Mathematics Department Topics for Qualification Exam

MSc Level Candidates 2023-2024

1. Abstract Algebra

Course Program:

Groups

Group (Definition, Properties, Examples) Group of integers modulo n Congruent modulo n (Definition, Properties) Cyclic group (Definition, Properties) Finite group (Definition, Examples) Permutation mapping (Definition, Examples)

Subgroups

Subgroup (Definition, Properties, Examples) Center of a group (Definition, Properties) Order of an element of a group Groups of cosets (Definition, Properties) Index of a subgroup Lagrange Theorem Non-trivial subgroup

Normal Subgroups and Quotient Groups

Normal subgroup (Definition, Properties) Quotient Groups (Definition, Properties) Normalizer subgroup (Definition, Properties) Commutator subgroup (Definition, Properties) Simple groups

Introduction to Rings

Definition and Examples of Rings Certain Elementary Theorems on Rings Some Special Types of Rings Definition of Field with Example Definition of Division Ring with Example Definition of Characteristic of a Ring 3

Subring and Ideals

Definition of Subring with Examples Definition of Ideals with Examples Properties of Subrings and Ideals The Sum of Two Ideals The Multiplication of Two Ideals Principal Ideals Simple Ring Idempotent and Nilpotent Elements of a Ring Centre of a Ring Radical Ideals

References

- [1] McCoy N. H. and Berger T. R., Algebra: Groups, Rings and Other Topics, Allyn and Bacon, Inc. Boston London Sydney Toronto, 1977.
- [2] Fraleigh J. B., A first Course in Abstract Algebra, ADDISON-WESLEY PUBLISHING COMPANY, 1982.
- [3] Herstei I. N., Topics in Algebra, JOHN WILEY & SONS New York Chichester Brisbane Toronto Singapore, 1975.
- [4] Allenby R B J T, Rings, Fields and Groups, Edward Arnold, 1983.
- Dummit D. S. and Foote R. M., Abstrat Algebra, John Wiley & Sons, Inc., 2003.
- [5] Singh S. and Zameeruddin Q., Modern Algebra, VIKAS PUBLISHING HOUSE PVT LTD, 1972.
- [6] Durbin J. R., Modern Algebra, JOHN WILEY & SONS
- New York Chichester Brisbane Toronto Singapore, 1985.
- [7] Gallian J. A., Contemporary Abstract Algebra, HOUGHTON MIFFLIN COMPANY, 1998.

2. Calculus

Calculus

- Functions
- Limits and Continuity
- Differentiation
- Application of Derivatives
- Integration
- Application of Definite Integrals
- Transcendental Functions
- Techniques of Integration

From THOMAS' CALCULUS, 12th Edition, to get this book and the books in the references use the following link:

https://drive.google.com/drive/folders/14wrqK7MyAsbHTfOmCLYvRo49kn-UpZd3?usp=share_link

References:

- [1] Heinbockel, J. H., Introduction to Calculus, Volume I, Copyright 2012 by John H. Heinbockel All rights reserved
- [2] JAMES STEWART, J., CLEGG, A. and WATSON, S., Calculus: Early Transcendentals, Ninth Edition, 2021, Cengage Learning, Inc

3. Introduction to Mathematical Statistics

Introduction to Mathematical Statistics:

- Statistics and Probability Theory;
- Discrete and Continuous Random Variables and their Distribution Functions;
- Some Special Distribution Functions:

Binomial; Poisson; Normal; Exponential; Gamma Distribution Functions and their

Means and Variances;

• Finding Distribution Functions for R.V.s using:

Transformation of Variables; Moments and Moment Generating Function

Technique;

• Finding Distribution Functions for R.Vs using:

Transformation of Variables;

Moment Generating Function Technique;

Order Statistics;

• Sampling Distribution; Distribution Function for Mean and Variance; the Central Limit Theorem.

Point Estimation: Maximum Likelihood Estimation; Moment Method

Interval Estimation; Properties for good Estimator; The Roa Crammer Inequality

• Statistical hypotheses.

References:

[1] Hogg, R., McKean, J. and Graig, A. (2019), Introduction to Mathematical Statistics, Pearson Education, Inc. 8th edition, New York.

[2] J. K. WANI, (1971), Probability and Statistical Inference, Meredith Corporation, 440 Park Avenus south, New York.

4. Linear Algebra

Contents:

- 1. Vector Spaces and subspaces
- 2. Spanning Sets, Linear Independence and Bases
- 3. Dimension and Direct Sum
- 4. Linear Transformation.

References:

- [1] Kolman, B., Introductory Linear Algebra with Applications, 2nd edition, Macmillan Publishing Co., Inc. Nyw York, 1980.
- [2] Kolman,_B. and Hill, D., Elementary Linear Algebra, 9th edition, Pearson Education, Inc, 2008.

5. Ordinary Differential Equations

- 1. Elimination of essential constants
- 2. Equations of first order and first degree
- 3. The equation is of first order and of second or higher degree
- 4. Linear differential equations with constant coefficients

References

[1] Schaum's: 2500 solved problem in Differential Equations. By Richard Bronson.

- [2] Applied Differential Equations. By Murray R. Spoegel.
- [3] Elementary Differential Equations. By Earl D. Rainvlle and Philip E. Bedient.