NEP: UGCF 2022

B.Sc. (Hons.) Mathematics

Syllabi and *Books* for Discipline-Specific Core Courses

Semester-I

Syllabi (Source File):
15092023_Maths_NEP.pdf

(From Page 1)

(The books are hosted on **GitHub** and **Drive**)

Depending on the features of the cited PDF file, either the PDF viewer or the Browser may be invoked.

DSC-I
ALGEBRA

Unit-I **Theory of Equations and Complex Numbers**

♦ General properties of polynomials and equations ♦ Fundamental theorem of algebra
♦ Relations between the roots and the coefficients ♦ Upper bounds for the real roots
♦ Theorems on imaginary, integral and rational roots ♦ Newton's method for integral roots
♦ Descartes' rule of signs ♦ DeMoivre's theorem for integer and rational indices and their applications
♦ The n^{th} roots of unity ♦ Cardan's solution of the cubic
♦ Descartes' solution of the quartic equation

Unit-II **Basic Number Theory**

♦ Division algorithm in $\mathbb{Z}$ ♦ Divisibility and the Euclidean algorithm
♦ Fundamental theorem of arithmetic ♦ Modular arithmetic and basic properties of congruences

Unit-III **Basics of Group Theory**

♦ Groups, Basic properties ♦ Symmetries of a square, Dihedral group
♦ Order of a group, Order of an element ♦ Subgroups ♦ Center of a group
♦ Centralizer of an element ♦ Cyclic groups and properties ♦ Generators of a cyclic group
♦ Classification of subgroups of cyclic groups

Essential Readings

1. Andreescu, Titu & Andrica, D. (2014) - Complex Numbers from A to ...Z (2nd Edition) - Birkhäuser
   View/Download (3.27 MB)

2. Dickson, Leonard Eugene (2009) - First Course in the Theory of Equations - John Wiley & Sons, Inc. - The Project Gutenberg
   View/Download (1.36 MB)

3. Gallian, Joseph. A. (2017) - Contemporary Abstract Algebra (9th Edition) - Cengage Learning India Private Limited, Delhi (Indian Reprint 2021)
View/Download (11.4 MB)

4. Goodaire, Edgar G. & Parmenter, Michael M. (2006) - Discrete Mathematics with Graph Theory (3rd Edition) - Pearson Education Pvt. Ltd. (Indian Reprint 2018)
View/Download (12.9 MB)

Suggestive Readings

- Burnside, W.S. & Panton, A.W. (1979) - The Theory of Equations, Vol. 1 (11th Edition) - S. Chand & Co. New Delhi, Dover Publications Inc. (Fourth Indian Reprint)
Not Available

- Burton, David M. (2011) - Elementary Number Theory (7th Edition) - McGraw-Hill Education Pvt. Ltd. (Indian Reprint)
View/Download (6.38 MB)

- Rotman, Joseph J. (1995) - An Introduction to The Theory of Groups (4th Edition) - Springer-Verlag, New York
View/Download (38.7 MB)

DSC-II
ELEMENTARY REAL ANALYSIS

Unit-I **Real Number System**

♦ Algebraic and order properties of $\mathbb{R}$ ♦ Absolute value of a real number
♦ Bounded above and bounded below sets ♦ Supremum and infimum of a non-empty subset of $\mathbb{R}$
♦ The completeness property of $\mathbb{R}$ ♦ Archimedean property ♦ Density of rational numbers in $\mathbb{R}$

Unit-II **Sequence**

♦ Sequences and their limits ♦ Convergent sequence ♦ Limit theorems ♦ Monotone sequences
♦ Monotone convergence theorem ♦ Subsequences ♦ Bolzano−Weierstrass theorem for sequences
♦ Limit superior and limit inferior for bounded sequence ♦ Cauchy sequence
♦ Cauchy's convergence criterion

Unit-III **Infinite Series**

♦ Convergence and divergence of infinite series of real numbers ♦ Necessary condition for convergence
♦ Cauchy criterion for convergence ♦ Tests for convergence of positive term series, Integral test, Basic comparison test, Limit comparison test, D'Alembert's ratio test, Cauchy's n^{th} root test, Raabe's test
♦ Alternating series ♦ Leibniz test ♦ Absolute and conditional convergence

Essential Readings

1. Bartle, Robert G. & Sherbert, Donald R. (2011) - Introduction to Real Analysis (4th Edition) - John Wiley & Sons. Wiley India (Edition 2015)
View/Download (9.18 MB)

2. Bilodeau, Gerald G., Thie, Paul R. & Keough, G. E. (2010) - An Introduction to Analysis (2nd Edition) - Jones and Bartlett India Pvt. Ltd. Student Edition (Reprinted 2015)
View/Download (150.1 MB)

3. Denlinger, Charles G. (2011) - Elements of Real Analysis - Jones and Bartlett India Pvt. Ltd. Student Edition (Reprinted 2015)
View/Download (180.9 MB)

Suggestive Readings

- Aliprantis C. D. & Burkinshaw, O. (1998) - Principles of Real Analysis (3rd Edition) - Academic Press
  View/Download (10.6 MB)
- Ross, Kenneth A. (2013) - Elementary Analysis: The Theory of Calculus (2nd Edition) - Undergraduate Texts in Mathematics, Springer (Indian Reprint)
  View/Download (3.28 MB)
- Thomson, B. S., Bruckner, A. M., & Bruckner, J. B. (2001) - Elementary Real Analysis - Prentice Hall
  View/Download (5.56 MB)

DSC-III
PROBABILITY AND STATISTICS

Unit-I **Descriptive Statistics, Probability, and Discrete Probability Distributions**

♦ Descriptive statistics: Populations, Samples, Stem-and-leaf displays, Dotplots, Histograms, Qualitative data, Measures of location, Measures of variability, Boxplots ♦ Sample spaces and events ♦ Probability axioms and properties ♦ Conditional probability, Bayes' theorem and independent events ♦ Discrete random variables and probability distributions ♦ Expected values ♦ Probability distributions: Binomial, geometric, hypergeometric, negative binomial, Poisson, and Poisson distribution as a limit

Unit-II **Continuous Probability Distributions**

♦ Continuous random variables ♦ Probability density functions ♦ Uniform distribution ♦ Cumulative distribution functions and expected values ♦ The normal, exponential and lognormal distributions

Unit-III **Central Limit Theorem and Regression Analysis**

♦ Sampling distribution and standard error of the sample mean ♦ Central Limit Theorem and applications ♦ Scatterplot of bivariate data ♦ Regression line using principle of least squares ♦ Estimation using the regression lines ♦ Sample correlation coefficient and properties

Practical

Software labs using Microsoft Excel or any other spreadsheet.

1) Presentation and analysis of data (univariate and bivariate) by frequeny tables, descriptive statistics, stem-and-leaf plots, dotplots, histograms, boxplots, comparative boxplots, and probability plots.
2) Fitting of binomial, Poisson and normal distributions.
3) Illustrating the Central Limit Theorem through Excel.
4) Fitting of regression line using the principle of least squares.
5) Computation of sample correlation coefficient.

Essential Reading

1. Devore, Jay L. (2016) - Probability and Statistics for Engineering and the Sciences (9th Edition) - Cengage Learning India Private Limited, Delhi (Indian Reprint 2020)
   View/Download (5.88 MB)

Suggestive Reading

- Mood, A. M., Graybill, F. A., & Boes, D. C. (1974) - Introduction to the Theory of Statistics (3rd Edition) - Tata McGraw-Hill Pub. Co. Ltd. (Reprinted 2017)
  View/Download (23.6 MB)