

SYLLABUS
For B.Sc. –II Honours Mathematics
Choice Based Credit System (CBCS)

MATA GUJRI COLLEGE
FATEHGARH SAHIB



DEPARTMENT OF MATHEMATICS
UNDERGRADUATE PROGRAMME
(Courses effective from Academic Year 2018-19)

CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

- 1. Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
- 2. Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other

discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

2.1 Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 Dissertation/Project: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

2.3 Generic Elective (GE) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

3. Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course: The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

3.1 AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.

3.2 AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Details of courses under B.Sc. (Honors)

Course	*Credits	
	Theory+ Practical	Theory + Tutorial
I. Core Courses		
(14 Papers)	14X4= 56	14X5=70
Core Course Practical / Tutorial*		
(14 Papers)	14X2=28	14X1=14
II. Elective Courses		
(8 Papers)		
A.1. Discipline Specific Elective	4X4=16	4X5=20
(4 Papers)		
A.2. Discipline Specific Elective		
Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		
B.1. Generic Elective/ Interdisciplinary	4X4=16	4X5=20
(4 Papers)		
B.2. Generic Elective		
Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		
❖ Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6th Semester		
III. Ability Enhancement Courses		
1. Ability Enhancement Compulsory Courses		
(AECC)		
(2 Papers of 2 credit each)	2 X 2=4	2 X 2=4
Environmental Science		
English/MIL Communication		
2. Skill Enhancement Courses (SEC)		
(Minimum 2)	2 X 2=4	2 X 2=4
(2 Papers of 2 credit each)		
Total credits	140	140
Institute should evolve a system/policy about ECA/ General Interest/Hobby/Sports/NCC/NSS/related courses on its own.		
* wherever there is a practical there will be no tutorial and vice-versa		

**B. Sc. HONOR MATHEMATICS-II
SEMESTER- III
BHMCC-301: GROUP THEORY**

[5 Lectures, 1 Tutorial per week]
Time: 3hrs.

Max.Marks : 100
[Final-75 + Internal Assessment-25]
Minimum pass marks 40%

INSTRUCTION FOR THE PAPER SETTER

The question paper will consist of three sections A, B & C. Each of section A, B will have four questions from the respective syllabus. Each will consist of twelve marks. Section C will have one compulsory question having nine parts of short-answer type covering the entire syllabus uniformly. Each will consist of three marks.

INSTRUCTION FOR THE CANDIDATES

Candidates are required to attempt five questions in all; selecting two questions from each section A & B. Section C is compulsory.

Section A

Group, Dihedral groups, definition and examples of groups including permutation groups and quaternion groups (illustration through matrices), elementary properties of groups. Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups. Properties of cyclic groups, classification of subgroups of cyclic groups. Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem.

Section B

External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups. Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems.

Books Recommended

1. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002.
2. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.
3. Joseph A. Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa Publishing House, New Delhi, 1999.
4. Joseph J. Rotman, *An Introduction to the Theory of Groups*, 4th Ed., Springer Verlag, 1995.
5. I.N. Herstein, *Topics in Algebra*, Wiley Eastern Limited, India, 1975.

SEMESTER- III
BHMCC-302: ANALYSIS-I

[5 Lectures, 1 Tutorial per week]
Time: 3hrs.

Max.Marks : 100
[Final-75 + Internal Assessment-25]
Minimum pass marks 40%

INSTRUCTION FOR THE PAPER SETTER

The question paper will consist of three sections A, B & C. Each of section A, B will have four questions from the respective syllabus. Each will consist of twelve marks. Section C will have one compulsory question having nine parts of short-answer type covering the entire syllabus uniformly. Each will consist of three marks.

INSTRUCTION FOR THE CANDIDATES

Candidates are required to attempt five questions in all; selecting two questions from each section A & B. Section C is compulsory.

SECTION-A

The real number system, least upper bound property, countable and uncountable sets, topology of real line and \mathbb{R}^n , metric spaces, compact sets, connected sets, completion of a metric space, limit superior and limit inferior of a real sequence.

[Scope as in the book 'Principles of Mathematical Analysis' by W. Rudin (3rd edition)]

Chapter-1(1.1 - 1.23), Chapter-2, 3 (3.1- 3.17)]

SECTION-B

Series, Series of Non-Negative numbers, the number e , the Root and Ratio Test, Power series,

[Scope as in Chapter 3(3.21-3.40) of Text 1]

Limits of functions, continuous functions, continuity and compactness, continuity and connectedness, discontinuity, monotone functions, infinite limits and limits at infinity, the derivative of a real function, mean value theorems, L'Hospital's rule, Taylor's theorem.

[Scope as in the book 'Principles of Mathematical Analysis' by W.Rudin (3rd edition)]

Chapter-4,5(5.1-5.15)]

TEXT BOOKS:

1. W. Rudin: Principles of Mathematical Analysis, McGraw Hill, 3rd Ed.1976.
2. Tom M. Apostol: Mathematical Analysis, second edition. Narosa Publishing House, 2nd Ed., Reprint 2002.

3. S. Shirali and H. L. Vasudeva: Metric Spaces, Springer, 2006.
4. S. C. Malik and Savita Arora: Mathematical Analysis, New Age International Publishers, Reprint 2008.
5. R.G. Bartle and D. R. Sherbert: Introduction to Real Analysis, John Wiley & Sons, Inc., 3rdEd. 2000.

SEMESTER- III
BHMCC-303: ORDINARY DIFFERENTIAL EQUATIONS

[5 Lectures, 1 Tutorial per week]
Time: 3hrs.

Max.Marks : 100
[Final-75 + Internal Assessment-25]
Minimum pass marks 40%

INSTRUCTION FOR THE PAPER SETTER

The question paper will consist of three sections A, B & C. Each of section A, B will have four questions from the respective syllabus. Each will consist of twelve marks. Section C will have one compulsory question having nine parts of short-answer type covering the entire syllabus uniformly. Each will consist of three marks.

INSTRUCTION FOR THE CANDIDATES

Candidates are required to attempt five questions in all; selecting two questions from each section A & B. Section C is compulsory. All questions carry equal marks.

Section A

Basic definitions: order and degree of differential equation, Solutions of differential equations, Geometrical interpretation of first order differential equation, Integral curves, isoclines. First order differential equations: Variables separable, homogeneous differential equations, non-homogeneous differential equations, integration factors, Linear & non-linear differential equations, exact differential equations, First order and higher degree differential equations: Equations solvable for x , y & p , Clairaut's equation, reducible to Clairaut's equation, approximations to first order differential equations: Lipschitz condition, Successive approximation, Existence and Uniqueness theorem (statement only).

Section B

Second order Differential Equations: Linear equations with constant coefficients, Standard Methods for solution, Nonhomogeneous linear with constant coefficients. linear equations with variable coefficients, Method of Variation of Parameter, Linear Independence, Linear dependence, Wronskian. series solution: ordinary points, regular singular points, Power series method, Method of Frobenius & its Applications.

Books Recommended

1. W.E. Boyce and P.C. DiPrima: Elementary Differential Equations and Boundary value problems, John Wiley, 1986.
2. Shepley L. Ross: Differential Equations, 3rd edition, Wiley-India.
3. E.L. Ince: Theory of Ordinary Differential Equations. Dover, 1956.
4. E. D. Rainville: Elementary Differential Equations, Bedient Publisher Prentice Hall, 1997.

SEMESTER- IV
BHMCC-401: ANALYSIS-II

[5 Lectures, 1 Tutorial per week]
Time: 3hrs.

Max.Marks : 100
[Final-75 + Internal Assessment-25]
Minimum pass marks 40%

INSTRUCTION FOR THE PAPER SETTER

The question paper will consist of three sections A, B & C. Each of section A, B will have four questions from the respective syllabus. Each will consist of twelve marks. Section C will have one compulsory question having nine parts of short-answer type covering the entire syllabus uniformly. Each will consist of three marks.

INSTRUCTION FOR THE CANDIDATES

Candidates are required to attempt five questions in all; selecting two questions from each section A & B. Section C is compulsory. All questions carry equal marks.

Section A

Riemann integration; inequalities of upper and lower sums; Riemann conditions of integrability. Riemann sum and definition of Riemann integral through Riemann sums; equivalence of two definitions; Riemann integrability of monotone and continuous functions, Properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions. Intermediate Value theorem for Integrals; Fundamental theorems of Calculus. Improper integrals; Convergence of Beta and Gamma functions.

Section B

Pointwise and uniform convergence of sequence of functions. Theorems on continuity, derivability and integrability of the limit function of a sequence of functions. Series of functions; Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M-Test. Limit superior and Limit inferior. Power series, radius of convergence, Cauchy Hadamard Theorem, Differentiation and integration of power series; Abel's Theorem; Weierstrass Approximation Theorem.

Text Books

1. R.G. Bartle D.R. Sherbert, *Introduction to Real Analysis*, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.

Books Recommended

1. K.A. Ross, *Elementary Analysis, The Theory of Calculus*, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
2. Charles G. Denlinger, *Elements of Real Analysis*, Jones & Bartlett (Student Edition), 2011.

SEMESTER- IV
BHMCC-402: MECHANICS

[5 Lectures, 1 Tutorial per week]
Time: 3hrs.

Max.Marks : 100
[Final-75 + Internal Assessment-25]
Minimum pass marks 40%

INSTRUCTION FOR THE PAPER SETTER

The question paper will consist of three sections A, B & C. Each of section A, B will have four questions from the respective syllabus. Each will consist of twelve marks. Section C will have one compulsory question having nine parts of short-answer type covering the entire syllabus uniformly. Each will consist of three marks.

INSTRUCTION FOR THE CANDIDATES

Candidates are required to attempt five questions in all; selecting two questions from each section A & B. Section C is compulsory. All questions carry equal marks.

Section A

Statics

Forces acting on a particle, parallel Forces, Couples, Moments and Coplanar forces acting on a rigid body and their resultant. Equilibrium of concurrent and Non-Concurrent coplanar forces, Friction, Virtual Work, Stable and unstable equilibrium and the Physical situations via problems.

Section B

Dynamics

Motion in a straight line, Newton's law of motion, Motion on an inclined plane. Motion under variable acceleration, Simple harmonic motion, Relative Motion, Projectiles, Work, Power, Energy.

Text Books

S.L. Loney: The Elements of Statics and Dynamics , Cambridge University Press, 1897.

Reference Readings

1. Chorlton, F.: Text Book of Dynamics, CBS New Delhi (1985).
2. J.L Merianx: Second Edition, Mechanics, part I, Statics, Wiley Tppan.

SEMESTER- IV
BHMCC-403: NUMERICAL METHODS

[5 Lectures, 1 Tutorial per week]
Time: 3hrs.

Max.Marks : 100
[Final-75 + Internal Assessment-25]
Minimum pass marks 40%

INSTRUCTION FOR THE PAPER SETTER

The question paper will consist of three sections A, B & C. Each of section A, B will have four questions from the respective syllabus. Each will consist of twelve marks. Section C will have one compulsory question having nine parts of short-answer type covering the entire syllabus uniformly. Each will consist of three marks.

INSTRUCTION FOR THE CANDIDATES

Candidates are required to attempt five questions in all; selecting two questions from each section A & B. Section C is compulsory. All questions carry equal marks.

Section A

Error Analysis , rounding , chopping , absolute error and relative error. Bisection, Regula-Falsi, Secant, Newton-Raphson, Muller, Chebyshev and General Iteration Methods and their rate of convergence , Aitken Method for acceleration of the Convergence, Methods for multiple roots.

Direct Methods: Gauss elimination method, Gauss-Jordan Elimination methods, Decomposition methods (LU and Cholskey), Partition method and their error analysis. Iterative Methods: Jacobi iterative method, Gauss-Seidel iterative method, Successive over relaxation iterative method, Convergence Analysis of iterative methods. Eigen Value Problems: Gerschgorin Theorem, Jacobi, Givens methods Householder's method for Symmetric matrices, Ruthishauser, Power and Inverse Power methods.

[Text 1, Chap 2.1 – 2.6, Chap 3]

Section B

Lagrange's interpolation, Newton Interpolation, Finite Difference Operators, Piecewise and Spline Interpolation, Interpolating Polynomials using Finite Differences and Hermite Interpolation. Least square approximation.

Numerical Differentiation, Error in Numerical Differentiation, Cubic Spline method, Maximum and Minimum values of a tabulated function, Numerical Integration: Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule, Boole's and Weddle's Rule, Integration using Cubic Splines, Romberg Integration, Newton Cotes formulae.

Taylor's Series method, Picard's Method, Euler's and modified Euler's methods, RungeKutta methods. [Text 1 Chap 4.1 – 4.9] [Text 3 Chap 5.1 – 5.4, Chap 7.1 - 7.5]

Text Books

1. M. K. Jain, S. R. K. lyenger and R. K. Jain: Numerical Methods for Scientific and Engineering Computations, 6th Edition, New Age Intenational (P) Limited, Publishers, New Delhi.
2. S.S.Sastry: Introductory Methods of Numerical Analysis, 4th Edition (2010), Prentice Hallof India Pvt. Ltd., New Delhi.

Books Recommended

1. Kendall E Atkinson: An introduction to Numerical Analysis, 2nd Edition John Wiley & Sons, Printed in India by Replika Pvt. Ltd., 1989.
2. FB Hilderbrand : Introduction to Numerical Analysis, 2nd Edition, Dover Publication Inc, New York, 1987.

SEMESTER- III
BHMSEC-304A: LOGIC AND SETS

L T P
2 0 0

Max. Marks: 50
External Examination 40
Internal Assessment 10
Minimum pass marks 40%

INSTRUCTION FOR THE PAPER SETTER

The question paper will consist of three sections A, B & C. Each of section A, B will have four questions from the respective syllabus. Each will consist of five marks. Section C will have one compulsory question having five parts of short-answer type covering the entire syllabus uniformly. Each will consist of two marks.

INSTRUCTION FOR THE CANDIDATES

Candidates are required to attempt five questions in all; selecting two questions from each section A & B. Section C is compulsory.

SECTION-A

Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.

SECTION-B

Sets, subsets, Set operations, the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set. Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation.

BOOK RECOMMENDED

1. R.P. Grimaldi, *Discrete Mathematics and Combinatorial Mathematics*, Pearson Education, 1998.
 2. P.R. Halmos, *Naive Set Theory*, Springer, 1974.
 3. E. Kamke, *Theory of Sets*, Dover Publishers, 1950.
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SEMESTER- III
BHMSEC-304B: ANALYTICAL GEOMETRY

L T P
 2 0 0

Max. Marks: 50
 External Examination 40
 Internal Assessment 10
 Minimum pass marks
 40%

INSTRUCTION FOR THE PAPER SETTER

The question paper will consists of three sections A, B & C. Each of section A, B will have four questions from the respective syllabus. Each will consist of five marks. Section C will have one compulsory question having five parts of short-answer type covering the entire syllabus uniformly. Each will consist of two marks.

INSTRUCTION FOR THE CANDIDATES

Candidates are required to attempt five questions in all; selecting two questions from each section A & B. Section C is compulsory.

SECTION-A

Techniques for sketching parabola, ellipse and hyperbola. Reflection properties of parabola, ellipse and hyperbola. Classification of quadratic equations representing lines, parabola, ellipse and hyperbola.

SECTION-B

Spheres, Cylindrical surfaces. Illustrations of graphing standard quadric surfaces like cone, ellipsoid.

BOOKS RECOMMENDED

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
 2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) Pvt. Ltd., 2002.
 3. S.L. Loney, *The Elements of Coordinate Geometry*, McMillan and Company, London.
 4. R.J.T. Bill, *Elementary Treatise on Coordinate Geometry of Three Dimensions*, McMillan India Ltd., 1994.
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SEMESTER- IV
BHMSEC-404A: NUMBER THEORY

L T P
 2 0 0

Max. Marks: 50
 External Examination 40
 Internal Assessment 10
 Minimum pass marks 40%

INSTRUCTION FOR THE PAPER SETTER

The question paper will consists of three sections A, B & C. Each of section A, B will have four questions from the respective syllabus. Each will consist of five marks. Section C will have one compulsory question having five parts of short-answer type covering the entire syllabus uniformly. Each will consist of two marks.

INSTRUCTION FOR THE CANDIDATES

Candidates are required to attempt five questions in all; selecting two questions from each section A & B. Section C is compulsory.

SECTION-A

Divisibility, division algorithm, greatest common divisor, least common multiple, application of Euclidean algorithm, linear Diophantine equation.
 Introduction of prime numbers, fundamental theorem of arithmetic, Goldbach conjecture.
 (Scope as in chapter 2, 3 of RR1)

SECTION-B

Basic properties of congruence, complete and reduced set of residues, linear congruence, Chinese Remainder theorem, Fermat's theorem and its applications, Wilson's theorem and its applications. (Scope as in chapter 4, 5 of RR1 up to sec 5.3)

TEXT BOOKS:

1. David M. Burton: Elementary Number Theory, Tata McGraw-Hill Edition, 6th Ed., Indian reprint, 2007.
2. Niven and Zuckerman: Introduction to Number Theory, Wiley Eastern, 3rd Ed.
3. Hardy and Wright: Introduction to Number Theory, Oxford University Press, 5th Edition.

SEMESTER- III
BHMSEC-404B: STATISTICAL METHODS

L T P
2 0 0

Max. Marks: 50
External Examination 40
Internal Assessment 10
Minimum pass marks 40%

INSTRUCTION FOR THE PAPER SETTER

The question paper will consists of three sections A, B & C. Each of section A, B will have four questions from the respective syllabus. Each will consist of five marks. Section C will have one compulsory question having five parts of short-answer type covering the entire syllabus uniformly. Each will consist of two marks.

INSTRUCTION FOR THE CANDIDATES

Candidates are required to attempt five questions in all; selecting two questions from each section A & B. Section C is compulsory.

Note: Use of scientific non-programmable calculator is allowed.

SECTION - A

Introduction to Statistics: Meaning and scope, advantage and disadvantage of statistics, Collection of data: Primary and secondary data (Methods of collecting data), Designing a questionnaire. Diagrammatical representation of data, frequency distribution

Graphical representation of data: Histogram, Frequency Polygon, Frequency Curves and ogives, Stem and Leaf display.

SECTION-B

Analysis of Quantative data: Measures of central tendency and Dispersion, Properties of an ideal measures of central tendency, Types of average- A.M., H.M., Median, Mode, Range, Mean deviation, Standard deviation, Variance and coefficient of variation.

Measures of Skewness, Definition of Skewness, Karl-Pearson's coefficient of skewness, bowley's coefficient of skewness, kurtosis, Sheppard's correction for moments(without derivation)

Text Books:

1. Goon,A.M., Gupta, M.K.: An Outline of Statistical Theory. Vol. I, and Dasgupta, B. 1985, Ed.3rd, World Press.
2. Gupta, S.C. and Kapoor, V.K.: Fundamental of Mathematical Statistics, Sultan Chand & Sons Educational Pub. New Delhi.

Generic Electives (GE)**Choices for GE-3 (Choose one from the following subjects)**

1. **Physics**
2. **Chemistry**
3. **Psychology**
4. **Geography**
5. **Computer Science**
6. **Economics**
7. **Commerce**

Choices for GE-4 (Choose one from the following subjects)

1. **Physics**
2. **Chemistry**
3. **Psychology**
4. **Geography**
5. **Computer Science**
6. **Economics**
7. **Commerce**