First Degree Programme in

Computer Applications (BCA)

SYLLABUS

Complementary Course in Mathematics

For 2023 admission onwards

SCHEME AND STRUCTURE OF THE COURSE

Sem	Course Code	Course Title	Instructional Hours per Week	Credit	Maximum Marks		
					CA	ESA	Total
I	MM 1131.9	Mathematics I	4	3	20	80	100
II	MM 1231.9	Mathematics II	4	3	20	80	100

PROGRAMME SPECIFIC OUTCOMES (PSO) FOR COMPLEMENTARY COURSE IN MATHEMATICS FOR FIRST DEGREE PROGRAMME IN COMPUTER APPLICATIONS-BCA

PSO1 To become familiar with modern mathematics and provide strong foundation in mathematics

PSO2 Recognize and appreciate the connections between theories and applications

PSO3 To acquire knowledge about certain mathematical concepts and techniques and their applications in computer software

PSO4 To apply Mathematics to analyze and develop computer programmes in the areas related to system software web designs and networking for efficient design

Semester I

Mathematics I

Code: MM1131.9 Instructional hours per week: 4

No. of Credits 3

Course Outcomes: After the completion of the course the students will be able to

CO1 Recall basic differentiation techniques, concepts of prime numbers and general concepts of differential equations. (Knowledge level).

CO2 Discuss hyperbolic and inverse hyperbolic function, Mean value theorem and Rolle's theorem. (Understanding Level)

CO3 Compute solution of differential equations, real part, imaginary part, polar form,exponentand log of complex numbers. (Applying Level)

CO4 Explain unique factorization theorem, Euclidean algorithm, congruence, Fermat's theorem and Wilson's theorem. (Analysing Level)

Module I (18 Hours)

Review of basic differentiation, Differentiation of hyperbolic functions, derivatives of hyperbolic functions, inverse hyperbolic functions logarithmic differentiation, implicit differentiation, Mean value theorem, Rolle's theorem.

Sections 2.3, 2.4, 2.5, 2.6, 2.7 of Chapter 2, 3.4 and 3.8 of Chapter 3 and 6.2 [exclude integration results] and 6.8 of Chapter 6 of Text 1.

Module II (18 Hours)

Differential equations, General Concepts, Formulation and solution of differential equations, first order (variable separable, homogeneous, exact) and second order with constant coefficients (complementary solution, particular solution).

Sections 1.1, 1.3, 1.4 and 1.5 of Chapter 1 and Section 2.1 and 2.2 of Chapter 2 of Text 2.

Module III (18 Hours)

Theory of Numbers, prime numbers, Unique factorization theorem,

Euclidean algorithm, congruences, Fermat's theorem, Wilson's theorem. [Theorems without proof]

Sections 2.5 of Chapter 2, Sections 3.1 and 3.2, Sections 4.1 and 4.2 and Sections 7.1 and 7.2 (Avoid Optional sections in text) of Text 3.

Module IV (18 Hours)

Complex Numbers, Separation into real and imaginary parts, Polar form of complex numbers, exponential and log of complex numbers

Sections 13.1, 13.2, 13.5 and 13.7 of Chapter 13 of Text 2.

Texts

Text 1 H Anton, I Bivens, S Davis. *Calculus*, 10th Edition, John Wiley & Sons.

Text 2 Erwin Kreyzig, *Advanced Engineering Mathematics*, 9th edition, New Age International Pvt Ltd.

Text 3 Thomas Koshy, *Elementary Number Theory with Applications*, 2nd Edition, Academic Press.

References

Ref. 1 Shanthi Narayan, *Differential Calculus*, S Chand & Company Zafar Ahsan, Differential Equations and their applications.

Ref. 2 Rudra Pratap, *Getting Started with MATLAB*, Oxford University Press.

COs	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1
CO2	2	2	2	2
CO3	2	2	2	1
CO4	3	3	2	2

(0-No correlation, 1-Low Correlation, 2-Moderate Correlation, 3-High Correlation)

Semester II

Mathematics II

Code: MM1231.9 Instructional hours per week: 4

No. of Credits 3

Course Outcomes: After the completion of the course the students will be able to

CO1 Recall set theory concepts, set operations, relations and its operations, equivalence relations and partitions, algebra and functions. (Remembering level)

CO2 Explain formal proofs, methods of proofs (proofs by contradiction, false proof and induction), logical equivalence, DeMorgan's law, tautologies, Implications, arguments, fallacies, communication model and error corrections. (Understanding Level)

CO3 Illustrate characteristic functions, Warshal's algorithm, recursion, group, ring, polish expressions and hamming codes. (Understanding Level)

CO4 Analyze Normal forms in prepositional logic, resolution, partial orders and ordered sets. (Analysing Level)

Module I (18 Hours)

Proof Methods, Logic: Formal proofs, Propositional reasoning, Proofs by contradiction, False Proofs, Proofs by Induction, Symbolic Logic: Boolean expressions, Logical Equivalence.

Introduction chapter from page 1 to 11 and Sections 1.2, 1.3, 1.4, 1.5 and 1.6 of Chapter 1 of the text.

Module II (18 Hours)

DeMorgan's Law, tautologies, Implications, Arguments, Fallacies, Normal forms in prepositional logic, Resolution, Review of Set theory concepts, set operations (avoid proofs), characteristic functions.

Sections 1.7, 1.9 to 1.19, 1.30, 1.31 and 1.33 of Chapter 1 and Sections 2.1, 2.3 and 2.4 of Chapter 2 of the text.

Module III (18 Hours)

Relations: operations on relations, equivalence relations and partitions, partial orders, ordered sets, Warshal's algorithm, Functions. (Avoid computer programs).

Sections 3.1 to 3.7 of Chapter 3 and Section 4.1 of Chapter 4 of the text.

Module IV (18 Hours)

Algebraic Structures: Algebra, DeMorgan's Law, Group, Subgroups examples and simple properties, Communication Model and error corrections, Hamming Codes.(Avoid computer programs).

Sections 5.1, 5.2, 5.3, 5.6 and 5.7 of the text.

Text

Text 1 Rajendra Akerkar, Rupali Akerkar, *Discrete Mathematics*, Pearson Education

References

Ref. 1 R M Somasundaram, *Discrete Mathematical structures*, PHI Learning Pvt. Ltd.

Ref. 2 Calvin C. Clawson, *Mathematical Mysteries, The beauty and magic of Numbers*, Viva Books Pvt Ltd.

Ref. 3 Rudra Pratap, *Getting Started with MATLAB*, Oxford University Press.

COs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	0
CO2	2	2	2	0
CO3	3	3	2	1
CO4	3	3	3	3

(0-No correlation, 1-Low Correlation, 2-Moderate Correlation, 3-High Correlation)

First Degree Programme in

Physics and Computer Applications

SYLLABUS

Complementary Course in Mathematics

For 2023 admission onwards

SCHEME AND STRUCTURE OF THE COURSE

Sem	Course Code	Course Title	Instructional Hours per Week	Credit	Maximum Marks		
					CA	ESA	Total
I	MM 1131.6	Mathematics I - Differential calculus of one variable and Special functions	5	4	20	80	100
II	MM 1231.6	Mathematics II - Integral calculus of one variable, Coordinate geometry and Complex numbers	5	4	20	80	100
III	MM 1331.6	Mathematics III - Differential equations, Linear equations, Abstract algebra and Laplace transforms	5	4	20	80	100
IV	MM 1431.6	Mathematics IV - Fourier series, Vector algebra, Vector calculus and Theory of equations	5	4	20	80	100

PROGRAMME SPECIFIC OUTCOMES (PSO) FOR COMPLEMENTARY COURSE IN MATHEMATICS FOR FIRST DEGREE PROGRAMME IN PHYSICS AND COMPUTER APPLICATIONS

PSO1 To acquire basic knowledge in functional areas of Mathematics and apply in the relevant field of learning

PSO2 To develop critical thinking, creative thinking and self confidence for the eventful success in career

PSO3 To recognize the importance and value of mathematical thinking and approach to problem solving

PSO4 To acquire relevant knowledge and skills in Mathematics appropriate to professional activities

PSO5 To become familiar with modern Mathematics

Semester I

Mathematics I

(Differential Calculus of One variable and Special functions)

Code: MM 1131.6 Instructional hours per week: 5

No. of Credits 4

Course Outcomes: After the completion of the course the students will be able to

CO1 Compute the limits and derivatives.

CO2 Explain the concept rate of change.

CO3 Analyse function behavior.

CO4 Understand basic concepts of some special functions.

Module I - Limits and continuity (24 Hours)

Definition of limits, One sided limits, two sided limits and infinite limits, computing limits, limits of polynomials and rational functions, limits involving radicals, limits of piecewise defined functions, limits at infinity. Continuity - Definition, continuity of polynomials and rational functions, continuity of compositions and continuity of Trigonometric functions.

Sections: 1.1, 1.2, 1.3, 1.5.1 to 1.5.6 and 1.6 of chapter 1 of text [1]

Module II - Differential Calculus of one variable (24 Hours)

Tangent lines, velocity, slopes and rates of change,rates of change in applications, Definition of the derivative function, computing instantaneous velocity, differentiability, relationship between differentiability and continuity, derivatives at the end points of an interval, other derivative notations, Techniques of differentiation, higher derivatives, product and quotient rule, derivatives of trigonometric functions, chain rule and implicit differentiation.

Sections : 2.1 to 2.7 of chapter 2 of text [1]

Module III - Applications of Derivatives (24 Hours)

Increase and decrease functions, concavity, absolute maxima and minima,

Rolle's theorem, Mean value theorem, L-Hospital's rule for evaluating limits in case of indeterminate forms.

Sections : 3.1, 3.2, 3.4, 3.5 and 3.8 of chapter 3 and 6.5 of chapter 6 in text [1].

Module IV - Special Functions (18 Hours)

Factorial function, Definition of Γ function, recursion relation, Γ function of negative numbers, some important formulas involving gamma functions, β functions, β functions in terms of Γ functions.

Sections 11.1 to 11.7 of text [2].

Texts

Text 1 Howard Anton, Irl C. Bivens, Stephen Davis, *Calculus*, 10th Edition, John Wiley and Sons.

Text 2 Mary L Boas, *Mathematics Methods in the Physical Sciences*, 3rd Edition, Wiley.

References

Ref. 1 Erwin Kreyszig, *Advanced Engineering Mathematics*, 10th Edition, Wiley-India.

Ref. 2 K F Riley, M P Hobson, S J Bence, *Mathematical methods for Physics and Engineering* 3^{rd} *Edition*, Cambridge University Press.

Ref. 3 Dr. B. S. Grewal, *Higher Engineering Mathematics* 43rd Edition, Khanna Publishers.

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	3
CO2	3	3	2	3	3
CO3	3	3	3	2	3
CO4	3	3	2	2	3

(0-No correlation, 1-Low Correlation, 2-Moderate Correlation, 3-High Correlation)

Semester II

Mathematics II

(Integral Calculus of One variable, Co ordinate Geometry and Complex Numbers)

Code: MM 1231.6 Instructional hours per week: 5

No. of Credits 4

Course Outcomes: After the completion of the course the students will be able to

CO1 Explain the relationship between area and integral.

CO2 Compute integrals.

CO3 Compute area and volume using integration.

CO4 Understand basic concepts of co ordinate geometry.

Module I - Integral calculus of one variable (24 Hours)

Area problem, the rectangle method for finding areas, Indefinite integral (integration from the view point of differential equations, slope fields, integral curves are excluded) integration by substitution, The definite integral (section 4.5- up to theorem 4.5.6), Fundamental theorem of Calculus, relationship between definite and indefinite integrals, Mean value theorem for integrals (without proof), Evaluting definite integrals by substitution.

Sections : 4.1, 4.2, 4.3, 4.5, 4.6 and 4.9 of chapter 4 of text [1].

Module II - Applications of Integration (24 Hours)

Area between two curves, Volumes by slicing disks and washers, volume by cylindrical shells, length of a plane curve, Area of surface of revolution.

Sections : 5.1 to 5.5 of chapter 5 of text [1].

Module III - Foundations of coordinate geometry (24 Hours)

Parametric equations of a curve, orientation of a curve, expressing ordinary functions parametrically, tangent lines to parametric curves, arc length of parametric curves, Polar coordinate systems, relationship between polar and rectangular coordinate systems, graphs in polar coordinate system,

symmetry test in polar coordinate system, tangent lines to polar curves, arc length of a polar curve, area in polar coordinates.

Sections : 10.1, 10.2 and 10.3 of chapter 10 of text [1].

Module IV - Complex numbers (18 Hours)

Complex numbers, geometric representation of imaginary numbers, geometric representation of $z_1 + z_2$, De-Moivre's theorem (without proof), roots of a complex number, complex function, exponential function of a complex variable..

Sections : 19.1 to 19.8 of chapter 19 of text [2].

Texts

Text 1 Howard Anton, Irl C.Bivens, Stephen Davis, *Calculus*, 10$^{\text{th}}$ Edition, John Wiley and Sons.

Text 2 Dr. B. S. Grewal, *Higher Engineering Mathematics* 43$^{\text{rd}}$ Edition, Khanna Publishers.

References

Ref. 1 Erwin Kreyszig, *Advanced Engineering Mathematics*, 10$^{\text{th}}$ Edition, Wiley-India.

Ref. 2 K F Riley, M P Hobson, S J Bence, *Mathematical methods for Physics and Engineering*, 3$^{\text{rd}}$ Edition, Cambridge University Press.

Ref. 3 Mary L Boas, *Mathematics Methods in the Physical Sciences*, 3$^{\text{rd}}$ Edition, Wiley.

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	3
CO2	3	2	2	3	3
CO3	3	3	3	3	2
CO4	3	2	1	2	2

(0-No correlation, 1-Low Correlation, 2-Moderate Correlation, 3-High Correlation)

Semester III

Mathematics III

(Differential Equations, Linear Equations, Abstract Algebra and Laplace Transforms)

Code: MM 1331.6 Instructional hours per week: 5

No. of Credits 4

Course Outcomes: After the completion of the course the students will be able to

CO1 Describe a first order differential equation and solve it.

CO2 Analyse the consistency of system of linear equations and solve it.

CO3 Understand some algebraic concepts.

CO4 Understand and apply the concept Laplace transform.

Module I - First Order Ordinary Differential Equations (24 Hours)

Differential Equations of first order - Definitions, solution of a differential equations, equations of the first order and first degree variable separable, homogeneous equations, equations reducible to homogenous form, linear equations, Bernoulli's equations, exact differential equations, equations reducible to exact equations, equations of the first order and higher degree, Clairaut's equation.

Sections : Chapter 11 of text [1].

Module II - System of linear Equations (18 Hours)

Introduction to determinants and matrices, rank of a matrix, solution of linear system of equations (exclude matrix inversion method), consistency of linear system of equations, linear transformations, vectors, eigenvalues, properties of eigen values (statement only), Cayley Hamilton theorem (statement only).

Sections : 2.1, 2.2, 2.7, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14 and 2.15 of Chapter 2 of text[1]

Module III - Abstract Algebra (24 Hours)

Group- definition and examples, elementary properties, finite groups and

subgroups, cyclic groups, elementary properties, result on order of elements.

Sections : 2, 4, 5 and 6 of text [2].

Module IV - Laplace Transforms (24 Hours)

Definition, transforms of elementary functions, properties of Laplace transforms, transforms of periodic functions, transforms of special functions, transforms of derivatives and integrals, multiplication by t^n, division by t, Evaluation of integrals by Laplace transforms.

Sections : 21.1 and 21.11 of chapter 21 of text [1].

Texts

Text 1 Dr. B. S. Grewal, *Higher Engineering Mathematics* 43rd Edition, Khanna Publishers.

Text 2 J B Fraleigh, *A First Course in Abstract Algebra*, 7th Edition, Pearson Education, INC.

References

Ref. 1 Howard Anton, Irl C. Bivens, Stephen Davis, *Calculus*, 10th Edition, John Wiley and Sons.

Ref. 2 Peter V O Neil, *Advanced Engineering Mathematics*, Thompson publications, 2007.

Ref. 3 Mary L Boas *Mathematics Methods in the Physical Sciences*, 3rd Edition, Wiley.

Ref. 4 Joseph Gallian, *Contemporary Abstract Algebra*, 8th Edition.

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	2
CO2	3	2	2	2	3
CO3	3	2	2	2	3
CO4	3	3	2	3	3

(0-No correlation, 1-Low Correlation, 2-Moderate Correlation, 3-High Correlation)

Semester IV

Mathematics IV

(Fourier Series, Vector Algebra, Vector Calculus and Theory of Equations)

Code: MM 1431.6 Instructional hours per week: 5

No. of Credits 4

Course Outcomes: After the completion of the course the students will be able to

CO1 Analyse Fourier Series.

CO2 Understand and apply basic operations among vectors.

CO3 Apply vector operators on scalar and vector point functions.

CO4 Understand the nature of roots fo polynomials and find approximate solutions.

Module I - Fourier Series (24 Hours)

Periodic functions, trigonometric series, Fourier series, Fourier coefficients, Euler formulas, periodic rectangular wave, derivation of Euler formulas, Arbitrary period, even and odd functions, half range expansions.

Sections : 11.1 and 11.2 of chapter 11 of text [2].

Module II - Vector Algebra (18 Hours)

Vectors, section formula,products of two vectors, Physical applications, scalar triple product, vector product of three vectors.

Sections: 3.1 to 3.10, text [1]

Module III - Vector Calculus (24 Hours)

Differentiation of Vectors,curves in space, velocity and acceleration, scalar and vector point functions, del applied to scalar point functions - gradient and vector point functions, physical interpretation of divergence, del applied twice to point functions,product of point functions, line integral.

Sections 8.1 to 8.11, text [1].

Module IV - Theory of Equations (24 Hours)

Fundamental theorem of Algebra(with out proof), relations between roots and coefficients of a polynomial, Reciprocal Equation, Descartes' rule of signs, finding approximate roots by bisection method and Newton - Raphson method. (Exclude symmetric functions of the roots, Sums of powers of the roots and Transformations of equations)

These topics can be found in text [3].

Texts

Text 1 Dr. B. S. Grewal, *Higher Engineering Mathematics* 43rd Edition, Khanna Publishers.

Text 2 Erwin Kreyszig, *Advanced Engineering Mathematics*, 10th Edition, Wiley-India.

Text 3 Barnard and Child, *Higher Algebra*, Mac Millan.

References

Ref. 1 Howard Anton, Irl C. Bivens, Stephen Davis, *Calculus*, 10th Edition, John Wiley and Sons.

Ref. 2 Mary L Boas *Mathematics Methods in the Physical Sciences*, 3rd Edition, Wiley.

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	3
CO2	3	2	2	2	2
CO3	3	3	2	3	2
CO4	3	3	2	3	2

(0-No correlation, 1-Low Correlation, 2-Moderate Correlation, 3-High Correlation)

First Degree Programme in

Computer Science

SYLLABUS

Complementary Course in Mathematics

For 2023 admission onwards

SCHEME AND STRUCTURE OF THE COURSE

Sem	Course Code	Course Title	Instructional Hours per Week	Credit	Maximum Marks		
					CA	ESA	Total
I	MM 1131.10	Mathematics I	4	3	20	80	100
II	MM 1231.10	Mathematics II	4	3	20	80	100

PROGRAMME SPECIFIC OUTCOMES (PSO) FOR COMPLEMENTARY COURSE IN MATHEMATICS FOR FIRST DEGREE PROGRAMME IN COMPUTER SCIENCE

PSO1 To provide sufficient knowledge and skills in mathematics

PSO2 Students should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations and terminology

PSO3 Assimilate various graph theoretic concepts and familiarize with their applications

PSO4 Demonstrate proficiency in writing proofs

Semester I

Mathematics I

Code: MM 1131.10 Instructional hours per week: 4

No. of Credits 3

Course Outcomes: After the completion of the course the students will be able to

CO1 To familiarize participants with the scope and applications of Calculus

CO2 Explain the underlying concepts and tools in Discrete Mathematics with emphasis on their applications to Computer Science.

CO3 Describe Linear Algebra and its applications

Module I - Differentiation and its Applications (18 Hours)

Differentiation: Hyperbolic and inverse hyperbolic functions.
Applications: n^{th} - derivative of - polynomials, exponential, sine, cosine, Leibniz Theorem (Without Proof) and its applications

Text Book: Howard Anton, Irl C. Bivens, Stephen Davis, *Calculus*, 10^{th} Edition, John Wiley & Sons

Module II- Linear Algebra (18 Hours)

System of Linear equations, Solving System of Linear equations, Vectors, Scalars, Addition, Scalar multiplication, dot product, vector projection, Independence.
Matrices, Identity matrix, Inverse of a matrix, Rank of a matrix, Nullity, Trace of a matrix, eigen values, eigen vectors , Matrix decompositions and Cramers' rule.

Text Book: B. S. Grewal, *Higher Engineering Mathematics*, 43^{rd} Edition, Khanna Publishers

Module III - Graph theory (18 Hours)

Basic concepts of graph theory, Graph terminology and Special types of graph, representation of graph, graph isomorphism, planar and non-planar graphs, Euler paths and circuits, Hamiltonian paths and circuits (without proofs), Trees, Spanning tree and theorems on trees.

Text Book: Narsingh Deo, *Graph Theory with Applications to Engineering*

and Computer Science

Module IV - Number Theory (18 Hours)

Numbers: Euclid's Algorithm - GCD of 2 natural numbers, Divisors of a given natural number. Congruence's: Euler's function $\phi(n)$ and its properties (without proof of theorems), Fermat's and Wilson's Theorems, Euler's extension of Fermat's theorem (Only Statements) and its applications to find the remainder when divisible by a given number.

Text Book: Lindsey N Childs, *A concrete introduction to Higher Algebra*, Second Edition, Springer.

References

Ref. 1 Kennenth A Rosen, *Discrete Mathematics and its Applications*, Tata McGraw-Hill Publications Co. Ltd

Ref. 2 Erwin Kreyszig, *Advanced Engineering Mathematics*, 10^{th} Edition, Wiley-India

Ref. 3 I. N. Herstein, *Topics in Algebra*, Second Edition, Wiley, 2006.

Ref. 4 J. P. Tremblay and R. Manohar, *Discrete Mathematical Structures with Application to Computer Science*, [Tata McGraw-Hill]

COs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	0	0
CO2	3	3	3	2
CO3	3	3	2	1

(0-No correlation, 1-Low Correlation, 2-Moderate Correlation, 3-High Correlation)

Semester II

Mathematics II

Code: MM 1231.10 Instructional hours per week: 4

No. of Credits 3

Course Outcomes: After the completion of the course the students will be able to

CO1 Explain the underlying concept and tools in Discrete Mathematics with emphasis on their applications to Computer Science.

CO2 Understand the basic idea of set theory and group theory.

CO3 To learn how codes in mathematics are used for error correction and data transmission.

Module I - Mathematical Logic (18 Hours)

Proposition and Connectives : Conditional and Bi conditional Equivalence of Propositions, Tautology and Contradictions, Duality Theorem and its properties, Algebra of Proposition.
Normal Form: Principal Disjunctive, Principal Conjunctive Normal Forms and its applications using truth tables only.
Theory of Inference: Rules of Inference - Rule P, Rule T and Rule CP, Consistent and Inconsistent Premises, Indirect Method of Proof using these inference rules.

Text Book: T Veerarajan, *Discrete Mathematics with Graph Theory and Combinatorics*, Tata McGraw-Hill, New Delhi, 2007.

Module II - Predicate Logic (18 Hours)

Quantifiers: Essential and Universal quantifier, Free and Bound Variables.
Rules of Specifications: Rule US, ES, UG, EG. Using these, convert a given statement into symbolic notation. Derivation from Premises using truth table and without using truth table.

Text Book: T Veerarajan, *Discrete Mathematics with Graph Theory and Combinatorics*, Tata McGraw-Hill, New Delhi, 2007.

Module III - Set Theory (18 Hours)

Partition of Set: POSET - HASSE diagrams for partial ordering - lub, glb.

Lattices: Definition and Examples, principle of duality, Properties - Idempotency, commutativity, associativity, absorption (sub lattices excluded).
Group Theory: Definition, Examples, Order of a Group and its elements.

Text Book: Tremblery, R. Manohar, *TMH Discrete Mathematical Structures with Applications to CS*.

Module IV - Coding Theory and Combinatorics (18 Hours)

Coding Theory: Group Code, Encoders and Decoders, Hamming Codes - Hamming distance, decoding and encoding function - correction and detection of errors in Group Codes - parity check matrix and its properties.
Combinatorics: Recurrence relations of degree k with constant coefficients (Homogeneous and Non-Homogeneous) and its solutions (Non-homogeneous including Polynomial, exponential - excluding their product combinations)- Generating function Method of is also included

Text Book: T Veerarajan, *Discrete Mathematics with Graph Theory and Combinatorics*, Tata McGraw-Hill, New Delhi, 2007.

References

Ref. 1 Ralph P Grimaldi, B V Ramana, *Discrete and Combinatorial Mathematics*, 5th Edition, Pearson Education.

Ref. 2 Keneth H Rosen, *Discrete Mathematics and its Applications*, Tata McGraw-Hill Pub.Co.Ltd.

Ref. 3 Seymour Lipschutz, Marc Lars Lipson, *Discrete Mathematics*, Schaum's Solved Problems, Series, McGraw-Hill International Editions

COs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	3	2	2
CO3	3	3	2	1

(0-No correlation, 1-Low Correlation, 2-Moderate Correlation, 3-High Correlation)

First Degree Programme in

Electronics

SYLLABUS

Complementary Course in Mathematics

For 2023 admission onwards

SCHEME AND STRUCTURE OF THE COURSE

Sem	Course Code	Course Title	Instructional Hours per Week	Credit	Maximum Marks		
					CA	ESA	Total
I	MM 1131.8	Calculus with Applications - I	4	3	20	80	100
II	MM 1231.8	Calculus with Applications - II	4	3	20	80	100
III	MM 1331.8	Calculus and Linear Algebra	3	3	20	80	100

PROGRAMME SPECIFIC OUTCOMES (PSO) FOR COMPLEMENTARY COURSE IN MATHEMATICS FOR FIRST DEGREE PROGRAMME IN ELECTRONICS

PSO1 Develop familiarity with modern mathematics and provide strong foundation in mathematics

PSO2 Recognize and appreciate the connections between theories and applications

PSO3 Recognize the importance and value of mathematical thinking and approach to problem solving

PSO4 Formulate and analyze mathematical models of real life situations

Semester I

Mathematics I

Calculus with Applications - I

Code: MM 1131.8 Instructional hours per week: 4

No. of Credits 3

Course Outcomes: After the completion of the course the students will be able to

CO1 To acquaint students with the scope and applications of Differential and Integral Calculus.

CO2 To develop an in-depth knowledge about the topics Complex numbers, Hyperbolic functions, Fourier series and Laplace transforms.

Module I - Differentiation with Applications (18 Hours)

(The following topics should be quickly reviewed before going to advanced topics; students should be asked to do more problems from exercises, and these problems should be included in assignments) Differentiation of products of functions; the chain rule; quotients; implicit differentiation; logarithmic differentiation; Leibnitz' theorem.

(The following topics in this module should be devoted more attention and time)

Special points of a function (especially, stationary points); curvature; theorems of differentiation – Rolle's Theorem, Mean Value Theorem.

The topics in this module can be found in chapter 2, sections 2.1.2, to 2.1.7, text [1] (Review of ideas through problems), chapter 2, sections 2.1.8, 2.1.9, 2.1.10, text [1] More exercises related to the topics in this module can be found in chapter 2 and chapter 3 of reference [1].

Module II - Integration with Applications (18 Hours)

Integration by parts; reduction formulae; infinite and improper integrals; plane polar coordinates; integral inequalities; applications of integration (finding area, volume etc).

The topics in this module can be found in chapter 2, sections 2.2.8 to 2.2.13, text [1].More exercises related to the topics in this module can be found in chapter 4, chapter 5 and chapter 7 of reference [1].

Module III - Complex numbers and Hyperbolic functions (18 Hours)

Complex numbers, Basic operations(Addition and subtraction; modulus and argument; multiplication; complex conjugate; division), Polar representation of complex numbers (Multiplication and division in polar form), De Moivre's theorem (trigonometric identities; finding the nth roots of unity; solving polynomial equations), Complex logarithms and complex powers, Applications to differentiation and integration, Hyperbolic functions (Definitions; hyperbolic trigonometric analogies; identities of hyperbolic functions; inverses of hyperbolic functions; calculus of hyperbolic functions).

The topics in this module can be found in chapter 3, sections 3.1 to 3.7 of text [1] More exercises related to the topics in this module can be found in chapter 6 of reference [1] and chapter 13 of text [2].

Module IV - Fourier series and Laplace transforms (18 Hours)

Fourier series - Basic definition, Periodic Functions, Fourier Coefficients, Dirichlet Conditions, Even and Odd Functions, Half range series.
Laplace Transforms - Definition, Properties (Linearity property, Shifting property, Multiplication by powers of t, Laplace transform of derivatives), Simple problems.

The topics in this module can be found in chapter 6 and chapter 11 of text [2].

Texts

Text 1 K F Riley, M P Hobson, S J Bence, *Mathematical methods for Physics and Engineering* 3^{rd} *Edition*, Cambridge University Press.

Text 2 Erwin Kreyszig, *Advanced Engineering Mathematics*, 10^{th} Edition, Wiley-India.

References

Ref. 1 H Anton, I Bivens, S Davis, *Calculus*, 10^{th} Edition, John Wiley and Sons.

Ref. 2 Mary L Boas, *Mathematics Methods in the Physical Sciences*, 3^{rd} Edition, Wiley.

Ref. 3 George B Arfken, Hans J Weber, Frank E Harris, *Mathematical Methods for Physicists*, 7^{th} Edition, Academic Press

COs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	2	3	3

(0-No correlation, 1-Low Correlation, 2-Moderate Correlation, 3-High Correlation)

Semester II

Mathematics III

Calculus with Applications - II

Code: MM 1231.8 Instructional hours per week: 4

No. of Credits 3

Course Outcomes: After the completion of the course the students will be able to

CO1 To acquaint students with vector algebra

CO2 To develop understanding about the difference between total and partial derivatives and to perform both operations.

CO3 To evaluate multiple integrals and apply it in relevant situations.

CO4 To develop knowledge and skill in vector calculus.

Module I - Vector Algebra (18 Hours)

Scalars and vectors, Addition and subtraction of vectors, Multiplication by a scalar, Basis vectors and components, Magnitude of a vector, Multiplication of vectors (Scalar product; vector product; scalar triple product; vector triple product), Equations of lines, planes and spheres, using vectors to find distances (Point to line; line to line).

The topics in this module can be found in chapter 7, sections 7.1 to 7.8, text [1] More exercises related to the topics in this module can be found in chapter 11 of reference [1] and chapter 6 of reference [2].

Module II - Partial Differentiation (18 Hours)

Definition of partial derivative, The total differential and total derivative, Exact and inexact differentials, theorems of partial differentiation, The chain rule, Change of variables, Taylors theorem for many-variable functions, Stationary values of many-variable functions, Stationary values under constraints.

The topics in this module can be found in chapter 5, sections 5.1 to 5.9 of text [1] More exercises related to the topics in this module can be found in chapter 13 of reference [1]

Module III - Multiple Integrals (18 Hours)

Double integrals, Triple integrals, Applications of multiple integrals (Areas and volumes), Change of variables in multiple integrals - Change of variables in double integrals; evaluation of some special infinite integrals, change of variables in triple integrals; general properties of Jacobians.

The topics in this module can be found in chapter 6, sections 6.1 to 6.4 of text [1] More exercises related to the topics in this module can be found in chapter 14 of reference [1].

Module IV - Vector Calculus (18 Hours)

Differentiation of vectors - Composite vector expressions; differential of a vector, Integration of vectors, Space curves, Vector functions of several arguments, Surfaces, Scalar and vector fields Vector operators - Gradient of a scalar field; divergence of a vector field; curl of a vector field, Vector operator formulae - Vector operators acting on sums and products; combinations of grad, div and curl, Cylindrical and spherical polar coordinates

The topics in this module can be found in chapter 10, sections 10.1 to 10.9 of text [1]. More exercises related to the topics in this module can be found in chapter 3 of reference [3].

Texts

Text 1 K F Riley, M P Hobson, S J Bence, *Mathematical methods for Physics and Engineering*, 3rd Edition, Cambridge University Press.

References

Ref. 1 H Anton, I Bivens, S Davis, *Calculus*, 10th Edition, John Wiley and Sons.

Ref. 2 Mary L Boas, *Mathematics Methods in the Physical Sciences*, 3rd Edition, Wiley.

Ref. 3 George B Arfken, Hans J Weber, Frank E Harris, *Mathematical Methods for Physicists*, 7th Edition, Academic Press

Ref. 4 Erwin Kreyszig, *Advanced Engineering Mathematics*, 10th Edition, Wiley-India.

COs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1
CO2	3	2	3	2
CO3	3	3	3	3
CO4	3	2	3	2

(0-No correlation, 1-Low Correlation, 2-Moderate Correlation, 3-High Correlation)

Semester III

Mathematics III

Calculus and Linear Algebra

Code: MM 1331.8 Instructional hours per week: 3

No. of Credits 3

Course Outcomes: After the completion of the course the students will be able to

CO1 To explain the underlying concepts and tools in Discrete Mathematics and their applications

CO2 To acquaint students with First order ordinary differential equations and their applications

CO3 To familiarize students with the scope and applications of Linear Algebra

Module I - Mathematical Logic (18 Hours)

Proposition and Connectives: Conditional and Bi-conditional Equivalence of Propositions, Tautology and Contradictions, Duality Theorem and its properties, Algebra of Proposition.
Normal Form: Principal Disjunctive, Principal Conjunctive Normal Forms and its applications using with and without truth tables
Theory of Inference: Rules of Inference - Rule P, Rule T and Rule CP, Consistent and Inconsistent premises, Indirect Method of Proof using these inference rules.

The topics in this module can be found in chapter 1 of text [3]. More exercises related to the topics in this module can be found in chapter 4 of reference [4].

Module II - Ordinary Differential Equations of First order (12 Hours)

First-order ordinary differential equations: General form of solution, First-degree first-order equations (Separable-Variable equations; Exact equations; inexact equations, integrating factors; linear equations; homogeneous equations; isobaric equations, Bernoulli's equation) Higher-degree first-order equations (Equations soluble for p; Clairaut's

equation)

The topics in this module can be found in chapter 14 of text [1]. More exercises related to the topics in this module can be found in chapter 1, 2 and 3 of reference [1].

Module III - Basic Linear Algebra (24 Hours)

Matrices and row reduction, Determinants, Cramer's rule for solving system of equations, vectors, lines and planes, linear combinations, linear functions, linear operators, linear dependence and independence, special matrices like Hermitian matrices and formulas, linear vector spaces, eigen values and eigen vectors, diagonalizing matrices, applications of diagonalization.

The topics in this module can be found in chapter 3 of text [2] More exercises related to the topics in this module can be found in chapter 7 and 8 of reference [1].

Texts

Text 1 K F Riley, M P Hobson, S J Bence, *Mathematical methods for Physics and Engineering*, 3rd Edition, Cambridge University Press.

Text 2 Mary L Boas, *Mathematics Methods in the Physical Sciences*, 3rd Edition, Wiley.

Text 3 T Veerarajan, *Discrete Mathematics with Graph Theory and Combinatorics*, Tata McGraw- Hill, New Delhi, 2007

References

Ref. 1 Erwin Kreyszig, *Advanced Engineering Mathematics*, 10th Edition, Wiley-India.

Ref. 2 H Anton, I Bivens, S Davis, *Calculus*, 10th Edition, John Wiley and Sons.

Ref. 3 George B Arfken, Hans J Weber, Frank E Harris, *Mathematical Methods for Physicists*, 7th Edition, Academic Press

Ref. 4 Seymour Lipschutz, Marc Lars Lipson, *Discrete Mathematics*, Schaum's Solved Problems Series, 3rd Edition, McGraw-Hill International Editions.

COs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	3	2

(0-No correlation, 1-Low Correlation, 2-Moderate Correlation, 3-High Correlation)