

UNIVERSITY OF CALICUT
(Abstract)

Implementation of the syllabus of M.Sc Mathematics (Final) course revised with effect from 1999 admission onwards - sanctioned - orders issued.

GENERAL AND ACADEMIC BRANCH 'J' SECTION

GAI/J1/7631/99

Dated, Calicut University P.O., 2.8.2000

- 1) Minutes of meeting of Board of Studies in Mathematics (FG) held on 17.12.1999.
2) Item No. I (12) of the minutes of meeting of Faculty of Science held on 27.6.2000.
3) Item No. II F(13) of the minutes of meeting of Academic Council held on 29.7.2000.

C R D E R
7

The meeting of Board of Studies in Mathematics (FG) held on 17.12.1999, finalised and approved the syllabus of M.Sc Mathematics (final year) course which was revised from 1999 admission onwards.

2) The Faculty of Science at its meeting held on 27.6.2000, vide item No. I (12) approved the minutes of Board of Studies including the syllabus.

3) The Academic Council at its meeting held on 29.7.2000, vide item No. II F(13), approved the minutes of Board of Studies as endorsed by the Faculty of Science.

4) Sanction has therefore been accorded for the implementation of the revised syllabus of M.Sc Mathematics (Final) with effect from 1999 admission onwards.

5) Orders are issued accordingly.

6) Syllabus is appended.

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DEPUTY REGISTRAR (G&A I)
FOR REGISTRAR

- 1) The H/D of Mathematics, University of Calicut
2) The Principals of colleges offering M.Sc Mathematics course.

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M.Sc. DEGREE IN MATHEMATICS
(New Scheme : 1999 Admissions onwards)
DETAILED SYLLABI

FIRST YEAR .

PAPER I: ALGEBRA

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

No. of hours of Lectures/week : 5

UNIT I

Groups, Rings.

\$\$\$[Chapter 2, Section 4; Chapter 3, Sections 5,6,7; Chapter 4, Sections 1,2,3]

UNIT II

Rings and Fields

\$\$\$[Chapter 6,Sections 1,2; Chapter 7, Sections 1,2,3; Chapter 8,Sections 1,3,4]

UNIT III

Fields

\$\$\$[Chapter 8,Section 5; Chapter 9,Sections 1,2,3,4,6,7,8,9]

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. C. Musili : Introduction to Rings and Modules
Narosa Publishing House, New Delhi (1992)
8. N. Jacobson : Basic Algebra , Vol. I
Hindustan Publishing Corporation (India),
Delhi 110 007 Reprint (1991)
9. P.B. Bhattacharya and S.K. Jain : First course in rings, fields and vector spaces
Wiley Eastern Ltd, New Delhi (1976)
10. T.W. Hungerford : Algebra
Springer Verlag GTM 73 (1987) 4th Printing.

PAPER II : LINEAR ALGEBRA

- TEXTS :** 1. **HOFFMAN, K., and KUNZE, R.,** LINEAR ALGEBRA, (2nd Edn.), Printice-Hall of India, 1991.
 2. **MUSILI, C,** INTRODUCTION TO RINGS AND MODULES. (2nd Revised Edn.), Narosa, 1994.
 3. **FRALEIGH, J.B.,** A FIRST COURSE IN ABSTRACT ALGEBRA (5th Edn.) Addison Wesley, England, 1999.

No. of hours of Lectures/week : 5

UNIT I

Rings and Modules

\$\$\$ [Chapter 5, Sections 1,2,3,4,5,6,7 from text 3.]

\$\$\$ [Chapter 5, Sections 1 - 11, from text 2]

UNIT II

Vector Spaces and Linear Transformations

\$\$\$[Sections 2.1 - 2.4, 3.1 - 3.7 from text 1]

UNIT III

Elementary Canonical Forms, Rational Forms and Jordan Forms

\$\$\$[Sections 6.1 - 6.8, 7.1 - 7.4 from text 1]

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. MacLane and G. Birkhoff : Algebra
Macmillan Pub Co NY (1967)
6. R.R. Stoll and E.T.Wong : Linear Algebra
Academic Press International Edn (1968)
7. G.D. Mostow and J.H. Sampson : Linear Algebra
McGraw-Hill Book Co NY (1969)
8. T.W. Hungerford : Algebra
Springer Verlag GTM No 73 (1974)

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UNIVERSITY OF CALICUT

(ABSTRACT)

Implementation of Scheme and Syllabus of M.Sc Maths -
Modification - in the revised syllabus with effect from 2000
admission - Onwards - Orders Issued.

GENERAL AND ACADEMIC BRANCH..I 'J' SECTION
NO:GAI/JI/7631/99 Dated : Calicut University-PO., 9-10-2000

- Read :-1) U.O.NO: GAI/JI/6975/96 dated : 12--8--1999
2) U.O. of even NO: Dated : 2--8--2000
3) Minutes of meeting of Board of Studies in
Mathematics (P.G) held on 14--8--2000

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O R D E R

The Scheme and Syllabus of M.Sc Maths (Previous and Final) were revised and implemented with effect from 1999 admission onwards Vide U.O.'s cited first and 2nd.

2) The Board of Studies in Maths (PG) at its meeting held on 14--8--2000, Vide item NO: 2, decided to replace the prescribed text book for Paper- I Algebra (Fraleigh 3rd Edition) by Fraleigh (5th Edition), consequently there is a reorganisation of the topics in the Syllabus. In view of this Paper-II ~~Linear~~ Algebra is also modified. Also that the text book for Paper-III Real Analysis is replaced by Real Analysis by H.L. Royden (Third Edition) following a slight reorganisation of the Paper-III.

2) The Board of Studies also resolved to finalise the details for the conduct of Computer Oriented Numerical Analysis (Theory and Practical).

3) In view of urgency, the Vice-Chancellor exercising the powers of Academic Council Vide Calicut University Act, 1975, Chapter--III 10 (13) approved the minutes

cont...p.2.

of meeting of Board of Studies. Subject to ratification by Faculty of Science and Academic Council, implementing the modifications with effect from 2000 admission onwards.

Orders are issued accordingly.

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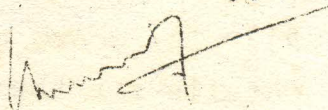
The Principals of Colleges
offering M.Sc Course.

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M.Sc. DEGREE IN MATHEMATICS
(New Scheme : 1999 Admissions onwards)
DETAILED SYLLABI

FIRST YEAR .

PAPER I: ALGEBRA

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

No.of hours of Lectures/week : 5

UNIT I

Groups, Rings.

\$\$\$[Chapter 2, Section 4; Chapter 3, Sections 5,6,7; Chapter 4, Sections 1,2,3]

UNIT II

Rings and Fields

\$\$\$[Chapter 6,Sections 1,2; Chapter 7, Sections 1,2,3; Chapter 8,Sections 1,3,4]

UNIT III

Fields

\$\$\$[Chapter 8,Section 5; Chapter 9,Sections 1,2,3,4,6,7,8,9]

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. C. Musili | : Introduction to Rings and Modules Narosa Publishing House, New Delhi (1992) |
| 8. N. Jacobson | : Basic Algebra , Vol. I Hindustan Publishing Corporation (India), Delhi 110 007 Reprint (1991) |
| 9. P.B. Bhattacharya and S.K. Jain | : First course in rings, fields and vector spaces Wiley Eastern Ltd.,New Delhi (1976) |
| 10. T.W. Hungerford | : Algebra Springer Verlag GTM 73 (1987) 4 th Printing. |

PAPER II : LINEAR ALGEBRA

- TEXTS : 1. HOFFMAN, K., and KUNZE, R., LINEAR ALGEBRA,
(2nd Edn.) , Printice-Hall of India, 1991.
2. MUSILI, C, INTRODUCTION TO RINGS AND MODULES.
(2nd Revised Edn.) , Narosa , 1994.
3. FRALEIGH, J.B., A FIRST COURSE IN ABSTRACT ALGEBRA
(5th Edn.) Addison Wesley, England, 1999.

No. of hours of Lectures/week : 5

UNIT I

Rings and Modules

\$\$\$ [Chapter 5, Sections 1,2,3,4,5,6,7 from text 3.]

\$\$\$ [Chapter 5, Sections 1 - 11, from text 2]

UNIT II

Vector Spaces and Linear Transformations

\$\$\$[Sections 2.1 – 2.4, 3.1 – 3.7 from text 1]

UNIT III

Elementary Canonical Forms, Rational Forms and Jordan Forms

\$\$\$[Sections 6.1 – 6.8, 7.1 – 7.4 from text 1]

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. MacLane and G. Birkhoff : Algebra
Macmillan Pub Co NY (1967)
6. R.R. Stoll and E.T. Wong : Linear Algebra
Academic Press International Edn (1968)
7. G.D. Mostow and J.H. Sampson : Linear Algebra
McGraw-Hill Book Co NY (1969)
8. T.W. Hungerford : Algebra
Springer Verlag GTM No 73 (1974)

PAPER III : REAL ANALYSIS

TEXTS: 1. RUDIN, W., PRINCIPLES OF MATHEMATICAL ANALYSIS
(3rd Edn.) Mc. Graw-Hill, 1986.

2. ROYDEN, H.L., REAL ANALYSIS
(3rd Edn.) Printice-Hall of India, New Delhi, 1995.

No. of hours of Lectures/week : 5

UNIT I

Real and Complex Numbers Systems, Basic Topology, Continuity, Differentiation
\$\$\$[Chapter 1, (including appendix); Chapter 2, Sections 2.15 -2.30; Chapter 4, Chapter 5
from text 1]

UNIT II

The Riemann Stieltjes Integral, Sequences and Series of Functions,
\$\$\$[Chapter 6, Chapter 7, from text 1]
Lebesgue Measure
\$\$\$[Chapter 3, from text 2]

UNIT III

The Lebesgue Integral, Differentiation and Integration, General Measure and Integration
Theory
\$\$\$[Chapters 4, 5 and 11 (omit section 7 on L^p spaces), from text 2]

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

M.Sc. DEGREE IN MATHEMATICS
(New Scheme : 1999 Admissions onwards)

DETAILED SYLLABI

FIRST YEAR

PAPER I: ALGEBRA

TEXT: FRALEIGN, J.B: A FIRST COURSE IN ABSTRACT ALGEBRA.
(Third edn) Narosa (1992)

No. of hours of Lectures/week: 5

UNIT I

Groups, Rings and fields.

\$\$\$ (Sections 8-9, 14-19 &

\$\$\$ (Sections 25-26, 28-29 from the text)

UNIT II

Rings and Fields

\$\$\$ (Sections 30-35, 38-39, from the text)

UNIT III

Fields

\$\$\$ (sections 40-43, 45-49, from the text)

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. C. Musili : Introduction to Rings and Modules
Narosa Publishing House, New
Delhi (1992)
8. N. Jacobson : Basic Algebra, Vol I.
Hindustan Publishing Corporation
(India),
Delhi 110 007 Reprint (1991)
9. P.B. Bhattacharya and
S.K. Jain : First course in rings, fields and
vector spaces Wiley Eastern Ltd,
New Delhi (1976)
10. T.W. Hungerford : Algebra.
Springer Verlag GTM 73 (1987) 4th
Printing.

TEXTS: I. HOFFMAN, K., and KUNZE, R., LINEAR ALGEBRA,
(2nd Edn)., Printice-Hall of India, 1991.
2. MUSILI, C, INTRODUCTION TO RINGS AND MODULES.
(2nd Revised Edn). Narosa, 1994.

No. of hours of Lectures/week:5

UNIT I

Vector Spaces and Linear Transformations

\$\$\$ (Sections 2.1 - 2.4, 3.1 - 3.7 from text I)

UNIT II

Elementary Canonical Forms, Rational Forms and Jordan Forms

\$\$\$ (Sections 6.1. - 6.8, 7.1-7.4 from text I)

UNIT III

Modules

\$\$\$ (Sections 5.1 - 5.11 from Text 2)

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 (1997)
5. S. MacLane and G. Birkhoff : Algebra
Macmillan Pub Co NY (1967)
6. R.R. Stoll and E.T. Wong : Linear Algebra
Academic Press International
Edn (1968)
7. G.D. Mostow and J.H. Sampson : Linear Algebra
McGraw-Hill Book Co NY (1969)
8. T.W. Hungerford : Algebra
Springer Verlag GTM NO 73 (1974)

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PAPER III: REAL ANALYSIS

TEXTS: I RUDIN, W. PRINCIPLES OF MATHEMATICAL ANALYSIS
(3rd Edn) Mc. Graw-Hill, 1986.
2. RANA, I.K. AN INTRODUCTION TO MEASURE AND
INTEGRATION

Narosa Publishing House, 1997.

No. of hours of Lectures/week: 5

UNIT I

Elements of set theory, Continuity, Differentiation, Sequences and Series of Functions.

\$\$\$ (Sections 2.15 - 2.30, 4.1 - 4.34, 5.16-5.19, 7.1. 7.33 from text I)

UNIT II

The Riemann Stieltjes Integral

\$\$\$ (Sections 6.1 - 6.27 from text I)

Extension of the Length Function, The Lebesgue Measure on R and its Properties

\$\$\$ (Chapters 3 and 4, all sections from text 2)

UNIT III

Integration, Fundamental Theorem of the Integral Calculus for the Lebesgue Integrals

\$\$\$ (Chapter 5 & 6, all sections from text 2)

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. H.L. Royden : Real Analysis Macmillan Pub
Co and Soltter Macmillan
Publishing (1983)
Third Edn. International Edn.
6. Hewitt and Stromberg K. : Real and Abstract Analysis
Springer Verlag GTM 25
(1975) Reprint.

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PAPER IV: TOPOLOGY

TEXT: MUNKRES, J.R, TOPOLOGY - A FIRST COURSE
Prentice Hall, 1987.

No. of hours of Lectures/Week : 5

UNIT

Topological Spaces and Continuous Functions
\$\$\$ (Sections 1.7, 1.9 & 1.10, 2.1-2.11 from the text)

UNIT II

Connectedness and Compactness, Countability and Separation Axioms
\$\$\$ (Sections 3.1 - 3.8, 4.1-4.4 from the text)

UNIT III

The Tychonoff Theorem, Complete Metric Spaces and Function Spaces
\$\$\$ (Sections 5.1 - 5.3, 7.1, 7.3 - 7.5 from the text)

REFERENCES

1. Dugnudji. 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
End (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)

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PAPER V: DIFFERENTIAL EQUATIONS

- TEXTS: 1. SIMMONS, G.F. DIFFERENTIAL EQUATIONS
Tata Mc Graw-Hill, 1974
2. AMARNATH, T. AN ELEMENTARY COURSE IN PARTIAL
DIFFERENTIAL EQUATIONS
Narosa, 1997.

no. of hours of Lectures/week: 5

UNIT I

Power Series Solutions, Special Functions of Mathematical Physics,
Systems of First Order Equations
\$\$\$ (Sections 25-39 from text 1)

UNIT II

Non-Linear Equations, The Existence and Uniqueness of Solutions
\$\$\$ (Sections 40-46, 55-57 from text 1)
First Order P D E
\$\$\$ (Sections 1.1-1.5 from text 2)

UNIT III

First Order P ^{D, E} D, Second Order P D E
\$\$\$ (Sections 1.6 - 1.11d, 2.1 - 2.9 from 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
1987.
3. P. Hartman : Ordinary Differential Equations.
John Wiley & Sons (1964)
4. L.S. Pontryagin : A course in ordinary Differential
Equations
Hindustan Pub. Corporation, Delhi
1967)
5. John F : Partial Differential Equations
Narosa Pub House New Delhi (1986)
6. Phoolan Prasad &
Renuka Ravindran : Partial Differential Equations
Wiley Eastern Ltd New Delhi (1985)
7. Courant R and Hilbert D : 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 2nd Edn (1969)
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
Mc Graw-Hill International Edn.
(1957)

K.A

SECOND YEARPAPER VI: COMPLEX ANALYSIS

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

2-CHOUDHARY, B. THE ELEMENTS OF COMPLEX ANALYSIS
2nd Edn Wiley Eastern Limited, (1992)

Number of hours of Lectures/Week: 4

UNIT I

Conformal mappings and complex integration.

\$\$\$ (Chapter 3, Section 4, all subsections & whole of Chapter 4, from text I)

UNIT II

Series and product developments, and the Riemann mapping theorem.

\$\$\$ (Chapter 5, all subsections from sections 1,2,3, and 4 & Chapter 6, all subsections from section 1, from text I)

UNIT III

Elliptic Functions, Simply Periodic Functions: Doubly Periodic Functions.

The Weierstrass Theory, Analytic Continuation

\$\$\$ (Chapter 7, all subsections from sections 1,2,3 from Text 1)

\$\$\$ (Chapter 13, section 13.1 to 13.4 from text 2)

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 s-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. Siverman, H. : Complex Variables Houghton Mifflin Co. Boston (1975)
7. Remmert, R. : Theory of Complex Functions UTM, Springer-Verlag, NY, (1991)

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

Number of hours of Lectures/week: 4

UNIT I

Lebesgue Measure and Integration: Fundamentals of normed Linear spaces, Bounded Linear maps on Banach Spaces, \$\$\$ (Chapter I, Section 4, Chapter II, Sections 5, 6, 7, 8 \$\$\$ & Chapter III, Sections 9, 10, 11, from the text)

UNIT II

Spectrum of a bounded operator, Spaces of bounded linear functionals, Compact operators on normed spaces. \$\$\$ (Chapter VI, Sections 21, 22, 23, 24, Chapter VII, Sections \$\$\$ 25, 26, 27, 28 (all sections except Fourier Plancherel Transform in sec 26, from the text.)

REFERENCES

1. George Pachman & Lawrence Narici : Functional Analysis
Academic Press, NY (1970)
2. Kolmogorov and Fomin S.V. : Elements of the theory of functions
and functional analysis
English translation, Graylock
Press Rochester NY (1972)
3. W. Dunford and J. Schwartz : Linear Operators Part I, General
Theory John Wiley & Sons (1958)
4. E. Kreyszig : Introductory Functional Analysis
with applications
John Wiley & Sons (1978)
5. F. Riesz and B. Nagy : Functional analysis
Frederick Unger NY (1955)
6. J.B. Conway : Functional Analysis
Narosa Pub House New Delhi
(1978)
7. Walter Rudin : Functional Analysis
TMH edition (1978)
8. Walter Rudin : Introduction to Real and Complex
Analysis
TMH Edition (1975)
9. J. Dieudonne : Foundations of Modern analysis
Academic Press (1969)

k.A

PAPER VIII: DIFFERENTIAL GEOMETRY

- TEXTS: 1. RUDIN. W. PRINCIPLES OF MATHEMATICAL ANALYSIS
(3rd Edn). McGraw - Hill (1986)
2. THORPE. J.A. ELEMENTARY TOPICS IN DIFFERENTIAL
GEOMETRY
Undergraduate Texts in Mathematics,
Springer - Verlag (1979)

Number of hours of Lectures/week: 4

UNIT I:

Functions of several variables, Graphs, level sets, vector fields, tangent spaces, vector fields on surfaces, orientation
\$\$\$ (Chapter 9 - all sections from text 1 &
\$\$\$ Chapters 1 to 5 from text 2)

UNIT II:

The Gauss map, Geodesics, Parallel transport, The Weingarten map, Curvature of plane curves, Arc length and line integrals, curvature of surfaces.
\$\$\$ (Chapter 6 to 12 from text 2)

UNIT III:

Parametrised surfaces, Local equivalence of surfaces and parametrised surfaces, Surface area and volume, Rigid motions and congruences, Isometries.
\$\$\$ (Chapter 14, 15, 17, 22, 23 from text 2)

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)

K.A 5/4

PAPER IX: TOPICS IN DISCRETE MATHEMATICS.

- TEXTS: 1. LIU, C.L, ELEMENTS OF DISCRETE MATHEMATICS
(2nd Edn) McGraw - Hill Book Co. (1985)
2. BONDY, J.A. & MURTHY V.S.R., GRAPH THEORY WITH
APPLICATIONS
The Macmillan Press Ltd, London (1977)

Number of hours of Lectures / week : 4

UNIT I

Computability and formal languages, Finite state machines, Analysis of algorithms.

\$\$\$ (Chapters 2,7,8 (all sections) from text 1)]

UNIT II

Graphs and subgraphs, Trees, Connectivity, Euler tours and Hamiltonian cycles.

\$\$\$ (Chapter I (sections I. 1 to 1.7), Chapter 2 (1 to 2.4), Chapter 3 (3.1 & 3.2) &

\$\$\$ Chapter 4 (sections 4.1, 4.2 & 4.4) from text 2)]

UNIT III

Matchings, Independent sets and Cliques, Vertex colouring, Planar Graphs.

\$\$\$ (Chapter 5 (sections 5.1 & 5.2), Chapter 7 (sections 7.1 to 7.3), Chapter 8 (sections

\$\$\$ 8.1, 8.2, 8.4 & 8.5), Chapter 9 (sections 9.1 to 9.3) from text 2)

REFERENCES

1. F. Harary : Graph Theory
Narosa Pub. House, New Delhi (1992)
2. C. Berge : Graphs and Hypergraphs
North Holland, Amsterdam (1973)
3. N. Biggs : Algebraic Graph Theory
Cambridge University Press (1974)
4. Narasing Deo : Graph Theory with applications to
Engineering and
Computer Science
Prentice Hall of India New Delhi (1987)
5. G. Ore : Graphs and their uses
Random House NY (1963)
6. Robin J, Wilson : Introduction to Graph Theory
Longman Scientific and Technical
Essex (1985)
(co-published with John Wiley and
sons NY)

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- 7. C.J. Dale : An Introduction to Data base systems
Addison Wesley Pub Co. Reading Mass.
(1981) 3rd Edn
- 8. D.E. Knuth : The art of Computer programming, Vols
I to III
Addison Wesley Pub Co, Reading Mass. (1973)
- 9. C.L. Liu : Introduction to combinatorial Mathematics
McGraw Hill Book Co NY (1968)
- 12. K.D. Joshi : Foundations of Discrete Mathematics
Wiley Eastern Ltd (1989)
- 13. Abbot J.C. : Sets, Lattices and Boolean Algebras
Allyn and Bacon, Boston (1969)
- 14. J.G. Michaels &
K.H. Rosen : Applications of Discrete Mathematics
McGraw-Hill International Edn
(Mathematics & Statistics Series) 1992.
- 15. Colman and Busby : Discrete Mathematical Structures
Prentice Hall of India (1985).

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ELECTIVE I. COMMUTATIVE ALGEBRA

TEXT: ATIVAH? M.F. & MACDONALD, I.G., INTRODUCTION TO
COMMUTATIVE ALGEBRA
Addison Wesley, NY, (1969).

No. of hours of Lectures/ week: 3

UNIT I

Rings and Ideals: Rings and ring homomorphisms- Ideals - Quotient rings - Zero Divisors - Nil potent elements - units - Prime ideals and maximal ideals - Nilradical and Jacobson radical - operations on ideals - Extension and contraction.

Modules: Modules and modular homomorphisms - submodules and quotient modules Operations on submodules- Direct sum and product
• Finitely generated modules - Exact sequences - Tensor product of modules - Restriction and extension of scalars - Exactness properties of the tensor product - Algebras

Rings and Modules of Fractions: Local properties - Extended and contracted ideals in rings of fractions.

\$\$\$ (Chapters, I, II and III from the text)

UNIT II

Primary Decomposition

Chain conditions

Noetharian rings: Primary decomposition in Noetherian rings - Artin rings

\$\$\$ (Chapters IV, VI, VII and VIII from the text)

UNIT III

Integral Dependence and Valuation: Integral dependence - The going up theorem - Integrally closed domains - The going down theorem - Valuation rings

Discrete Valuation Rings and Dedkind domains: Discrete valuation rings - Dedkind Domains - Fractional ideals

Completions: Topologies and completions - Filtrations - Graded rings and modules - The associated graded ring

\$\$\$ (Chapters V, IX and X 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: |

ELECTIVE 2. THEORY OF NUMBERS

TEXT : E MIL GROSSWALD: TOPICS FROM THE THEORY OF NUMBERS
Birkhauser Boston, 2nd Edn (1984)

No. of hours of Lectures/week : 3

UNIT I

Elementary Number Theory

Divisibility, Congruences and Quadratic residues

\$\$\$ (Part 2 : Chapter 3 Sections 3.1 to 3.5, Chapter 4, Sections 4.4, 4.5 and 4.6 & \$\$\$ Chapter 5, Sections 5.1 and 5.2, from the text)

UNIT II

Analytic Number Theory

Arithmetic Functions: The distribution of primes and Riemann's function, Prime Number Theorem.

\$\$\$ (Chapter 6, Sections 6.1 to 6.7 and 6.10, Chapter 8, Sections 8.1 to 8.5 and 8.7, 8.8 &

\$\$\$ Chapter 9, Sections 9.1 to 9.4 from the text)

UNIT III

Algebraic Number Theory

Arithmetic of Number Fields; ideal Theory, Fermat's Equation.

\$\$\$ (Chapter 10, Sections 10.1 to 10.13, Chapter 11, Sections 11.1 to 11.5 & \$\$\$ Chapter 14, Sections 14.1 to 14.4 from the text)

REFERENCES

1. W.W. Adams & I.J. Goldstein: Introduction to Number Theory
Printice Hall Inc. Englewoods,
(1976)
2. Tom M. Apostol : Introduction to Analytic Number
Theory, Springer International
Edn. (4th Reprint) Narosa Pub.
House, Delhi, 1993)
3. A. N. Stewart & D.O. Tall : Algebraic Number Theory (2nd
Edn), Chapman & Hall London,
1985).
4. P. Samuel : Theory of Algebraic Numbers
Hermann Paris Houghton Mifflin
(1975)
5. W.J. Le Veque : Topics in Number Theory, Vols
I & II Addison Wesley Pub.
Co. Readings Mass (1961).
6. A. Hurwitz & N. Kritiko : Lectures on Number Theory
Springer Verlag, Universitext (1986)
7. H. Davenport : The higher arithmetic
Cambridge Univ. Press. Sixth Edn
(1992).
8. Kenneth H Rosen : Elementary Number Theory and
its applications
Addison Wesley Pub. Co. 3rd Edn
(1993)
9. G.H. Hardy & E.M. Wright : Introduction to the theory of
numbers
Oxford International Edn (1985)
10. D.P. Parent : Exercises in Number Theory
(Springer Verlag (Problem
Books in Math) 1984
11. Don Redmond : Number Theory
Monographs & Texts in Mathematics
No: 220
Marcel Dekker Inc (1994)

ELECTIVE 3. ALGEBRAIC NUMBER THEORY

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

No. of hours of Lectures/week : 3

UNIT I

1. Algebraic background
 2. Algebraic numbers
 3. Quadratic and cyclotomic fields
 4. Factorization into irreducibles (1)
- \$\$\$ (Chapter 1, Sections 1.4 to 1.6, Chapter 2, Sections 2.1 to 2.6.
\$\$\$ Chapter 3, Sections 3.1 and 3.2 & Chapter 4, Sections 4.1 to 4.3, from the text.

UNIT II

5. Factorization into irreducibles
- Examples of non-unique factorization into irreducible, Prime factorization, Euclidean domains, Euclidean quadratic fields.
Theorem 4.20 of the equation $y^2 + 4 = z^3$.
(Ramanujan - Nagell Theorem excluded)
6. Ideals
 7. Lattices:
 8. Minkowski's theorem:
- \$\$\$ (Chapter 4, Sections 4.4 4.7 and theorem 4.20 of sections 4.8.
Chapters 5, Sections 5.1 to 5.4
° Chapter 6, Sections 6.1 and 6.2 Chapter 7, Sections 7.1 to 7.3
from the text)

UNIT III

9. The Space L :
 10. Class-groups and class-number.
 11. Fermat's last theorem.
- Some history. Elementary considerations. Kummer's Lemma. (Kummer's theorem excluded)
12. Dirichlet's unit theorem:
- \$\$\$ (Chapter 8, Section 8.1, Chapter 9, Sections 9.1 to 9.5,
Chapter 11, Sections 11.1 to 11.3 &
\$\$\$ Chapter 12, Sections 12.1 to 12.4 from the text)

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. LFR, 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).

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ELECTIVE 4. ALGEBRAIC GEOMETRY

TEXT: KETH KENDIG, ELEMENTARY ALGEBRAIC GEOMETRY
 MTM 44, Springer Verlag, NY, (1977)

No. of hours of Lectures/week: 3

UNIT I

Examples of curves: Introduction. The topology of a few specific plane curves.

Intersecting curves. Curves over \mathbb{Q}

Plane curves: I. Projective spaces. Affine and projective varieties

Examples. Implicit mapping theorems. Some local structure of plane curves.

\$\$\$ (Chapter I, Sections 1 to 4 & Chapter II Sections 1 to 4, from the text).

UNIT II

Plane curves: II. Sphere coverings. The dimension theorem for plane curves. A Jacobian criterion for nonsingularity. Curves in $\mathbb{P}^2(\mathbb{C})$ one connected. Algebraic curves are orientable. The genus formula for nonsingular curves.

Commutative ring theory and algebraic geometry. I Introduction.

Some basic lattice theoretic properties of varieties and ideals.

The Hilbert Basis Theorem. Some basic decomposition theorems on ideals and varieties. The Nullstellensatz. statement and

consequences: Proof of the Nullstellensatz.

\$\$\$ (Chapter II, Sections 5 to 10 & Chapter III, Sections 1 to 6, from the text)

UNIT III

Commutative ring theory and algebraic geometry. II. Quotient rings and subvarieties. Isomorphic coordinate rings and varieties. Induced lattice properties of coordinate ring examples. Induced lattice properties of coordinate ring injections. Geometry of coordinate ring extensions.

Varieties of arbitrary dimension: Introduction. Dimension of arbitrary varieties. The dimension theorem.

\$\$\$ (Chapter III, Sections 7 to 11 & Chapter IV, Sections 1 to 3n from the text)

REFERENCES

1. W. Fulton : Algebraic curves, WA Benjamin Inc (1969)
2. R.J. Walker : Algebraic Curves
Springer Verlag, Reprint (1991)
3. F. Kirwan : Complex Algebraic Curves
LMS Student Texts No. 23 Cambridge Univ.
Press (1992).
4. O. Zariski and P. Samuel : Commutative Algebra, Vols 1 and 2.
Springer Verlag, NY (1976)
5. R. Hartshorne : Algebraic Geometry
GTM 52, Springer Verlag, NY (1977)
6. P. Kunz : Introduction to Commutative Algebra
and algebraic
Geometry
Springer Verlag, NY (1980)

ELECTIVE 5. ALGEBRAIC GEOMETRY -AN ALGORITHMIC APPROACH

TEXT . DAVID COX, JOHN LITTLE, DONALD O' SHEA

IDEALS, VARIETIES AND ALGORITHMS

UTM, Springer Verlag - NEW York - 1992.

No. of hours of Lectures/week : 3

UNIT I

Geometry, Algebra, and Algorithms

Polynomials and Affine Space, Affine Varieties, Parametrizations of Affine Varieties,

Ideals, Polynomials of One Variable.

Groebner Bases

Introduction, Problems, Orderings on the Monomials in $k(x_1, \dots, x_n)$ A Division Algorithm in $k[x_1, \dots, x_n]$ Monomial Ideals and as Dickson's Lemma, The Hilbert Basis

Theorem and Groebner Bases, Properties of Groebner Bases.

\$\$\$ (Chapter 1, and Sections 1 to 6 of Chapter 2, from the text)

UNIT II

Elimination Theory

The Elimination and Extension Theorems, The Geometry of Elimination, Implicitization Singular Points and Envelopes, Singular Points, Envelopes, Unique Factorization and Resultants, Irreducible Polynomials and Unique Factorization, Resultants, Resultants and the Extension Theorem.

The Algebra - Geometry Dictionary

Hilbert's Nullstellensatz, Radical Ideals and the Ideal-Variety

Correspondence, Sums, Products, and Intersections of Ideals,

Sums of Ideals, Products of Ideals, Intersections of Ideals,

Zariski Closure and Quotients of Ideals, Irreducible Varieties

and Prime Ideals Decomposition of a Variety into Irreducibles.

\$\$\$ (Chapter 3 and Sections 1 to 6 of Chapter 4, from the text)

UNIT III

Projective Algebraic Geometry

The Projective Plane, Projective Space and Projective Varieties,

The Projective Algebraic Geometry Dictionary, The Projective Closure

of an Affine Variety, Projective Elimination Theory, The Geometry

of Quadric Hypersurfaces.

The Dimension of a Variety.

The Variety of a Monomial Ideal, The Hilbert Function and the

Dimension of a Variety.

The Dimension of an Affine Variety, The Dimension of a Projective Variety.

\$\$\$ (Chapter 8 and sections 1 & 3 of Chapter 9, from the text)

REFERENCES

1. W. Fulton : Algebraic curves
WA Benjamin Inc (1969)
2. R.J. Walker : Algebraic Curves
Springer Verlag, NY, (Reprint), (1991)
3. F. Kirwan : Complex Algebraic Curves, I.MS
Student Text No.23, Cambridge
Univ. Press, (1992)
4. O. Zariski and P. Samuel: Commutative Algebra, Vols 1 and 2
Springer Verlag NY (1976)
5. R. Harshorne : Algebraic Geometry,
GTM 52, Springer Verlag, NY (1977)
6. R. Kunz : Introduction to Commutative Algebra
and Algebraic Geometry, Springer
verlag NY, (1980)
7. Keith Kendig : Elementary Algebraic Geometry
GTM 44, Springer Verlag, NY, (1997)

ELECTIVE 6. MEASURE AND INTEGRATION

TEXT: WALTER RUDIN; REAL AND COMPLEX ANALYSIS

(3rd Edn) McGraw- Hill International Edn.

New Delhi (1987)

No. of hours of Lectures/week: 3.

UNIT I

Abstract Integration: Set Theoretic notions and terminology, The Concept of measurability.

Simple functions: Elementary Properties of measures, Arithmetic in $(0, \infty)$ Integration of positive functions, Integrations of complex functions, The role played by sets of measure zero. L^p -Spaces: Convex functions and inequalities, The L^p spaces, Approximation by Continuous functions.

\$\$\$ (Chapter 1 and 3 from the text)

UNIT II

Positive Borel Measures: Vector spaces, Topological preliminaries, The Riesz Representation Theorem, 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^1

The Riesz representation Theorem.

\$\$\$ (Chapter 2 and 6 from the text)

UNIT III

Differentiation, Derivatives of measures, The fundamental theorem of Calculus, Differentiable transformations.

Integration of Product Spaces, Measurability on Cartesian Products, measures. **Product measures.**

The Fubini's Theorem, Completion of product measures, Convolutions.

\$\$\$ (Chapter 7 and 8, omitting 8.6 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
(1938) 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
Blaisdell Publishing Co NY (1965)
5. G. de Barra : Measure Theory and Integration
Wiley Eastern Ltd. Bangalore (1981)

ELECTIVE 7. ALGEBRAIC TOPOLOGY

TEXT: FRED H. GROOM: BASIC CONCEPTS OF ALGEBRAIC TOPOLOGY
WTM. Springer Verlag, NY (1978)

No. of hours of Lecture/Week : 3

UNIT I

Geometric Complexes and Polyhedra: Introduction, Examples.
Geometric Complexes and Polyhedra, Orientation of geometric complexes.

Simplicial Homology Groups: Chains, cycles, Boundaries and homology groups,

Examples of homology groups: The Structure of homology groups:
The Euler Poincare's *Theorem*.

The Pseudomanifolds and homology groups of S^n .

\$\$\$ (Chapter 1 Sections 1.1 to 1.4 & Chapter 2 sections 2.1 to 2.5 from the text)

UNIT II

The Fundamental Group: Introduction. Homotopic paths and the fundamental group.

The covering Homotopy property for S^n . Examples of fundamental groups. The relation between $H_1(K)$ and $\pi_1(K)$

Covering Spaces: The definition and some examples. Basic properties of covering spaces. Classification of covering spaces. Universal covering spaces. Applications \$\$\$ (Chapter 4 Sections 4.1 to 4.5 & Chapter 5 Sections 5.1 to 5.5 from the text)

UNIT III

Simplicial Approximation : Introduction, Simplicial approximation, Induced homomorphisms on the Homology groups, The Brouwer fixed point theorem and related results.

The Higher Homotopy Groups, Introduction, Equivalent definitions of $\pi_n(X, x_0)$. Basic properties and examples, Homotopy equivalence, Homotopy groups of spheres.

The relation between $H_n(K)$ and $\pi_n(K)$

\$\$\$ (Chapter 3 Sections 3.1 to 3.4 & Chapter 6 Sections 6.1 to 6.6 from the text)

REFERENCES

1. Eilenberg S and Steenrod N : Foundations of Algebraic Topology
Princeton Univ Press (1952)
2. S.T. Hu : Homology Theory
Holden-Day (1965)
3. S.T. Hu : Homotopy Theory
Academic Press (1959)
4. Massey W.S. : Algebraic Topology: An Introduction
Springer Verlag NY (1977)
5. C.T.C. Wall : A Geometric Introduction to Topology
Addison-Wesley Pub Co Reading Mass. (1972).

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ELECTIVE 8. CALCULUS OF VARIATIONS

TEXT: I. M. GELFAND & S.V. FOMIN. CALCULUS OF VARIATIONS
Prentice Hall Inc. N.Y (1963)

No. of hours of Lectures/week : 3

UNIT I

1. ELEMENTS OF THE THEORY: Functionals. Some simple variational problems. Function spaces. The variation of a functional. A necessary condition for an extremum. The simplest variational problem. Euler's equation. The case of several variables. A simple variable end-point problem. The variational derivative. Invariance of Euler's equation.

2. FURTHER GENERALIZATIONS: The fixed end -point problem for unknown functions. Variational problems in parametric forms. Functional depending on higher order derivatives. Variational problems with subsidiary conditions.

\$\$\$ (Chapters I and 2 (sections 1 to 12), from the text)

UNIT II

1. THE GENERAL VARIATION OF A FUNCTIONAL: The derivation of the basic formula. End-points lying on two given curves or Surfaces. Broken extremals. The Weierstrass-Eremann conditions.

2. THE CANONICAL FORM OF THE EULER EQUATIONS AND RELATED TOPICS: The canonical form of Euler equations. The Legendra transformations. Canonical transformations. Noethre's theorem. The Principal of least action. Conservation laws. The Hamilton-Jacobi equation. Jacobi's theorem.

3. THE SECOND VARIATION: SUFFICIENT CONDITION FOR A WEAK EXTREMUM. Quadratic functionals. Second variation of functional. The formula for second variation. Legendre's condition Analysis of the quadratic functional $\int (P_2^2 + Q_2^2) dx$ Jacobi's necessary condition More an Conjugate points. Sufficient condition for a weak. Extremum. Generalization to a unknown fuctionsk. Connection between Jacobi's condition and the theory of quadratic forms.

\$\$\$ (Chapters 3,4 and 5 (sections 13 to 30), from the text)

UNIT III

1. FIELDS, SUFFICIENT CONDITIONS FOR A STRONG EXTREMUM. Consistent boundary conditions. General definition of a field. The field of a Functional. Hilbert's invariant integral. The Weiersterase E-Function. Sufficient conditions for strong extremum.

2. VARIATIONAL PROBLEMS INVOLVING MULTIPLE INTEGRALS: Variation of a functional defined on a fixed region. Variational derivation of Equations of motion of continuum mechanical systems. Variation of functional defined on a variable region. Applications to Field theory.

\$\$\$ (Chapters 6 and 7 (sections 31 to 38), from the text.

REFERENCES

| | | |
|-------------------------------|---|--|
| 1. Bliss G.A | : | Calculus of Variations Open Court Pub. Co. Chicago (1925) |
| 2. Bliss G.A. | : | Lectures on Calculus of Variations Univ. of Chicago Press, Chicago (1945) |
| 3. Bolza O. | : | Lectures on Calculus of Variations G.E. Stechart & Co. NY (1931) |
| 4. Courant R and Hilbert D | : | Methods of Mathematical Physics, Vol I Wiley Eastern, Reprint. (1975) |
| 5. Elsgoltz L | : | Differential Equations and the Calculus of variations MIR Publishers, Moscow (1973) |
| 6. Goursat E. | : | Course d' Analyse Paris (1910,1911) |
| 7. Morse M. | : | The Calculus of Variations in the large Amer Math Soc (1934) |

No. of hours of Lectures/week: 3

UNIT I

1. EQUATION OF MOTION: Differentiation following the fluid equation of continuity. Boundary conditions, Equation of motion of an inviscid fluid, Conservative forces, Steady motion, The energy equation, Rate of change of circulation, Constancy of circulation: Vortex motion, Permanence of vorticity, Irrotational motion, Pressure equation, Connectivity, A cyclic and cyclical rotational motion, Kinetic energy of liquid, Kelvin's minimum energy theorem, Meanvalue of the velocity potential Kinetic energy of infinite liquid.

2. TWO - DIMENSIONAL MOTION: Motion in two- dimension-Intrinsic expression for the vorticity, Rate of change of vorticity Intrinsic equations of steady motion, Stream function, Velocity derived from stream function, Rankin'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 and IV, from the text)

UNIT II

1. STREAMING MOTION: Complex potential, Complex vorticity, Stagnation points, Speed-Flow through an aperture, Circulation about an elliptic cylinder. The circle theorem, Streaming motion past a circular cylinder, The dividing stream line, Pressure distribution on the cylinder, Cavitation, Rigid boundaries and circle theorem, Theorem of Blasius.

2. TWO-DIMENSIONAL SOURCES; NO SINKS: Two dimensional source, complex potential for a simple source-combination of sources and streams: Source and sink of equal strength, Doublet, Source and equal sink in a stream: The method of images: Effect on a wall of a source parallel to the wall. Image of a doublet in plane, source in a source outside a circular cylinder. The lines system for a source outside a circular cylinder. The force exerted on a circular cylinder by a source. Source and sink outside a circular cylinder. The image of a doublet in a circular cylinder. The force on a cylinder due to a doublet. in conformal transformation.

\$\$\$ (Chapter VI and VIII, from the text)

UNIT III

1. AEROFOILS: Circulation about a circular cylinder, Streaming and circulation about a Circular cylinder. The aerofoil, Geometrical construction for Joukowski transformation, Theorems of Kutta and Joukowski.

2. STOKES'S STREAM FUNCTION: Stokes stream function: Simple source, Uniform stream, Source in a uniform stream, Finiteline source, Airship form source and equal sink, Doublet Rankin's solid, sphere theorem, Sphere in a stream.

\$\$\$ (Chapters VII and XVI, from the text)

REFERENCES

1. Von Mises and K.O. Friedrichs : Fluid Dynamics
Springer International Edition
Reprint, (1998)
2. James EA John : Introduction to Fluid Mechanics
(2nd Edn)
Prentice Hall of India, Delhi,
(1983), Reprint.
William L Haberman.
3. F. Chrolten : Fluid Dynamics
John Wiley & Sons (1975)

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ELECTIVE 10. OPERATIONS RESEARCH

TEXT: K.V. MITAL: OPTIMIZATION METHODS IN OPERATIONS
RESEARCH AND SYSTEMS ANALYSIS
(2nd Edn) Wiley Eastern (P) Ltd, Delhi

No. of hours of Lecture/week: 3

UNIT I

A quick review of the topics: Euclidean space, Linear algebraic equations, Convex sets and quadratic forms.

(No. questions will be asked from the above topics)

1. EXTREMA OF FUNCTIONS: Taylor series, Limitations of the method of Differential Calculus, Constrained extrema, Method of Lagrange multipliers, Convex functions, General problem of mathematical programming.
2. LINEAR PROGRAMMING: LP in two-dimensions, General LP problem, Feasible, basic and optimal solutions, Simplex method, Degeneracy, Revised simplex method, Sensitivity Analysis and parametric LP.
3. TRANSPORTATION PROBLEM: The transportation problem, Loosely in transportation array, Degeneracy, Unbalanced problem, Transportation with transshipment, Caterer problem, Assignment problem, Generalized transportation problem.

UNIT II

1. FLOW AND NETWORK: Flow and potential in networks, Graphs, Minimum path problem, Problem of minimum potential difference, scheduling of sequential activities. Maximum flow problem and duality in it, Generalized problem of maximum flow.
2. INTEGER PROGRAMMING: ILP in 2 dimensional space, General ILP and ~~ILP~~ problems, Cutting plane methods, Branch and bound method, The D-I variable,
3. QUADRATIC PROGRAMMING: Kuhn-Tucker Theory and quadratic programming. Kuhn-Tucker conditions, Primal and dual problems.

UNIT III

1. GEOMETRIC PROGRAMMING: General method, Generalization through Kuhn-Tucker theory, Extension to negative terms.
2. DYNAMIC PROGRAMMING: A minimum path problem Single additive (multiplicative)/separable return, Computational economy in DP. Serial multistage model, Examples of failure, Decomposition, Backward and forward recursion, More than one constraint: Application to continuous systems.
3. THEORY OF GAMES: Matrix games, Minimax theorem; Saddle point; Strategies and pay off, Theory of matrix games, Graphical solution, Dominance, Rectangular game as an LP problem.

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 application
(2nd Edn) Wiley Eastern (P) Ltd,
New Delhi.
4. Füssel L Ackoff and Maurice W. Sasioni : Fundamentals of operation research
Wiley Eastern Ltd, New Delhi, (1991)
5. Charles S. Beightler, D.T. Phillips & 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)

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* Additively (multiplicatively)

ELECTIVE 11. PROBABILITY THEORY

TEXT B. R. BHAT: MODERN PROBABILITY THEORY

(2nd Edn.) Wiley Eastern Limited, Delhi (1988)

No. of hours of Lectures/week: 3

UNIT I

1. SETS AND CLASSES OF EVENTS: 1) The event 2) Algebra of sets
3. Fields and ~~o~~-fields 4) Class of events.
2. RANDOM VARIABLES: 1) Functions and inverse functions
- 2) Random variables 3. Limits of random variables.
- 3) PROBABILITY SPACE: 1) Definition of probability 2) Some simple properties 3) Discrete probability space 4) General Probability space 5) Induced probability space 4
4. DISTRIBUTION FUNCTIONS: Distribution function of a random variable
- 2) Decomposition of D.F. 3) Distribution functions of vector random variables. 4) Correspondence theorem.

\$\$\$ (Chapters 1 to 4 from the text)

UNIT II

1. EXPECTATION AND MOMENTS: 1) Definition of expectation
- 2) Properties of expectation 3) Moments, inequalities.
2. CONVERGENCE OF RANDOM VARIABLES: 1) Convergence in probability
- 2) Convergence almost surely 3) Convergence in Distribution
- 4) Convergence in rth mean. 5) Convergence theorems for expectations 6) Fubini's theorem.
- 3) CHARACTERISTIC FUNCTIONS: 1) Definition and simple properties
- 2) Some more properties 3) Inversion formula 4) Characteristic functions and moments 5) Bochner's theorem.
4. CONVERGENCE OF DISTRIBUTION FUNCTIONS: 1) Weak convergence
- 2) Convergence of distribution functions and characteristic functions 3) Convergence of moments.

\$\$\$ (Chapters 5 to 8 from the text)

UNIT III

1. INDEPENDENCE: Definition 2) Multiplication properties
- 3) Zero-one law.
2. LAWS OF LARGE NUMBERS: Convergence of a series of independent random variables 2) Kolmogorov Inequalities and A.S. Convergence
- 3) Stability of independent R.V.'s.
3. GENERAL LIMIT THEOREM: 1) Introduction 2) IID Case
- 3) Variable distributions
4. CONDITIONING: Radon-Nikodym Theorem 2) Conditional expectation
- 3) Properties of conditional expectation.

\$\$\$ (Chapters 9, 10, 11 (sections 11.1 to 11.3) & Chapter 12 (sections 12.1 to 12.3))

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).

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ELECTIVE 12. linear integral equations

TEXT: MIKHLIN, S.G. LINEAR INTEGRAL EQUATIONS
Hindustan Pub. Corporation, Delhi (1960)

No. of hours of Lectures/week : 3.

UNIT I

Fredholm Equations.

Concept of Integral equations - Scalar product and norm - Orthogonality
Fredholm operator and its degree. Iterated Kernel- Method of
successive.

Approximations - Volterra equations - Abel equations- Concept
of resolvent- Systems of linear algebraic equations - Integral
equations with degenerate kernels - General case of Fredholm
equations - Conjugate Fredholm equation.

Fredholm theorems.

\$\$\$ (Chapter 1-Sections 1 to 12 from the text)

UNIT II

Continuation of Fredholm Equations.

Resolvent- Continuous solutions of Integral equations

Systems of Integral equations - Examples of non-Fredholm integral
equations - Riesz Schauder Equations. Extension of Fredholm
theorems.

Symmetric Kernels - Fundamental theorems on symmetric equations.

Theorem on existence of a Characteristic constants - Hilbert

Schmidt theorem - Solutions of symmetric Integral equations.

\$\$\$ (Chapter 1-Sections 13,16,17, 18, Chapter II - All sections,
and Chapter III- Sections 24,25,26,27 28 from the text.

UNIT III

Bilinear series - Bilinear series for iterated kernel - Resolvent
of a symmetric kernel - Extremal properties of characteristic
constants and proper functions.

Applications of integral equations.

Boundary value problem for an ordinary differential equation -

Characteristic constants and proper functions of an ordinary

differential equations - Proof of the Fourier method.

\$\$\$ (Chapter III - sections 29,30,31,32 and Chapter IV- Sections
38,39, 40 from the text)

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- 4 Fundamental concepts of operators - Method of successive approximations for Equations with conjugate bounded operators.
(Completely continuous operators-Solution of Riesz-Schander equations *