

SYLLABUS
For B.Sc. Honors Mathematics-I
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).

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.

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 (4 Papers)	4X4=16	4X5=20
A.2. Discipline Specific Elective Practical/ Tutorial* (4 Papers)	4 X 2=8	4X1=4
B.1. Generic Elective/ Interdisciplinary (4 Papers)	4X4=16	4X5=20
B.2. Generic Elective Practical/ Tutorial* (4 Papers)	4 X 2=8	4X1=4

❖ **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. HONS. MATHEMATICS-I

SEMESTER-I

BHMCC-101: CALCULUS-I

[4 Lectures per week]

Max. Marks: 100

Time: 3hrs

[Final Exam-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

Differential Calculus: Definition of the limit of a function. Basic properties of limits. Continuous functions and classification of discontinuities. Differentiability. Hospital rule. Applications of derivatives. Asymptotes. Test for concavity. Points of inflexion. Tracing of Curves (Cartesian and polar form). Singular points. Curvature, Envelope and Evolutes. (Scope as in Chapters 1,2,3 of Calculus and Analytic Geometry by Thomas and Finney, Ninth Edition)

SECTION B

Integral Calculus: Integration of functions. Riemann sum and definite integrals. Properties, Mean value theorem, Fundamental theorem.

(Scope as in Chapters 4 of Calculus and Analytic Geometry by Thomas and Finney, Ninth Edition)

Applications of integrals: Areas between curves. Finding volumes by slicing. Volumes of solids of Revolution-Disks and Washers. Cylindrical Shells. Lengths of plane curves. Areas of surfaces of revolution.

(Scope as in Chapters 5 of Calculus and Analytic Geometry by Thomas and Finney, Ninth Edition)

TEXT BOOKS:

1. George B. Thomas and Ross L. Finney: Calculus and Analytic Geometry, 9th Edition, Addison Wesley, 1998.
2. Liefhold Louis: Calculus and Analytic Geometry, 2nd Edition, New York, Harper & Row 1972.
3. LipmenBers: Calculus, IBH Mumbai 1974.
4. Shanti Narayan, P. K. Mittal: A Course of Mathematical Analysis, S. Chand,
5. Babu Ram: Advanced Engineering Mathematics, Pearson, 2012.

SEMESTER-I**BHMCC-111: CALCULUS-I**

[4 Practical per week]

Max. Marks: 50

[Final Exam-50]

Minimum pass marks 40%

Practical / Lab work to be performed on a computer using Mathematica**INSTRUCTIONS FOR THE PAPER SETTER/ CANDIDATE**

The final practical paper will contain

Practical to perform in examination from the list of practicals 25 marks

Practical Note Book, Evaluation and Viva Voce 25 marks

Note: The subject teacher will provide the required knowledge of software to the students to perform the practicals.

PRACTICAL LIST

- a) Plotting of graphs of function $\exp(ax+b)$, $\log(ax + b)$, $1/(ax + b)$, $\sin(ax + b)$, $\cos(ax+ b)$, $|ax + b|$ and to illustrate the effect of a and b on the graph.
- b) Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second Derivative graph and their comparison.
- c) Sketching of parametric curves.
- d) Matrix operation (addition, multiplication, inverse, transpose, determinant, rank)
- e) Eigenvectors, eigenvalues, Characteristic equation and verification of Cayley Hamilton equation, system of linear equations
- f) Illustrate the geometric meaning of Rolle's Theorem for a given functions on the given interval.
- g) Illustrate the geometric meaning of Lagrange's mean value theorem of the given functions on the given interval.
- h) Taylor's series - visualization by creating graphs.

SEMESTER-I**BHMCC-102: MATRICES & THEORY OF EQUATIONS**

[5 Lectures + 1 Tutorial per week]

Max. Marks: 100

Time: 3hrs

[Final Exam-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

Matrices, Algebra of Matrices, Symmetric, Skew symmetric, Hermitian and Skew Hermitian Matrices, Elementary operations on matrices, Inverse of a matrix, Linear Independence of rows and columns matrices, rank of matrices, Equivalence of row and column rank. Eigen values and Eigen vectors, characteristic polynomial, minimal polynomial, Cayley Hamilton theorem and its use in finding inverse of a matrix, Applications of matrices to systems of linear equations (both homogeneous and non-homogeneous), Theorem on consistency of system of linear equations.

SECTION B

Polynomials Euclid's algorithm for greatest common divisor, Unique factorization of polynomial over a field F of numbers (statement only), Fundamental theorem of Algebra (statement only), roots and their multiplicity, irreducible polynomial over F . Relationship between roots and their coefficients.

Fundamental theorem of symmetric polynomials (without proof), Evaluation of symmetric functions of roots, rational roots of polynomials with integral coefficients, Descartes rule of sign, Sturm theorem (statement only), Solution of cubic equation and bi-quadratic equation (Cardan's, Descartes', Ferrari's)

TEXTBOOKS

1. A. Khurosh: Higher Algebra, Moscow Mir Publisher, 1972.
2. K. B. Datta, Matrix and Linear Algebra, PHI, New Delhi, 2000.

3. S. Lang: Linear Algebra, Undergraduate Texts in Mathematics, Springer-Verlag, New York, 1989.
4. Schaum's Outlines: Linear Algebra, Tata McGraw-Hill, Edition 3rd, 2006.
5. P.B. Bhattacharya, S.K. Jain, S.R. Nagpaul, First course in Linear Algebra, Wiley Eastern, New Delhi, 1983.

**B. Sc. HONS. MATHEMATICS-I
SEMESTER-II
BHMCC-201: CALCULUS-II**

[4 Lectures per week]

Time: 3hrs

Max. Marks: 100

[Final Exam-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

Multivariable Functions: Functions of several variables. Limits and continuity. Partial derivatives. Differentiability. The chain rule, Directional derivatives, Gradient vectors and tangent planes. Extreme values and saddle points. Lagrange multipliers. Double integrals. Double integrals in Polar Form. Triple integrals in Rectangular co-ordinates. Triple integrals in Cylindrical and Spherical co-ordinates.

(Scope as in Chapters 12 and 13 of Calculus and Analytic Geometry by Thomas and Finney, Ninth Edition).

SECTION B

Vector Analysis: Vectors in the plane. Cartesian Co-ordinates and vectors in spaces. Dot and cross products. Lines and planes in space, Cylinders and Quadric surfaces. Cylindrical and Spherical coordinates Vector valued functions and space curves. Modelling Projectile Motion. Arc length and Unit Tangent vector curvature, Torsion and the TNB Frame. Line and Surface integrals Green, Gauss and Stokes theorems.

(Scope as in chapters 10, 11 and 14 of Calculus and Analytic Geometry by Thomas and Finney, Ninth Edition)

TEXT BOOKS

1. G. B. Thomas and Ross L. Finney: Calculus and Analytic Geometry, 9th Edition, Addison Wesley, 1998.
2. Liefhold Louis: Calculus and Analytic Geometry, 2nd Edition, New York, Harper &

Row 1972.

3. Lipman Bers: Calculus, IBH Mumbai 1974.
4. Maurice D. Weir, J. Hass and Frank R. Giordano: Thomas Calculus, 11th Edition, Pearson Pub., 2008.
5. Jain and Iyngar: Advanced Engineering Mathematics, Narosa Publication.
6. Babu Ram: Advanced Engineering Mathematics, Pearson, 2012.

SEMESTER- II
BHMCC-211: CALCULUS-II (LAB)

[4 practical per week]

Time: 3hrs

Max. Marks: 50

[Final Exam-50]

Minimum pass marks 40%

Practical / Lab work to be performed on a computer using Mathematica

Max. Marks: 50

4 Practicals per week Minimum Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTER/ CANDIDATE

The final practical paper will contain

Practical to perform in examination from the list of practicals 25 marks

Practical Note Book Evaluation and Viva Voce 25 marks

Note: The subject teacher will provide the required knowledge of the software to the students to perform the practicals.

PRACTICAL LIST

- a) Tracing of conics in Cartesian coordinates/ polar coordinates.
- b) Obtaining surface of revolution of curves.
- c) Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic paraboloid, Hyperbolic paraboloid using Cartesian coordinates.
- d) Graph of Hyperbolic functions.
- e) Computation of limit, differentiation and integration of vector functions.
- f) Drawing the tangent plane to the given surface at the given point.
- g) Visualization of line, Plane, cylinder, cone, sphere in 3-dimension
- h) Use of incremental approximation to estimate the given function at the given point and compare it with calculated value.

B. Sc. HONS. MATHEMATICS-I**SEMESTER-II****BHMCC-202:CO-ORDINATE GEOMETRY**

[5 Lectures + 1 Tutorial per week]

Max. Marks: 100

Time: 3hrs

[Final-75 + Internal Assessment-25]

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 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

Pair of Straight lines: Joint equation of pair of straight lines and angle between them, condition of parallelism and perpendicularity, joint equation of the angle bisectors, joint equation of lines joining origin to the intersection of a line and a curve.

Circle: General equation of circle, circle through intersection of two lines, Tangents and Normals, Chord of contact, pole and polar, pair of tangents from a point, equation of chord in terms of midpoint, angle of intersection and orthogonality, power of a point w.r.t. circle, radical axis, coaxial family of circles, limiting points.

Conic: General equation of conic, Tangents, Normals, chord of contact, pole and polar, of tangents from a point, equation of chord in terms of midpoint, diameter. Conjugate diameters of ellipse and hyperbola, special properties of parabola, ellipse and hyperbola, conjugate hyperbola, asymptotes of hyperbola, rectangular hyperbola.

SECTION B

Review of lines and planes in 3-dimension, change of axes, shift of origin, rotation of axes, sphere, section of a sphere by a plane. Sphere through a given circle. Intersection of a line and sphere, tangent line, tangent plane, angle of intersection of two spheres and condition of orthogonality, power of a point w.r.t. a sphere, Radical planes, radical axis, radical center, coaxial family of spheres, limiting points.

Cylinder, Cone with vertex at origin as the graph of homogeneous equation of second degree in x,y,z , cone as a surface generated by a line passing through fixed curve and a fixed point outside the plane of the curve, reciprocal cones, right circular and elliptic cones, right circular cone as a surface of revolution obtained by rotating the curve in a plane about an axis, enveloping cones, ellipsoid, equations of hyperboloids, paraboloids in the standard form, tangent planes and normals.

TEXT BOOKS:

1. P.K. Jain and Khalil Ahmed: A text book of Analytical Geometry of two dimensions, Wiley Eastern Ltd, 1994.
2. P.K. Jain and Khalil Ahmed: A text book of Analytical Geometry of three dimensions, Wiley Eastern Ltd, 1999.
3. Shanti Narayan and P.K Mittal: Analytical Solid Geometry, 17th Revised Edition, S.Chand and Co., New Delhi, 2006.
4. S. L. Looney: The Elements of Coordinate Geometry, Maxford Books, 1896.
5. S. L. Looney: The Elements of Coordinate Geometry Part-I, New Age International Publisher, 2016.

Generic Electives (GE)

Choices for GE-1 (Choose one from the following subjects)

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

Choices for GE-2 (Choose one from the following subjects)

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