

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

NOORUL ISLAM UNIVERSITY

DEPARTMENT OF MATHEMATICS

M.PHIL. MATHEMATICS

CURRICULUM & SYLLABUS

SEMESTER - I

SL. No.	SUBJECT CODE	SUBJECT	L	T	P	C
THEORY						
1.	MA401	Research Methodology in Mathematics	4	1	0	5
2.	MA402	Advances in Pure Mathematics	4	1	0	5
3.	GE401	Teaching Methodology	4	1	0	5
TOTAL			12	3	0	15

MA401 RESEARCH METHODOLOGY IN MATHEMATICS 4 1 0 5**Objectives:**

- To get prior idea on preparing research articles and dissertation in Mathematics.
- To develop enough skills in LATEX so that students themselves able to prepare articles and dissertation in Mathematics.
- To develop enough skills in MATLAB so that students themselves able to compute the values using the formulae.

Unit- I: Thesis Format

Theses and dissertations-Defining the problem-Limiting the problem – Consulting source material – preparing a working bibliography.

Selecting a topic-The chapter outline - -the preliminaries of the general format – page and chapter format – chapter divisions and subdivisions – spacing – pagination – margins – paragraphs indentation

Unit-II: Research Literature

Research in Mathematics - Proof techniques (Proof by induction, proof by contradiction and constructive proof only) – Mathematical Journals – AMS subject classification 2010(primary and secondary. Main subjects only) - Impact factor- H Factor-citation index- SCOPUS-search engines.

Unit-III: LaTeX

Document class- Page style - Parts of the document- Table of contents- changing font- centering and intending- Theorem like declarations- Tables- Mathematical environments- Mathematical symbols and Bibliographies.

Unit-IV: MATLAB

Programming in MATLAB – Polynomials, Curve Fitting and Interpolation - Applications in Numerical Analysis- Solving equation with one variable-Maxima or Minima of a function, Numerical Integration and Ordinary Differential Equation.

Unit-V: Self study and usage of English in Mathematics

1. The meaning of first thirty words/mathematical concepts starting with each English alphabet that are explained in the book James and James, Mathematics dictionary, 4 edition, CBS publishers and distributors ,2000.
2. Principle of self study of Mathematics as given in the Introduction in the book, William Massey, ‘ Algebraic Topology: An introduction’, Springer Verlag 1977.
3. Principles of self study and problem solving in the full book, George Polya, ‘How to Solve it’, Second edition, Prentice Hall of India, New Delhi, 110001, 2005
4. Proper language for writing research paper, Douglas West” The Grammar according to West”.

TEXT BOOKS

Unit-I:

Thesis and Assignment Writing

Jonathan Anderson, Berray H.Durston, Millicant Poole.

Chapter 1(pages 4 – 5)

Chapter 2(pages 8 – 12)

Chapter 3(pages 15 – 17 & 21 - 22)

Chapter 5(pages 35 – 47)

Chapter 6(pages 53 – 57).

Unit-II: Refer respective website addresses

1. Mathematical Journals (National and International)
2. DOAJ (doaj.org)
3. Digital Library of Sciences (gallup.unm.edu)
4. AMS subject classification (ams.org)
5. Google search engines (main and scholar).
6. For Proof Techniques refer ‘ Discrete Mathematics Proof Techniques & Mathematical Structures – R. C. Fenner’.

Unit-III:

“A Guide to Latex and Electronic”, 4th edition – Helmet Kopka and

Patrick.W.Daly,Addison- Wesly Longman Limited,2004

Section 3.1,3.2,3.3,3.4

Section 4.1,4.2,4.5,4.8

Section 5.1, 5.3 and 9.3

Unit-IV:

Amos Gilat, MATLAB An Introduction with Applications, John wiley & sons, 2004.

Unit II – Chapters 8 and 9

MA402

ADVANCES IN PURE MATHEMATICS

4 1 0 5

Objectives:

- To equip the students with the advanced Research topics in pure Mathematics.
- To get comprehensive idea on the recent trends in the topics of Algebra and Analysis.

Unit I

Exact sequences on modules – Tensor product of modules – Exactness of the tensor product – Chain conditions.

Unit II

Noetherian rings – Primary decomposition in Noetherian rings - Artinian rings.

Unit III L^p Spaces

Convex Functions and Inequalities – Jensen’s Inequality – Holder’s & Minkowski’s Inequalities – The L^p Spaces – Completeness – Approximation by continuous functions.

Unit IV Hilbert Spaces

Inner products and Linear Functionals – The Schwartz inequality – The Triangle Inequality – Hilbert space – Subspaces – Orthogonality – Orthonormal sets - Bessels inequality – The Riesz – Fisher Theorem - The Hausdroff Maximal Theorem.

Unit V Banach Spaces

Banach Spaces – Baire’s Theorem – The Banach – Steinhaus Theorem – The Open mapping Theorem – Fourier series of Continuous Function – Fourier Coefficients of L^1 – Sinchens – The Hahn – Banach Theorem.

Text Books :

1. “Introduction to Commutative Algebra” by M.F.Atiyah and I.G.Macdonald , Addison – Wesley Publication Company, 1969. (Units I & II)

2. “Real and Complex Analysis (3rd edition)”, Walter Rudin, McGraw-Hill International Editions, New Delhi, 1987. (Units III to V)

Unit I : Chapter 2 (Pages 22-29)

Chapter 6

Unit II : Chapters 7 and 8

Unit III : Chapter 3

Unit IV : Chapter 4 (except 4.23, 4.24, 4.25, 4.26)

Unit V : Chapter 5 (except 5.22 to 5.25)

Reference:

“Commutative Algebra”, Gopalakrishnan N.S, Oxonian Press Pvt. Ltd. New Delhi 1984.

GE401

TEACHING METHODOLOGY

4 1 0 5

OBJECTIVES

1. To understand the concepts and Practices of Teaching Methodology in Higher Education
2. To understand the Concept and Practices of Educational Psychology
3. To develop the awareness in modern teaching practices and evaluation
4. To provide systematic knowledge about motivation and emotion

UNIT - I**15**

Higher Education - Teaching Technology: Objectives and Role of Higher Education- Learning and Learning Hierarchy - Information Processing – Learning Events and Outcomes. Teaching Technology - Meaning, concept and scope – Instructional Designs: Objectives based, Skill based, Competency based, Learning style based and Model based Large Group Techniques: Lecture, Modified Lecture, Panel Discussion, Team Teaching, Project Approach and Workshop – Simulation, Role Playing, Brain Storming, Case formulation, analysis and Discussion. Concept of Micro – teaching - Steps - Micro-teaching Cycle - Rationale of Micro-teaching Procedure - Phase of Micro-teaching.

UNIT – II**10**

Educational Evaluation: Methods of Evaluation -Self Evaluation – Analysis of Teaching- Identification of Teaching Skills - Core Teaching Skills-Teaching Skills and their Specification-Teacher Evaluation- Methods. The measurement and evaluation process - concept - scope and need - Basics - characteristics of good measuring instruments - validity - Objectivity - reliability usability and norms. Models in educational evaluation - 3d model - total reflection model and individual judgment model. - scores and methods of feed back to students - new trends in evaluation.

UNIT –III**10**

Educational Psychology : Meaning and Definition - modern psychology - Study of psychology: Structuralism, Functionalism, and Behaviorism. - Branches of Psychology - Educational Psychology -Concepts, Nature and Scope - Importance of Educational Psychology for the Teacher. Key perspectives in psychology: The facets of behavior - New trends in psychology - Research methods in psychology: Observation, Correlation and the Experimental method - Ethical issues in psychological research. Group Dynamics- Competition and Co-operation – Group Behaviour- Leadership Traits – Classroom Climate.

UNIT – IV**15**

Motivation and Emotion : Motivation and Learning - Functions of Motives - Kinds of Motives - Theories of Motivation - Hull's Drive education, Maslow's Hierarchy of Needs, Achievement - Motivation - Carl Rogers: self theory – McClelland: Achievement Motivation - Components - Fear of Failure and Hope of Success - Motivation in the classroom context - Praise and Blame, Rewards and Punishments - Feedback / Knowledge of

Results - Level of Aspiration - Achievement Motivation - Emotions, Expression and Impact - Relationship between emotion and cognition. - Levels of aspiration and its psychological implications.

UNIT – V

10

ICT Enabled Teaching – Meaning and Scope. Electronic Media in Education: Concept, Selection, Use and Variety-e-Learning Resources: e-Learning, e-books, e-journals etc-Web-based Learning: Access and Teaching Issues. Conducting lessons using interactive whiteboards / Electronic Board – conducting an online class / online discussion - virtual Classroom – Video conferencing – Building Animation Tools

TOTAL HOURS: 60

REFERENCE BOOKS:

1. Aggarwal.J.C. (2008) Essentials of Educational Psychology (2nd Edition) Vikas Publishing House Pvt. Ltd., New Delhi.
2. Baron A. Robert (2000) Psychology. Prentice-Hall of India, New Delhi.
3. Chauhan. S. S. (2007) Advanced Educational Psychology (7th Edition), Vikas Publishing House Pvt. Ltd. New Delhi.
4. Dennis Child (1973) Psychology and the Teacher. Holt Rinehart and Winston, New York.
5. Hurlock B. Elizabeth (1980) Adolescent Development. Tata McGraw Hill, New Delhi.
6. Hurlock B.Elizabeth (1980) Developmental Psychology. Tata McGraw Hill, New Delhi.
7. John.W.Santrock (2006) Educational Psychology, Mc graw-hill Higher Education, New Delhi.
8. Mangal. S. K (2007) Advanced Educational Psychology (2nd Edition), Prentice-Hall of India Pvt. Ltd., New Delhi
9. Vedanayagam, E.G. (1989) Teaching Technology for College Teachers. New Delhi: Sterling Publishers (p) Ltd.
10. Rajasekar, S. (2005) Computer Education and Educational Computing, Hyderabad: Neelkamal Publications.
11. Kumar, K. L. (1997) Educational Technology, New Delhi: New Age International (p) Ltd.
12. SampathKumar, K. Paneerselvam, A and Santhanam, S. (1990) Introduction to Educational Technology, New Delhi: Sterling Publishers (Pvt) Ltd.
13. Tony Bates, A.W. (2005) Technology, e-Learning and Distance Education, New York: Routledge.

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CURRICULUM & SYLLABUS

SEMESTER - II

SL. No.	SUBJECT CODE	SUBJECT	L	T	P	C
THEORY						
1.	XxEx1	ELECTIVE – 1 (Advances in Applied Mathematics/ Optimization Techniques/ Stochastic Models in Queuing Theory/ Advanced Graph Theory)	4	1	0	5
PROJECT						
2.	MA4P1	Dissertation	0	0	30	15
TOTAL			4	1	30	20

ELECTIVE PAPERS

MA4A1 ADVANCES IN APPLIED MATHEMATICS 4 1 0 5

Objectives:

- To motivate the students to do research in the field of interest.
- To impart the recent topics in Graph theory, Stochastic Processes and Fuzzy Algebra.

Unit I Perfect Graphs

Perfect graph Theorem-Chordal Graphs- Other classes of perfect graphs- Imperfect graph- The Strong perfect graph conjecture.

Unit II Eigenvalues of Graphs

Characteristic polynomial- Linear algebra of real symmetric matrices- Eigen values and graph parameters- eigen values of a regular graphs- Eigen values of expanders – Strongly regular graphs

Unit III Markov Chains

Definitions and Examples, Higher Transition Probabilities, Sequences of Chain Dependent Trails, Classification of States and Chains, Determination of Higher Transition Probabilities, Stability of a Markov System, Graph Theoretic Approach.

Unit IV Markov Processes with Discrete State Space

Poisson Process and its Extensions. Poisson Process, Poisson Process and Related Distributions, Generalizations of Poisson Process, Birth and Death process, Markov Processes with Discrete State Space.

Unit V Fuzzy Algebra

Fuzzy sets – Standard operators on fuzzy sets –Fuzzy subgroups – Fuzzy subgroup generated by a fuzzy set – Fuzzy normal subgroups – Fuzzy ideals – Fuzzy ideal generated by a fuzzy subset – Fuzzy ideals and Fuzzy cosets.

Text Books:

- 1) **Introduction to Graph Theory** - D.B.West , 2nd edition, Prentice Hall of India 2005,
Unit I Section 8.1 , Unit II Section 8.6
- 2) **Stochastic Processes**- J. Medhi, 3rd Edition, New Age International (P) Limited
Publishers,2009.
Unit III Chapter II - 2.1 to 2.7 , Unit IV Chapter III - 3.1 to 3.5.
- 3) **Fuzzy sets and fuzzy logic** – Geroge J. Klir, Bo Yuan, Prentice Hall of India-2008.
- 4) **Fuzzy Algebra**, Rajesh Kumar, University of Delhi, Publication division.
First Edition – July 1993
Unit V In book 3, Chapter 2.
In book 4, Chapter 2 Sections 2.2 & 2.3,
Chapter 3 Sections 3.1, 3.2, 3.3, 3.4, 3.5.

Reference Book:

Samuel Karlin and Howard Taylor ,”First Course in Stochastic Processes”,Academic Press.

MA4A2

OPTIMIZATION TECHNIQUES

4 1 0 5

Objectives

- To gain a well found knowledge of optimizing a function and variational problems
- To solve initial and boundary value problems using integral transforms.
- To optimize a linear or nonlinear objective function with system of equalities and inequalities over a set of unknown real variables where some of the constraints are nonlinear.

Unit I Dynamic Programming

Bellman's principle of optimality – Characteristics of the dynamic programming model – The recursive equation approach – Solution of discrete dynamic programming problem.

Unit II Game Theory and Decision Theory

Two person zero sum games – Saddle point – Dominance rule – Graphical solution. Decision making under risk – Decision tree – Decision under uncertainty. Simulation technique for decision making.

Unit III Calculus of Variations

Euler's equation – Functional dependent on first and higher order derivatives – Functional dependent on functions of several independent variables —Simple applications: Rayley Ritz Method and Isoperimetric Problems.

Unit IV Boundary Value Problems using Integral Transforms

One dimensional wave equation, diffusion equation- Solution by Laplace and Fourier transform methods.

Unit V Nonlinear Programming.

Unconstrained Extremal Problems – Constrained Extremal Problems – Nonlinear Programming Algorithm – Unconstrained Nonlinear Algorithms – Constrained Nonlinear Algorithms

Text Books:

1. H.A.Taha, "Operations Research - An Introduction" (Fifth Edition - 1996), Prentice Hall of India (P) Limited, New Delhi
(Unit I - Chapter – 10, Unit II - Chapter – 12, Unit V - Chapter –19& Chapter-20.)
2. Sankara Rao, K., "Introduction to Partial Differential Equations", Prentice-Hall of India (Unit IV)
3. Gupta, A.S., "Calculus of Variations with Applications", Prentice-Hall of India, New Delhi (Unit III)

Reference Books:

1. D. Phillips, A. Ravindran, Solberg, Operations Research: Principals and Practice, John Wiley & Sons (1976).

2. Dr.Venkataraman, M.K., “ Higher Mathematics for Engineering and Science”, National Publishing Company.,1992.
3. S.S.Rao, Engineering Optimization, (3rd Edition, 1996), New Age International (p) Ltd, New Delhi.

MA4A3 STOCHASTIC MODELS IN QUEUEING THEORY 4 1 0 5

Objectives:

- To develop an understanding of queuing systems under different configurations.
- To develop skills in analysing and interpreting the results.
- To master essential stochastic modelling tools including Markov chains and queuing theory
- To formulate and solve queuing problems which involve setting up stochastic models

Unit I

Steady state solution for M/M/1 model - Measures of effectiveness - Waiting Time distributions - Little's formula - Finite system capacity - Queues with truncation (M/M/1/K) - Transient behaviour - Busy period analysis.

Unit II

Birth-Death Processes - Queues with parallel channels (M/M/C) - Queues with parallel channels and Truncation (M/M/C/K) - Erlang's formula (M/M/C/C).

Unit III

Queues with Unlimited Service (M/M/) - Steady state results - Transient analysis - Finite source Queues - State dependent Service - Queues with impatience - M/M/1 Balking - M/M1 Reneging.

Unit IV

Bulk Input ($M^x/M/1$) - Bulk Service ($M/M^y/1$) Erlangian Models ($M/E_k/1$ and $E_k/M/1$)

Unit V

Single Server Queues with Poisson Input and General Service (M/G/1) - Measures of effectiveness - Steady system size probabilities - Special Cases ($M/E_k/1$ and M/D/1)

Text Book:

Donald Gross and Carl M. Harris, Fundamentals of Queueing Theory, John Wiley & Sons, New York.

Unit I & II - Sec 3.1 to 3.4; Unit III - Sec 3.5 to 3.8;

Unit IV - Sec 4.1 to 4.3.2.; Unit V - Sec 5.1.1 to 5.1.5

Reference Book:

H.A.Taha, “Operations Research - An Introduction” (Fifth Edition - 1996) Prentice Hall of India (P) Limited, New Delhi, 1996.

MA4A4

ADVANCED GRAPH THEORY

4 1 0 5

OBJECTIVES:

- To motivate the students to do research in the field of Graph Theory.
- To introduce graphs as a powerful modeling tool that can be used to solve practical problems in various fields. To achieve this goal, the course introduces the main concepts such as Ramsey numbers, Perfect graphs and Eigenvalues.

UNIT I HAMILTONIAN CYCLES

Necessary conditions, sufficient conditions, Cycles in directed graphs.

UNIT II PERFECT GRAPHS

The perfect graph Theorem, Chordal Graphs Revisited, other classes of perfect graphs, Imperfect graphs.

UNIT III RAMSEY THEORY

The Pigeonhole principle revisited, Ramsey's Theorem, Ramsey Numbers, Graph Ramsey theory.

UNIT IV RANDOM GRAPHS

Existence and Expectation, Properties of Almost All Graphs, Threshold Functions, Evaluation and graph Parameters, connectivity, cliques.

UNIT V EIGENVALUES OF GRAPHS

The Characteristic polynomial, Linear algebra of real symmetric Matrices, Eigenvalues and graph parameters, Eigenvalues of regular graphs.

TEXT BOOK:

Introduction to Graph Theory, D.B. West, 2nd edition, Prentice Hall of India, 2005.

Unit I : Section 7.3

Unit II : Section 8.1

Unit III : Section 8.3

Unit IV : Section 8.5

Unit V : Section 8.6