E06T	ALGEBRAIC NUMBER THEORY

PROJECT

The Project work in this Programme has to be done in the III & IV Semesters with a total credit of 4 including Project Viva.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

There shall be final examinations and viva-voce at the end of each semester.
At each semester the marks for viva-voce is 25.

The internal evaluation scheme for each course shall contain

(a) Internal examinations – 2 : (2 x 5 = 10 Marks)
(b) Seminar / Viva : (1 x 4 = 4 Marks)
(c) Assignment : (1 x 3 = 3 Marks)
(d) Attendance : (1 x 4 = 3 Marks)

Total Marks = 20

End Semester Examination Question Paper Pattern

For each course there will be an external examination of duration 3 hours. Each question paper will consists of 12 short answer questions, each of marks 2, 12 paragraph type questions each of marks 4 and 4 essay type questions, each of marks12. All short answer questions are to be answered while 8 paragraph type questions and 2 essay type questions are to be answered with total marks of 80. The questions are to be evenly distributed over the entire syllabus.

	Type of question		Marks per question	Total Marks	Time (minutes)
Part - A	Short Answer	12 out of 12	2	24	54
Part - B	Paragraph Type	8 out of 12	4	32	72
Part - C	Essay Type	2 out of 4	12	24	54
				80	180 Minutes

SEMESTERWISE MARKS AND TOTAL MARKS

SEMESTER – I

Title of the course	Marks
Algebra – I	100
Linear Algebra	100
Real Analysis – I	100
ODE & Calculus of Variations	100
Discrete Mathematics	100
Viva – Voce	25

SEMESTER- II

Title of the course	Marks
Algebra – II	100
Real Analysis – II	100
Topology – I	100
PDE & Integral Equations	100
Number Theory	100

Viva – Voce	25

SEMESTER – III

Title of the course	Marks
Complex Analysis	100
Functional Analysis – I	100
Topology – II	100
Linear Programming	100
Viva - Voce	25

SEMESTER – IV

Title of the course	Marks
Functional Analysis – II	100
Differential Geometry	100
Elective – I	100
Elective – II	100
Viva – Voce	25
Project	100

TOTAL CREDITS AND MARKS

SEMESTER	CREDITS	MARKS
I	21	525
II	21	525
III	17	425
IV	21	525
TOTAL	**80**	**2000**

SEMESTER- I

DMAT1B01T: ALGEBRA - I

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

TEXT: FRALEIGH, J.B**. : A FIRST COURSE IN ABSTRACT ALGEBRA.**
(Seventh Edn.) Narosa (1999)

UNIT I

Plane Isometries , Direct products & finitely generated Abelian Groups, Factor Groups, Factor-Group Computations and Simple Groups, Group action on a set, Applications of G-set to counting.
[Sections 12,11,4,14,15,16,17]

UNIT II

Isomorphism theorems, Series of groups, (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).
[Sections 34,35,36,37,39]

UNIT III

Group Presentations, Rings of polynomials, Factorization of polynomials over a field, Non commutative examples, Homomorphism and factor rings.
[40,22,23,24,26]

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 & Brikhoff : Algebra
Macmillian
11. Joseph A. Gallian : Contemporary Abstract Algebra (4th Edition)
Narosa 1999

DMAT1B02T: 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, (2^{nd} 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)
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.

DMAT1B03T: 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 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.
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

DMAT1B04T: 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)

DMAT1B05T: 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
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 (5^{th} Edition) MC Graw Hill 2003.

SEMESTER- II

DMAT2B07T: ALGEBRA – II

No. of Credits: 4

No.of hours of lectures/week: 5

TEXTS : FRALEIGH, J.B**. : A FIRST COURSE IN ABSTRACT ALGEBRA**
(Seventh 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.
[27,29,31,32]

UNIT II

Finite Fields, Automorphisms of Fields, The Isomorphism Extension Theorem, Splitting Fields, Separable Extensions.
[33,48,49,50,51]

UNIT III

Galois Theory, Illustration of Galois Theory, Cyclotomic Extensions, Insolvability of the Quintic.
[53,54,55,56]

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

DMAT2B08T: REAL ANALYSIS - II

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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

DMAT2B09T: 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

DMAT2B10T: PARTIAL DIFFERENTIAL EQUATIONS 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)

DMAT2B11T: 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 [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;

UNIT II

Some Elementary Theorems on the Distribution of Prime Numbers, Congruences [Chapter 4 Sections 4.1 to 4.10 of Text 1,Chapter 5 (All Sections)]

UNIT III

Quadric Residues and Quadratic Reciprocity Law, Cryptography [Chapter 9 Sections 9.1 to 9.7 of Text 1, Chapter 3 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.

SEMESTER III

DMAT3B13T: 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, Fundamental Theorems, Cauchy's Integral Formula [Chapter 3 sections 2.1,2.2,2.3,3.1,3.2,3.3 chapter 4 sections 1.1 to 2.3]

UNIT II

Local Properties of Analytic Functions, The General Form of Cauchy's Theorem, Calculus of Residues,Harmonic functions.
[Chapter 4 Sections 3.1 to 6.4]

UNIT III

Power series Expansions, Simply Periodic Functions, Doubly Periodic Functions, The Weierstrass Theory.[Chapter 5 Sections 1.1 to 1.3,Chapter 7 sections 1.1 to 3.3]

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)

DMAT3B14T: FUNTIONAL ANALYSIS-I

No. of Credits: 4

Number of hours of Lectures/week: 5

TEXT : **LIMAYE , B.V** : FUNCTIONAL ANALYSIS
(2^{nd} 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. Bhatia. : Notes in 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)

DMAT3B15T**: TOPOLOGY-II**

No. of Credits: 4

No. of hours of Lectures / week: 5

TEXT 1 : **K.D. JOSHY** : 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. K.D. Joshi : Introduction to General Topology
   Wiley Eastern Ltd (1983)
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

DMAT3B16T: LINEAR PROGRAMMING AND ITS

APPLICATIONS

No. of Credits: 4

No. of hours of Lecture/week: 5

TEXT : **K.V. MITAL:** OPTIMIZATION METHODS IN OPERATIONS RESEARCH AND SYSTEMS ANALYSIS

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. 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

DMAT4B18T: 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. Bhatia. : Notes in 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)

DMAT4B19T**: 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

DMAT4E01T: MEASURE AND INTEGRATION

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

TEXT : **WALTER RUDIN** : REAL AND COMPLEX ANALYSIS
(3rd Edn.) Mc Graw- 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,Topological preliminaries;The Riesz Representation Theorem (Proof omitted)
[Chapter 1(1.2 to 1.41) and Chapter 2(Sections 2.3 to 2.14)]

UNIT II

Regularity properties of Borel measures ; Lebesgue measure; Continuity properties of measurable functions,Total variation ; Absolute continuity ; Consequences of the Radon-Nikodym theorem.
[Chapter 2(2.15 to 2.25) , Chapter 6(6.1 to 6.14)]

UNIT III

Bounded linear functionals on L^P ; The Riesz representation Theorem,Measurability on Cartesian products; Product measures ,The Fubini's Theorem ;Completion of product measures.
[Chapter 6 (6.15 to 6.19), Chapter 8 (8.1 to 8.11)]

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)

DMAT4E02T: 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 view on preliminaries of computers, programming languages, Algorithms and flow charts.

(Following lessons as in the Tex 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 if stream 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 transcendal 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

DMAT4E03T: 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

DMATE04T: 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.

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 : Introduction to Fluid Mechanics (2^{nd} 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.

DMAT4E05T: 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, 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)

DMAT4E06T: 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.
[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]

UNIT 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.]

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.

PATTERN OF EXAMINATION

The examination will consists of a written paper and a practical examination of one and half duration each.

The written paper will carry a maximum of 30 marks and the practical examination will carry a maximum of 50 marks of which 15 marks for Part A, 25 marks for part B and 10 marks for record. Also 20 marks is for internal assessment as in the case of other papers.

The written examination will be in the same pattern of other theory papers which has a compulsory part carrying 6 marks and 24 marks from the three units of the syllabus for answering four questions without omitting any unit.

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.