

201 - B. Sc. MATHEMATICS

Programme Structure and Scheme of Examination (under CBCS)
(Applicable to the candidates admitted in Affiliated Colleges from
the academic year 2022 -2023 onwards)

Course Code	Part	Study Components & Course Title	Hours/ Week	Credit	Maximum Marks		
					CIA	ESE	Total
SEMESTER - I							
22UTAML11	I	Language Course - I : Tamil/Other Languages	5	3	25	75	100
22UENGL12	II	English Course - I : Communicative English I	5	3	25	75	100
22UMATC13	III	Core Course - I : Classical Algebra	5	4	25	75	100
22UMATC14		Core Course - II : Differential Calculus and Trigonometry	5	4	25	75	100
		Allied - I : Paper – 1: Numerical Methods using Python I / Physis-I	4	4	25	75	100
		Allied Practical – I: Numerical Methods with Python / Physics	4	-	-	-	-
22UENV18	IV	Environmental Studies	2	2	25	75	100
Total			30	20			600
SEMESTER - II							
22UTAML21	I	Language Course - II : Tamil/Other Languages	5	3	25	75	100
22UENGL22	II	English Course - II : Communicative English II	5	3	25	75	100
22UMATC23	III	Core Course – III : Integral Calculus	4	4	25	75	100
22UMATC24		Core Course – IV : Analytical Geometry 3D	3	3	25	75	100
		Allied – I : Paper -2: Numerical Methods using Python – II / Physics – II	4	4	25	75	100
		Allied Practical – I : Numerical Methods with Python / Physics	2	3	40	60	100
22UMATE27		Internal Elective – I : (Choose any 1 out of 3)	3	3	25	75	100
22UVALE27	IV	Value Education	2	1	25	75	100
22USOFS28		Soft Skill	2	1	25	75	100
Total			30	25			900

Internal Elective Courses

22UMATE27-1	Internal Elective - I	1. Fourier Series and Fourier Transform
22UMATE27-2		2. Matrix Theory
22UMATE27-3		3. Number Theory

Allied Courses

22UNUMA01	Theory	1. Numerical Methods using Python - I
22UPHYA01		2. Physics - I
22UNUMA02	Theory	1. Numerical Methods using Python - II
22UPHYA02		2. Physics - II
22UNUMPO2	Practical	1. Practical – Numerical Methods with Python
22UPHYP02		2. Physics Practical

Allied Courses offered by the Department of Mathematics

22UNUMA01	Theory	Numerical Methods using Python - I
22UNUMA02	Theory	Numerical Methods using Python - II
22UNUMPO2	Practical	Numerical Methods using Python
22UMATA01	Theory	Mathematics – I (For B.Sc. Physics, Chemistry, Statistics and Computer Science)
22UMATA02	Theory	Mathematics – II (For B.Sc. Physics, Chemistry, Statistics and Computer Science)
22UMAF01	Theory	Mathematical Foundations – I (For B.Sc Computer Science & BCA)
22UMAF02	Theory	Mathematical Foundations – II (For B.Sc Computer Science)
22UBUMA01	Theory	Business Mathematics (For B.Com I Year)

YEAR - I	CLASSICAL ALGEBRA	22UMATC13
SEMESTER - I		HRS/WK – 5
CORE- I		CREDIT – 4

COURSE OBJECTIVES

In this course students are exposed to topics like Theory of Equations, Summation of Series, Matrices and Elementary Number Theory. The stress is on the development of problem solving skills.

Unit-1: Theory of Equations

Polynomial Equations - Symmetric Functions of roots in terms of Coefficients - Sum of r-th powers of roots - Reciprocal Equations - Transformation of Equations.

Unit-2: Theory of Equations (Contd...)

Descartes Rule of Signs - Approximate Solutions of Polynomials by Horner's method - Newton - Raphson method of Solution of a Cubic Polynomial.

Unit-3: Summation of Series

Summation of series using Binomial - Exponential and Logarithmic series (Theorems without proofs) - Approximation using Binomial & Exponential series.

Unit-4: Elementary Number Theory

Prime Number - Composite Number - Decomposition of a Composite Number as a Product of Primes uniquely (without proof) - Divisors of a Positive Integer - simple problems.

Unit-5: Elementary Number Theory (Contd.)

Congruence Modulo n - Euler Function (without Proof) - Highest Power of a Prime Number p contained in n! - Fermat's and Wilson's Theorems (statements only).

Text Books

- 1) P. Kandasamy, K. Thilagavathy, Content and treatment as in the book Mathematics for B.Sc. Vol-I, II, III & IV, S.Chand & Company Ltd., New Delhi-55 (2004).
- 2) S. Narayanan, R. Hanumantha Rao, T.K. Manicavachagom Pillay and Dr. P. Kandaswamy, Ancillary Mathematics, Volume-I, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 2009.

Supplementary Readings

- 1) T.K. Manicavachagom Pillay, T.Natarajan and K.S.Ganapathy, Algebra, Volume I & II, S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai, 2004.
- 2) S. Arumugam, Algebra, New Gamma Publishing House, Palayamkottai, 2003.
- 3) A. Singaravelu, Algebra and Trigonometry, Vol.-I & II, Meenakshi Agency, Chennai, 2003.
- 4) S. Sudha, Algebra and Trigonometry, Emerald Publishes, Chennai. B.Sc. Mathematics: Syllabus (CBCS), 1998.

COURSE OUTCOMES

On successful completion of the course, the student will be able to:

- 1) Apply the fundamental concept of theory of equations and to find solutions.
- 2) Apply Descartes' rule, Horner's method, Newton Raphson methods for finding approximate solutions.

- 3) Apply summation of series using Binomial, Exponential and Logarithmic series for finding approximations.
- 4) Apply the elementary number theory for highest power of prime number.
- 5) Apply the elementary number theory for Fermat's and Wilson's theorem.

OUTCOME MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	3	3	3	2

1-Low 2-Moderate 3- High

YEAR - I	DIFFERENTIAL CALCULUS AND TRIGONOMETRY	22UMATC14
SEMESTER - I		HRS/WK – 5
CORE- II		CREDIT – 4

COURSE OBJECTIVES

To inculcate the basics of differentiation and their applications, the notion of curvatures, radius of curvature in Cartesian and polar coordinates, Evolutes & Involutes, students can be trained to understand the basic concepts of Trigonometry.

UNIT I

Methods of Successive Differentiation – Leibnitz's Theorem and its applications
Increasing & Decreasing functions –Maxima and Minima of functions of two variables.

UNIT II

Curvature – Radius of curvature in Cartesian and in Polar Coordinates – Centre of curvature–Evolutes & Involutes

UNIT III

Expansions of $\sin(nx)$, $\cos(nx)$, $\tan(nx)$ – Expansions of $\sin nx$, $\cos nx$ –
Expansions of $\sin(x)$, $\cos(x)$, $\tan(x)$ in powers of x .

UNIT IV

Hyperbolic functions – Relation between hyperbolic & Circular functions- Inverse hyperbolic functions.

UNIT V

Logarithm of a complex number –Summation of Trigonometric series – Difference method- Angles in arithmetic progression method –Gregory's series

Text Books

- 1) S.Narayanan and T.K.Manicavachagom Pillai, Calculus Volume I, S.Viswanathan (Printers&Publishers) Pvt Limited, Chennai -2011.
- 2) S.Arumugam & others, Trigonometry and Fourier series, New Gamma Publications -1999

UNIT-I	Chapter III	Sections 1.1 to 2.2 & Chapter IV Section 2.1 2.2 and Chapter V 1.1 to 1.4 of [1]
UNIT-II	Chapter X	Sections 2.1 to 2.6 of [1]
UNIT-III	Chapter 1	Sections 1.2 to 1.4 of [2]
UNIT-IV	Chapter 2	Sections 2.1& 2.2 of [2]
UNIT V	Chapter 3 & 4	Sections 4.1,4.2 & 4.4 of [2]

Supplementary Readings

- 1) S.Arumugam and Isaac, Calculus, Volume1, New Gamma Publishing House, 1991.
- 2) S. Narayanan, T.K. Manichavasagam Pillai, Trigonometry, S. Viswanathan Pvt Limited, and Vijay Nicole Imprints Pvt Ltd, 2004.

COURSE OUTCOMES

On successful completion of the course, the students will be able to

- 1) To know the basic concepts of Successive approximations and Leibnitz's theorem
- 2) Know the principles of Maxima and Minima for 2 variables.

- 3) Find the radius of curvature for Cartesian and Polar coordinates, Evolutes and Involutives.
- 4) Know the expansions of Trigonometric functions.
- 5) Understand the concepts of Hyperbolic and Inverse Hyperbolic functions, Logarithm of Complex numbers, summation of Trigonometry series, Gregory series.

OUTCOME MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	2	3	2
CO5	3	3	2	3	2

1-Low 2-Moderate 3- High

YEAR - I	INTEGRAL CALCULUS	22UMATC23
SEMESTER -II		HRS/WK – 4
CORE- III		CREDIT – 4

COURSE OBJECTIVES

In this paper the student is exposed to the idea of integration and different methods of integration. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage. The application of integration to the evaluation of areas and volumes is also introduced.

Unit I :

Introduction, Definite integral-Methods of integration-Integrals of functions of the form

$$\int \frac{f'(x)}{f(x)} dx, \int [f(x)]^n f'(x) dx, \int F[f(x)]f'(x) dx, \int \frac{dx}{ax^2+bx+c}, \int \frac{lx+m}{ax^2+bx+c} dx$$

Unit II :

Reduction formulae-Bernoulli's formula

$$I_n = \int x^n e^{ax}$$

$$I_n = \int \cos^n x dx$$

$$I_n = \int \sin^n x dx$$

$$I_{m,n} = \int \sin^m x \cos^n x dx$$

Unit III :

Change of order of integration – Properties of definite integrals.

Unit IV:

Double integrals – Double integrals in Polar coordinates – Triple integrals.

Unit V:

Application of double and triple integrals – area- volume.

Text Books (In API Style)

1.S. Narayanan and T.K. Manicavachogam Pillay, Calculus Vol. II, Ananda Book Depot, 2021.

Unit-I Chapter 1: Sections 1 to 4

Unit-II Chapter 1: Sections 13 to 15.

Unit-III Chapter 1: Sections 11

Chapter 5: Section 2

Unit-IV Chapter 5: Section 3

Chapter 5: Sections 1 to 5.

Unit-V Chapter 5: Sections 4 to 6.

Supplementary Reading:

- 1) G.B.Thomas and R.L.Finney. (1998) Calculus and Analytic Geometry,
- 2) Addison Wesley (9th Edn),Mass. (Indian Print).
- 3) M.K.Venkataraman. (1992) Engineering Mathematics-Part B. National Publishing Company,Chennai.
- 4) T, Veerarajan, Engineering Mathematics [For Semester I and II], 3rd Edition, Tata McGraw Hill Education Private Limited, New Delhi.

Course Outcomes:

On successful completion of the course, the students will be able to

- 1) Solve problems using the different methods of integration.
- 2) Solve problems in techniques of Reduction formulae and Bernoulli's formula.
- 3) Solve problems in Change of order of integration and Properties of definite integrals.
- 4) Solve problems in double and triple integrals.
- 5) Apply double and triple integrals in finding area and volume.

OUTCOME MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	2	2
CO5	3	3	3	3	2

1-Low 2-Moderate 3- High

YEAR - I	ANALYTICAL GEOMETRY 3D	22UMATC24
SEMESTER -II		HRS/WK – 3
CORE- IV		CREDIT – 3

COURSE OBJECTIVES

This paper aims to understand the fundamental concepts of Analytical Geometry in Three Dimension, such as Distance between points, Projections, Angle between planes, Line of intersection of two planes, Length of perpendicular, Symmetrical form of the equations of a line, Coplanar lines, Shortest distance between two given lines, Centre and radius of Sphere, Equation of a circle on a sphere, The equation of Right circular cone and cylinder, Central quadrics

Unit-1

Rectangular Cartesian Co-ordinates: Direction Cosines of a line.

Unit-2

The Plane.

Unit-3

The Straight Line.

Unit-4

The Sphere.

Unit-5

The Central Quadrics and Cone.

Text Book

T.K. Manickavachagom Pillay and T. Natarajan, Content and treatment as in the book Analytical Geometry, (Part-II – Three Dimensions), S.Viswanathan Printers & Publishers Pvt. Ltd., Chennai, Reprint 2011

Unit – I: Chapter 1 (Fully) (Pages 1-23)

Unit-II: Chapter 2 (Fully) (Pages 24-45)

Unit- III: Chapter 3 (Fully) (Pages 46-92)

Unit- IV: Chapter 4 (Fully) (Pages 93-114)

Unit- V: Chapter 5 (Fully) (Pages 115-190)

Supplementary Readings

- 1) P.Duraipandian and Laxmi Duraipandian, Analytical Geometry-3D, Emerald Publishers, Chennai, 1975.
- 2) G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, Addison Wesley (9th Edn.), Mass. (Indian Print), 1998.
- 3) P.R.Vittal, Coordinate Geometry, Margham Publishers, Chennai, 2003.

COURSE OUTCOMES

On successful completion of the course, the students will able to:

- 1) Explain fundamental concepts of analytical geometry in 3D, about direction cosines of a line and the plane, equation and plane.
- 2) Know the straight line, symmetric form of equation of a line, equation of a line passing through two given points, the plane and the straight line, intersection of three planes.

- 3) Understand the Length of perpendicular distance, Coplanar lines.
- 4) Solve problems on Symmetrical form of the equations of a line, Shortest distance between two given lines, Centre and radius of Sphere
- 5) Find the equation of Sphere, the length of the tangent from point to sphere, equation of a circle on a sphere, intersection of two spheres, cone, cylinder and central quadrics.

OUTCOME MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	2	2
CO3	3	3	3	3	2
CO4	2	3	3	3	2
CO5	3	3	3	3	2

1-Low 2-Moderate 3- High

YEAR - I	FOURIER SERIES AND FOURIER TRANSFORM	22UMATE27-1
SEMESTER -II		HRS/WK – 3
ELECTIVE-I		CREDIT – 3

COURSE OBJECTIVES

Introduce the Fourier series and its application and the concepts of Half range Sine and Cosine series Dirichlet's conditions, Fourier Integrals, Fourier Sine and Cosine Integral, and different type Fourier transforms.

Fourier Series:

Unit-1:

Introduction, Dirichlet conditions, Euler's Formulae for Fourier Series, Theorem for the convergence of Fourier series, Fourier Series for functions of period 2π . Examples.

Unit-2:

Change of Interval - Fourier Series for functions of period 2Δ , Dirichlet's conditions, Examples. Fourier Series of a function with its periodic extension.

Unit-3:

Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Examples.

Unit-4:

Definition - Fourier Integrals - Fourier Sine and Cosine Integral - Complex Form of Fourier Integral - Fourier Transform: Fourier Sine and Cosine Transforms - Finite Fourier Sine and Cosine Transforms (without proof)

Unit-5:

Properties of Fourier Transforms - Convolution Theorem for Fourier Transforms - Parseval's Identity for Fourier Transforms - (without derivation), Inverse of Fourier Transform, Examples.

Text Books

- 1) Unit- I, II, III: Dr. M. K. Venkataraman and Mrs. Manorama Sridhar, Content and treatment of Chapter 1 Fourier series as in the book Calculus and Fourier Series, The National Publishing company, Chennai 2001.
- 2) B.S.Grewal. Higher Engineering Mathematics (2002), Khanna Publishers, New Delhi.

Supplementary Readings

- 1) S. Narayanan and T.K. Manicavachagom Pillay, Calculus Volume-III, S. Viswanathan (Printers & Publisher) Pvt. Ltd. Chennai, 2008.
- 2) M.K.Venkataraman, Engineering Mathematics-Part B. National Publishing Company, Chennai, 1992.
- 3) Dr. B. S. Grewal, Higher Engineering Mathematics Edition 43rd, Khanna Publishers, New Delhi, 2014.
- 4) K. Vairamanickam, Nirmala P. Ratchagar and S. Tamilselvan, Engineering Mathematics – II, Scitech Publications (India) Pvt. Ltd., Chennai, 2011.
- 5) K. Vairamanickam, Nirmala P. Ratchagar and S. Tamilselvan. Transforms and Partial Differential Equations, Scitech Publications (India) Pvt. Ltd., Chennai, 2012.

COURSE OUTCOMES

On successful completion of the course, the students will be able to:

- 1) Find the Fourier series representation of a function of one variable.
- 2) Find the solution of the wave, diffusion and Laplace equations using the Fourier series.
- 3) Demonstrate the use of Fourier Transform to connect the time domain and frequency domain.
- 4) Understand different types of Fourier Transform and its properties.
- 5) Solve problems on Fourier Transform and inverse Fourier Transform.

OUTCOME MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	2	3	3	3	2
CO5	3	3	3	3	2

1-Low 2-Moderate 3- High

YEAR - I	MATRIX THEORY	22UMATE27-2
SEMESTER -II		HRS/WK – 3
ELECTIVE-II		CREDIT – 3

COURSE OBJECTIVES

In this course students are trained to develop skills in finding rank, inverse, Eigen values, Eigen vectors and quadratic forms.

Unit-1:

Rank of the Matrix – Inverse of the Matrix.

Unit-2:

Symmetric – Skew Symmetric – Hermitian – Skew Hermitian – Orthogonal and Unitary matrices.

Unit-3:

Eigen values – Eigen vectors – Cayley Hamilton theorem.

Unit-4:

Diagonalisation by similarity transformation.

Unit-5:

Quadratic Forms – Nature of Quadratic Forms.

Text Book

- 1) S. Narayanan, R. Hanumantha Rao, T.K. Manicavachagom Pillay and Dr. P. Kandaswamy, Ancillary Mathematics, Volume-I, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 2009.

Supplementary Readings

- 1) K. Vairamanickam, Nirmala P. Ratchagar and S. Tamilselvan, Engineering Mathematics, Scitech Publications (India) Pvt. Ltd., Chennai, 2009.
- 2) Richard Bellman, Introduction to Matrix Analysis, Second Edition, T.M.G. Publishing Company Ltd., New Delhi, 1974.

COURSE OUTCOMES

On successful completion of the course, the students will be able to:

- 1) Find the rank and inverse of a matrix.
- 2) To understand the symmetric, skew symmetric, Hermitian, orthogonal and Unitary matrices
- 3) Find Eigen Values and Eigen Vectors.
- 4) Diagonalize the matrix using similarity transformation.
- 5) Find the nature of Quadratic forms.

OUTCOME MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	2
CO2	3	2	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	3	3	3	2

1-Low 2-Moderate 3- High

YEAR - I	NUMBER THEORY	22UMATE27-3
SEMESTER -II		HRS/WK – 3
ELECTIVE-III		CREDIT – 3

COURSE OBJECTIVES

To highlight the niceties and nuances in the world of numbers, the students will be given training on divisibility of numbers and the fundamental theorem of arithmetic, prepare them for coding through congruences and make them understand the Applications of Fermat's theorem, Wilson's theorem and famous Chinese remainder theorem.

Unit I

Euclid's Division Lemma – Divisibility – The Linear Diophantine Equation – The Fundamental Theorem of Arithmetic

Unit II

Permutations and Combinations – Fermat's Little Theorem – Wilson's Theorem – Generating Functions

Unit III

Basic Properties of Congruences Residue Systems. Linear Congruences – The Theorems of Fermat and Wilson Revisited.

Unit IV

The Chinese Remainder Theorem – Polynomial Congruences – Combinational Study of $F(n)$.

Unit V

Formulae for $d(n)$ and $s(n)$ – Multiplicative Arithmetic Function – The Mobius Inversion Formula.

Books for Study

1. Number Theory by George E.Andrews, Hindustan Publishing Corporation – 1984, Edition.

Unit I : Chapter - 2 Sec. 2.1 – 2.4 pages 12-29

Unit II : Chapter – 3 Sec. 3.1, 3.4 pages 30-44

Unit III : Chapter – 4Sec. 4.1 – 4.2 Pages 49 – 55, Sec. 5.1- 5.2 Pages 58-65

Unit IV : Chapter – 4 Sec. 5.3 – 5.4 pages 66-74, Sec. 6.1 Pages 75-81

Unit V : Chapter – 5 Sec. 6.2 – 6.3 Pages 82-92

Text Books

- 1) Basic Number Theory by S.B.Malik, Vikas Publishing House Pvt. Ltd.,
- 2) A First Course Theory of Numbers by K.C.Chowdhury. Asian Books Pvt. Ltd., I Edition (2004)

COURSE OUTCOMES

On successful completion of the course, the students will be able to:

- 1) Know the divisibility of Numbers using Euclid's division Lemma.
- 2) Solve problems on Permutations and Combinations.
- 3) Understand the concepts of Chinese theorem and Multiplicative arithmetic functions.
- 4) Apply the Fermat's and Wilson's theorems for solving problems in Numbers.
- 5) Solve problems on Linear Congruence and Polynomial congruence.

OUTCOME MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	2	3	3	3	2
CO4	3	3	3	3	2
CO5	3	3	3	2	2

1-Low 2-Moderate 3- High