

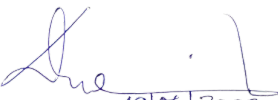
(NEP-2020)

**Curriculum and Credit Framework
for Under Graduate Programmes**

**Four Years Under Graduate Degree with Honours in
Mathematics**



**Rajiv Gandhi University
(A Central University)
RONO HILLS, DOIMUKH,
ARUNACHAL PRADESH**


19/06/2023
संयुक्त कुलसचिव (शैक्षणिक एवं सम्मेलन)
राजीव गांधी विश्वविद्यालय
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Rajiv Gandhi University
Rono Hills, Doimukh (A.P.)

Programme Objectives and Programme Learning Outcomes

Programme Objectives:

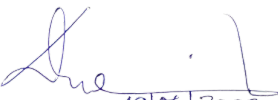
The main objectives of the B.Sc. (Hons.) Mathematics Programme are to:

- PO1: Inculcate strong interest in learning mathematics.
- PO2: Evolve broad and balanced knowledge and understanding of definitions, key concepts, principles and theorems in Mathematics.
- PO3: Enable learners/students to apply the knowledge and skills acquired by them during the programme to solve specific theoretical and applied problems in mathematics.
- PO4: Develop in students the ability to apply relevant tools developed in mathematical theory to handle issues and problems in social and natural sciences.
- PO5: Provide students with sufficient knowledge and skills that enable them to undertake further studies in mathematics and related disciplines
- PO6: Equip the students with basic skills and fundamentals of Research.

Programme Learning Outcomes:

After completing the programme the students will be able to:

- PLO1: Understand basic concepts of pure and applied mathematics.
- PLO2: Apply Mathematics as a tool to solve problems of other disciplines.
- PLO3: Pursue higher studies in the subject to take part in the academic upliftment of the subject.
- PLO4: Develop new techniques/methods for solving the unsolved problems mathematics and related disciplines.
- PLO5: Take up Research and Projects.
- PLO6: Write research papers and give presentations in seminars and conferences.

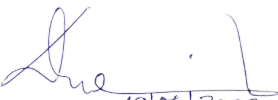

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**Course Structure of 1st and 2nd Semester for Four Years UG Degree with Honours
in Mathematics**

Semester	Course	Credit	Course	Credit	Course	Credit	Course	Credit	Course	Credit	Course	Credit	Total
I	Major 1: MAT- CC -1110 Calculus	4	Minor 1 (XXX-MC-1110)	4	MDC 1 (XXX-MD-1110)	3	AEC 1 (XXX-AE-1110)	4	SEC 1 (XXX-SE- xxx)	3	VAC 1 (XXX-VA -xxx)	2	20
II	Major 2: MAT- CC -1210 Higher Algebra	4	Minor 2 (XXX-MC-1210)	4	MDC 2 (XXX-MD-1210)	3	AEC 2 (YYY-AE-1210)	4	SEC 2 (XXX-SE- xxx)	3	VAC 2 (XXX-VA -xxx)	2	20

Note: In the 1st and 2nd semester along with the Major course a Mathematics (Hons.) student has to choose

- a) Two Minor Courses, one in each semester from Chemistry, Physics or Statistics as minor.
- b) Two Multi-disciplinary Courses (MDC), one in each semester from any MDC course of discipline available in the college/university, which has neither been studied in 10+2 level nor chosen as Major or Minor course in the present programme by the student.
- c) Two Skill Enhancement Course (SEC), one in each semester from any discipline including Mathematics.
- d) Two Ability Enhancement Courses (AEC), one in each semester among the courses being offered by the other departments.


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Course Details for 1st and 2nd Semesters

MAJOR COURSES (CC)

Semester	Course Code	Course Name	Credits			
			L	T	P	Total
I	MAT- CC -1110	Calculus	3	1	-	4
II	MAT- CC -1210	Higher Algebra	3	-	1	4

MINOR COURSES (MC)

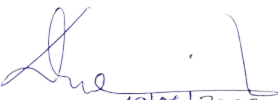
Semester	Course Code	Course Name	Credits			
			L	T	P	Total
I	MAT-MC-1110	Differential and Integral Calculus	3	1	-	4
II	MAT-MC-1210	Differential Equation	3	1	-	4

SKILL ENHANCEMENT COURSES (SEC)

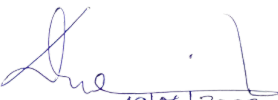
Semester	Course Code	Course Name	Credits			
			L	T	P	Total
I	MAT-SE-0010	Fundamentals of Computers	2	0	1	3
II	MAT-SE-0020	Programming in C	1	0	2	3

MULTIDISCIPLINARY COURSES (MDC)

Semester	Course Code	Course Name	Credits			
			L	T	P	Total
I	MAT-MD-1110	Elementary Mathematics-I	2	1	-	3
II	MAT-MD-1210	Elementary Mathematics-II	2	1	-	3


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MAJOR/CORE COURSES (CC)


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MAT-CC-1110

CALCULUS

Credit: 4 (L-3, T-1, P-0)

Total Lectures: 60

Total Marks: 100 (Theory: 80, Internal Assessment: 20)

Course Objectives: The primary objective of this course is to introduce the graphs of functions and basic tools of calculus and their geometrical properties which are helpful in understanding their applications in real world problems.

Course Learning Outcomes: This course will enable the students to:

- (i) Learn differentiability, limit and continuity tests for functions and their applications in diverse fields.
- (ii) Learn different theorems along with their geometric properties and applications.
- (iii) Learn partial differentiation of functions

Unit-I: Functions, limit and continuity (ϵ and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Recursion formulae for higher order derivatives **(Lectures: 15)**

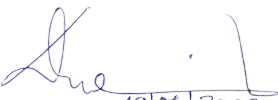
Unit-II: Tangents and normals, Curvatures, Asymptotes, Tracing of curves, Derivative in determining increasing, decreasing, and concavity of functions, relative and absolute extrema, and their applications, rectilinear motion and derivative, Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar form. **(Lectures: 20)**

Unit-III: Rolle's theorem, Mean Value theorems, Taylor's theorem and remainders, Taylor's series, Maclaurin's series and their applications. **(Lectures: 10)**

Unit-IV: Integration by successive reduction and applications, area under plane curves, area between two curves, rectification of plane curves (Cartesian, parametric and polar curves), application of integration in determining volumes, areas of surface of revolution. **(Lectures: 15)**

Recommended Books:

1. T. G.B. Thomas and R.L. Finney, *Calculus*, 13th ed.. Pearson Education, Delhi.
2. S. Narayan & P. K. Mittal, *Differential Calculus*, S. Chand & Co Ltd.
3. S. Narayan & P. K. Mittal, *Integral Calculus*, S. Chand & Co Ltd.
4. B. C. Das & B. N. Mukherjee, *Differential Calculus*. U.N. Dhur & Sons Pvt. Ltd.


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MAT- CC -1210
Higher Algebra
Credit: 4 (L-3, T-0, P-1)
Total Lectures: 60

Total Marks: 100 (Theory: 60, Practical: 20, Internal Assessment: 20)

Course Objectives: The primary objective of this course is to introduce the basic tools of theory of equations, complex numbers, matrices and determinant to understand their applications.

Course Learning Outcomes: This course will enable the students to:

- i) Employ De Moivre's theorem in a number of applications.
- ii) Recognize consistent and inconsistent systems of linear equations by the row echelon form.
- v) Learn about the solution sets of linear systems using matrix method.
- vi) solve problems using softwares.

Unit-I: Polar representation of complex numbers, n^{th} roots of Unity, De Moivre's theorem for rational indices and its applications, Expansions of $\sin n\theta$, $\cos n\theta$ and $\tan n\theta$, Evaluation of indeterminate quantities, Expansions of $\sin^n \theta$ and $\cos^n \theta$ in cosines or sines of multiples of θ , Expansions of $\sin n\theta$ and $\cos n\theta$ in series of descending and ascending powers of $\sin \theta$ and $\cos \theta$. **(Lectures: 15)**

Unit-II: Euler's expansion of cosine and sine, Hyperbolic functions and its applications; Inverse functions; Logarithmic functions of complex numbers; Gregory's series and its applications. **(Lectures: 10)**

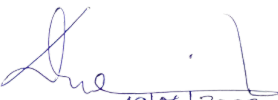
Unit-III: Polynomials and division algorithm; Roots of polynomial equations, Relations between the roots and the coefficients, Transformation of equations; Descartes rule of signs; Solution of cubic and biquadratic equations. **(Lectures: 10)**

Unit-IV: Determinants & Matrices; Minors and cofactors, adjoint and inverse of a matrix. Systems of linear equations, row reduction and normal forms, echelon forms, elementary operations on matrices, consistency of systems of linear system equations $Ax=b$, Gauss elimination method. symmetric and skew-symmetric matrices, Hermitian and skew-Hermitian matrices, Orthogonal matrices. Elementary operations on matrices. Rank of a matrix. **(Lectures: 15)**

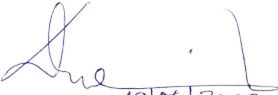
Unit-V: Practical / Lab work to be performed in Computer Lab. Using R/Python/Mathematica/MATLAB/Maple/Scilab/Maxima etc. in consonance with the units I to IV. **(Lectures: 10)**

Recommended Books:

1. J. Hall & P. Knight, *Higher Algebra* Arihant Publications.
2. S. Barnard & J M. Child, *Higher Algebra*, New Age International Private Limited.
3. B.C. Das & M. Mukherjee, *Higher Trigonometry*, U.N. Dhur & Sons (P) Ltd.


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MINOR COURSES (MC)


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MAT-MC-1110
Differential and Integral Calculus
Credit: 4 (L-3, T-1, P-0)
Total Lectures: 60

Total Marks: 100 (Theory: 80, Internal Assessment: 20)

Course Objectives: The primary objective of this course is to introduce basic tools of calculus and geometric properties which are helpful in understanding their applications in real world problems.

Course Learning Outcomes: This course will enable the students to:

- (i) Learn concepts of limit, continuity and derivatives of functions.
- (ii) Learn different theorems related to continuous functions.
- (iii) Learn basic concept of integration and its applications.

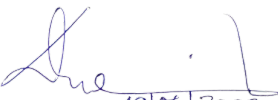
Unit-I: Limit and Continuity, Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions. **(Lectures: 20)**

Unit-II: Tangents and normals, Rolle's theorem, Mean Value theorems, Taylor's series, Maclaurin's series, Maxima and Minima, Indeterminate forms. **(Lectures: 20)**

Unit-III: Integration by partial fractions, integration of rational and irrational functions. Properties of definite integrals. Reduction formulae for integrals. Rectification of plane curves, area under plane curves, volume and surface areas of solid of revolution. **(Lectures: 20)**

Books Recommended:

1. T. G.B. Thomas and R.L. Finney, *Calculus*, 13th ed.. Pearson Education, Delhi.
2. S. Narayan & P. K. Mittal, *Differential Calculus*, S. Chand & Co Ltd.
3. S. Narayan & P. K. Mittal, *Integral Calculus*, S. Chand & Co Ltd.
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MAT-MC-1210
Differential Equations
Credit: 4 (L-3, T-1, P-0)
Total Lectures: 60

Total Marks: 100 (Theory: 80, Internal Assessment: 20)

Course Objectives: The main objective of this course is to introduce the students to the exciting world of differential equations and their solutions methods.

Course Learning Outcomes: The course will enable the students to learn basics of differential equations and methods for solving.

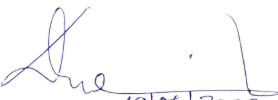
Unit-I: Order and degree of ordinary differential equation, formation of differential equation, General solution, variable separable form, Homogeneous differential equations, Equation reducible to Homogeneous equation from. **(Lectures: 20)**

Unit-II: Exact differential equations, equation reducible to exact form, Integrating factors, rules to find an integrating factor. Linear equation (including Bernoulli's equation and other simple cases reducible to reducible to linear), First order second degree equations. **(Lectures: 20)**

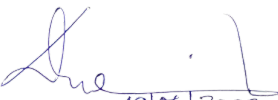
Unit-III: Linear differential equations second order with constant coefficients. Linear homogenous equations with constant coefficients, Linear non-homogenous equations, the method of variation of parameters, **(Lectures: 20)**

Books Recommended

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons.
2. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill Education
- 3.. M. D. Raisinghannia, *Ordinary and Partial Differential Equation*. S. Chand and Co. (2020).


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Skill Enhancement Courses (SEC)


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MAT-SE-0010

Fundamentals of Computers

Credit: 3 (L-2, T-0, P-1)

Total Lectures: 45

Total Marks: 100 (Theory: 60, Practical: 20, Internal Assessment: 20)

Course Objectives: The course aims at acquainting the students about the Basic structure and working of computers.

Course Learning outcomes: After the course, the student will be able to:

1. Understand how data are stored in computer.
2. Use technology ethically, safely, securely, and legally.
3. Identify and analyze computer hardware, software, and network components.
4. Make intelligent computer purchase decisions.

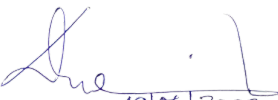
Unit I: Number systems: Binary Number System, Octal number system, Hexadecimal number system, Inter conversion between number systems, Binary arithmetic. **(Lectures: 15)**

Unit-II: Introduction to Computer, Block Diagram of Computers, generations and classification of Computers, System Hardware, Memory, Input and Output Devices, Interaction between User and Computer. Operating System: types and functions of Operating Systems, Translators: Assembler, compiler and interpreter. **(Lectures: 15)**

Unit-III: Practical in consonance with application software MS Office. **(Lectures: 15)**

Books Recommended

1. E. Balaguruswamy, *Fundamentals of Computers*, McGraw Hill Education India.
2. P. Dey. & M. Ghosh., *Computer fundamentals and programming in C*, Oxford University Press,
3. A. Goel, *Computer Fundamentals*, Pearson Education India.
4. V. Rajaraman V.& N. Adabala, *Fundamentals of computers*, Prentice Hall India Learning,
5. V. Gupta, *Computer Concepts and C Programming*, Dreamtech Press.


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MAT-SE-0020
Programming in C
Credit: 3 (L-1, T-0, P-2)
Total Lectures: 45

Total Marks: 100 (Theory: 30, Practical: 50: Internal Assessment: 20)

Course Objectives: The course aims at introducing the concepts of C Programming.

Course Learning outcomes: After the course, the student will be able to:

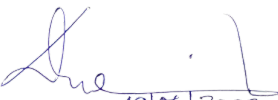
- i) Understand the notion of c Programming.
- ii) code a program on their own.
- iii) Solve problems which cannot be solved analytically.

Unit I: Introduction to C Programming: Basic structure, constants, variables, Data types, operators and expressions, Control statements: if statement, switch statement, conditional operator statement and goto statement. Looping, nested loops continue and break statements. Arrays and functions. **(Lectures: 15)**

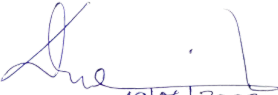
Practical: Practical in consonant with the materials in Unit I. **(Lectures: 30)**

Books Recommended

1. E. Balaguruswamy, *Programming in ANSI C*, McGraw Hill Education India,
2. P. Dey & and M. Ghosh, *Computer fundamentals and programming in C*, Oxford University Press.
3. V. Gupta, *Computer Concepts and C Programming*, Dreamtech Press.


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Multidisciplinary Course (MDC)


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MAT-MD-1110
Elementary Mathematics-I
Credit: 3(L-2, T-1, P-0)
Total Lectures: 45

Total Marks: 100 (Theory: 80, Internal Assessment: 20)

Course Objectives: The primary objective of this course is to introduce the basics of matrices, determinant, set theory, permutation and combination.

Course Learning Outcomes: This course will enable the students to:

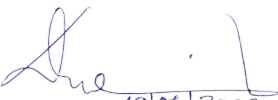
- (iii) Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix.
- (iv) Understand basics of set theory and their properties.
- (v) Learn about the concept of permutation and combination

Unit I: Matrices: Matrices, types of matrices. Determinants, rank of a matrix, inverse of a matrix, and invariance of rank under elementary transformations. Reduction to normal form and echelon forms. Consistency and solutions of system linear equations. **(Lectures: 30)**

Unit II: Sets, relations, congruence and equivalence relation, functions. Permutation and Combination. **(Lectures: 15)**

Books Recommended:

1. J. Hall & P. Knight, *Higher Algebra* Arihant Publications.
2. R. Bronsons, *Matrix Operations*, McGraw-Hill Education.
3. I. N. Heirstein, *Topics in Algebra*, Wiley.
4. S. Lipschutz, M. L. Lipson, &V. H. Patil, *Discrete Mathematics*, McGraw-Hill Education.


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MAT-MD-1210
Elementary Mathematics-II
Credit: 3(L-2, T-1, P-0)
Total Lectures: 45

Total Marks: 100 (Theory: 80, Internal Assessment: 20)

Course Objectives: The primary objective of this course is to introduce the basics of coordinate geometry and Calculus.

Course Learning Outcomes: This course will enable the students to:

- (i) understand the basic concepts of two-dimensional coordinate geometry.
- (ii) Understand the concept continuity, differentiability and integrability.
- (iii) Find the derivatives and integrals of various functions.

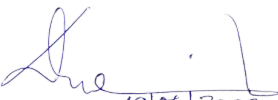
Unit I: Two-dimensional coordinate geometry: Distance between two points, Slope of a line and angle between two lines. Various forms of equations of a line: parallel to axes, point-slope form, slope-intercept form, two-point form, intercepts form and normal form. General equation of a line. Equation of family of lines passing through the point of intersection of two lines. Distance of a point from a line. **(Lectures: 15)**

Unit II: Differential Calculus: Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit function. Derivatives of exponential, logarithmic functions. Derivative of functions expressed in parametric forms. Second order derivatives. Increasing/decreasing functions, Maxima and minima of function of single variable.

Integral calculus: Integration of a variety of functions by substitution, by partial fractions and by parts. Definite integrals as a limit of a sum. Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals. **(Lectures: 30)**

Books Recommended:

1. S. L Loney, *The Elements of Coordinate Geometry (Part-I)*, Arhant Prakashan Ltd.
2. S. Narayan & P. K. Mittal, *Differential Calculus*, S. Chand & Co Ltd.
3. S. Narayan & P. K. Mittal, *Integral Calculus*, S. Chand & Co Ltd.
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