HSNC University Mumbai

(2024-2025)

Ordinances and

Regulationswith

Respect to

Choice-Based Credit

System(CBCS)

For the Programs Under

The Faculty of Science and Technology

For the Course

Logical Reasoning and Quantitative Aptitude
Semester-III and Semester -IV
(w.e.f. 2024-2025)
under NEP 2020

Board of Studies in Mathematics

1. **Name of Chairperson**
   Mrs. Usha G. Hemasundar ,Head, Department of Mathematics, M Sc Mathematics Associate Professor, K. C. College Ph: 9892234921 Email id: usha.gollakota@kccollege.edu.in
   Name of Co-Chairperson
   Ms. Shubhada Kanchan, MSc Mathematics,Department of Mathematics and Statistics Assistant Professor, H. R. College,Ph: 9975673087 Email id: shubhadark@yahoo.co.in
2. **Two to five teachers each having minimum five years teaching experience amongst the full-time teachers of the Departments, in the relevant subject.**
   a.) Dr. Pankit Gandhi, MSc (Mathematics), M Phil, Ph.D., LL.B., Associate Professor, K. C. College, Ph: 8169381936 Email id: pankit.gandhi@kccollege.edu
   b.) Mrs. Vijayalaxmi Suvarna ,M Sc Mathematics, M.Phil ,Assistant Professor,H. R. College, Ph: 9987395783; Email id: vijayalaxmi_suvarna@rediffmail.com
   c.) Mrs. Mrunal Hardikar ,M Sc Mathematic, Assistant Professor, K. C. College, Ph: 9653227252; Email id: mrunal.hardikar@kccollege
   d.) Mrs. Nilesh Bhandarkar ,M Sc Mathematic, Assistant Professor, K. C. College, Ph: 98200868037; Email id:nilesh.bhandarkar@kccollege
3. **One Professor / Associate Professor from other Universities or professor / Associate Professor from colleges managed by Parent Body; nominated by Parent Body;-**
   a.) Dr Sushil Kulkarni , Professor, Head, School of Mathematics,Applied Statistics &Analyticas,NMIMS,PhNo9870126536;Emailid: sushiltry@gmail.comn
4. **External experts from Industry / Research / eminent scholar in the field relevant to the subject nominated by the Parent Body**;
   a.) Dr Ajit Kumar , Ph.D. Mathematics,Associate Professor and Head, Department of Mathematics, Institute of Chemical Technology, Mumbai,Ph No. 99690 31202; E Mail id ajit72@gmail.com
   b.) Dr. Amiya Ranjan Bhowmick, Ph.D. Applied Mathematics and Statistics; Assistant Professor, Institute of Chemical Technology, Mumbai, Ph no: 08334835300/7738101583; amiyaiitb@gmail.com/ar.bhowmick@ictmumbai.edu.in
   c.) Mr. Prashant Shukla,MSc statistics, Masters in Financial Management JBIMS; Chief Investment Officer, Aston Capital Advisor Pvt Ltd,Partner at HBD Consulting LLP; Ph no:9821470975; Email id: sprash@rediffmail.com
   d.) Mr. Kaushal Shah,M.Com, PGDBA(Finance),Senior Manager, Treasury Reliance Power, Ph no: 9320105703; Email id: krushalshah78@gmail.com
5. **Top rankers of the Final Year Graduate and Final Year Post Graduate examination of previous year of the concerned subject as invitee members for discussions on framing or revision of syllabus of that subject or group of subjects for one year.**
   Ms. Gunjan Shinde, B Sc, Mathematics, Currently pursuing online Degree in dataScience and Programming from IIT,Madras

Semester III
General Elective -I
Course Title: Logical Reasoning and Quantitative Aptitude III

Course Objectives:

1. To develop familiarity with positive integers, prime numbers, and concepts of divisibility and remainders.
2. To understand patterns of additive (arithmetic) and multiplicative (geometric) nature in sequences and series and to introduce recurrence relations.
3. To introduce the ideas behind important statistical parameters (averages and variations) in an intuitive way.

Course Learning Outcomes:

1. The learner will be able to solve problems based on divisibility rules, find GCD, LCM of two numbers, find remainders, and apply concept of remainders to solve calendar problems.
2. The learner will be able to identify patterns of arithmetic and geometric sequences and use this knowledge to find nth terms, sum up to n terms and sum up to infinity for geometric or telescopic series. The learner will be able to recognize recursive patterns in certain sequences and use simple methods such as backtracking to find nth term of sequences.
3. The learner will be able to calculate and display graphically, the measures of center, measures of location and also calculate various measures of spread of data.

Evaluation Pattern:

The course will be assessed for a total of 75 marks and will consist of:

- **Summative Assessment** (End Semester Theory Exam): 50 **marks**.
  Paper Pattern:

  Q1: Unit I: Attempt any two out of four (10 marks)
  Q2: Unit II: Attempt any two out of four (10 marks)
  Q3: Unit III: Attempt any two out of four (10 marks)
  Q4: Objective questions based on all units. (20 marks)

- **Formative Assessment: 20 marks.**
  (Self-Learning Evaluation – 15 marks (Can be in the form of a class assignment or a home assignment or a case study) and Class performance – 5 marks)

Detailed Syllabus

Unit	Content	No. of Lectures
1	**1Number Systems** 1.1 Integers, divisibility and primes, division algorithm, prime factorization, GCD and LCM of two/three numbers, 1.2 Properties of divisibility, number of divisors and sum of divisors of a positive integer, tests of divisibility (divisibility by 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 16), finding remainders and last two digits of an expression (expression includes products and powers). 1.3 Introduction to congruence modulo 'm', basic properties of congruences, application to calendar problems. (leap years, find the day of the week)	**15**
2	**2.Progressions and Series** 1.1. Arithmetic and Geometric progressions: n^{th} term formula, sum up to n terms formula, finding three, four or five numbers in A.P and G.P. with given conditions. 1.2. Special series: summing up to n terms of special sequences, formulas for sum of squares and cubes of first n natural numbers, geometric series, telescopic series. 1.3. Introduction to recurrence relations, formulating a recurrence relation from a given progression and vice versa, formulating recurrence relation for a given problem and solution for simple cases using backtracking.	**15**
3	**2. Statistical Reasoning** 2.1. Need of Averages: Arithmetic mean, Weighted arithmetic mean, mode, locating mode graphically. 2.2. Positional Averages: Median, quartiles, deciles and percentiles, locating positional averages graphically. 2.3. Variations, concepts of absolute and relative variations, root-mean-square, standard deviation, variance and consistency.	**15**

Reference Books

1. Discrete Mathematics and Its Applications by Kenneth H. Rosen, McGraw Hill, Special Indian Edition.
2. Statistics 4th Edition, by David Freedman, Robert Pisani, Roger Purves, Viva-Norton Student Edition.
3. Elements of Discrete Mathematics, 3rd Edition, by C Liu, Tata McGraw Hill
4. Higher Algebra by Hall and Knight, Classic Text Series, 7th edition, Arihant Publication
5. First Steps in Number Theory: A Primer on Divisibility, by Shailesh Shirali, Universities Press, January 2000 edition.
6. Foundations of Discrete Mathematics, by K.D. Joshi, New Age International Publishers limited, 2003 edition.

Semester IV
General Elective -I
Course Title: Logical Reasoning and Quantitative Aptitude IV

Course Objectives:

1. To familiarize with factorial notation, understand the concepts of permutations and combinations using fundamental principles of counting, and study permutations and combinations in various scenarios.
2. To distinguish between simple and compound interest, study the effect of compounding for varying interest rates and time periods, and to understand time value of money.
3. To understand the concept of network diagrams (or directed graphs), their equivalent matrix representations, and to learn shortest path algorithms. To understand patterns and rules for coding and decoding of messages and to learn binary codes.

Course Learning Outcomes:

1. The learner will be able to comprehend various counting problems and use appropriate concepts of permutations and combinations to solve the problems.
2. The learner will be able to solve problems involving investments, profit and loss, simple as well as compound interest and calculate present value and future value.
3. The Learner will be able to apply the concepts of networks or graphs to solve practical problems of ranking teams, finding minimum cost and distance in various network flow diagrams. The Learner will also be able to encode and decode messages using a given cipher. In particular, they will also use binary codes to convert a given word or message to binary form.

Evaluation Pattern:
The course will be assessed for a total of 75 marks and will consist of:

- **Summative Assessment** (End Semester Theory Exam): **50 marks**.
  Paper Pattern:

  Q1: Unit I: Attempt any two out of four (10 marks)
  Q2: Unit II: Attempt any two out of four (10 marks)
  Q3: Unit III: Attempt any two out of four (10 marks)
  Q4: Objective questions based on all units. (20 marks)

- **Formative Assessment: 20 marks.**
  (Self-Learning Evaluation – 15 marks (Can be in the form of a class assignment or a home assignment or a case study) and Class performance – 5 marks)

Detailed Syllabus

Unit	Content	No. of Lectures
1	**1. Counting Techniques** 1.1 Factorial notation, Permutations with and without repetition, circular permutations. 1.2 Combinations, Combinatorial identities. 1.3 Permutations and combinations of multisets.	**15**
2	**2. Managing Money** 2.1 Profit, loss and partnerships. 2.2 Simple Interest, Compound Interest, Frequency of compounding and effective interest rates, Comparing accumulated values of simple interest Vs Compound interest with various frequencies (Conceptual understanding of linear growth Vs exponential growth) 2.3 Time value of money	**15**
	3 **Network Diagrams and Codes** 3.1 Ranking problems: Concept of directed graph, Matrix representation of directed graph (Dominance matrix), Using dominance matrix to rank players. 3.2 Network flow diagrams, shortest path between two nodes, minimum cost, minimum distance problems. 3.3 Coding and Decoding, Binary logic, Concept of binary addition	**15**

Reference Books

1. Introductory Combinatorics, 5th Edition, by Brualdi, Pearson
2. Learning Mathematics through Modelling and Simulation by Jonaki Ghosh, Amber Habib and Geetha Venkatraman, University Press
3. Elements of Discrete Mathematics, 3rd Edition, by C Liu, Tata McGraw Hill
4. An Elementary Introduction to Mathematical Finance, Third Edition by Sheldon M. Ross, Cambridge University Press.
5. Introduction to Graph Theory by Douglas B. West, Pearson Education Asia.
6. Higher Algebra by Hall and Knight, Classic Text Series, 7th edition, Arihant Publication
7. Discrete Mathematics, B.S. Vatsa, Suchi Vatsa, New Age International Publishers limited, 4th edition.
8. Foundations of Discrete Mathematics, by K.D. Joshi, New Age International Publishers limited, 2003 edition.
9. Using and Understanding Mathematics: A quantitative Reasoning Approach: 7th edition – Bennett and Briggs (Pearson)