MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA– 8
(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Mathematics | Semester: I
Course Title: Differential Equations | Course Code:20MTCCDE15
No. of Hrs.:90 | LTP:510 | Credits:5

Objectives

- To emphasize appropriate methods of solving ODE
- To provide with problem-solving techniques
- To enhance analytical, reasoning and technical skills

Course Outcomes

CO1: Classify and solve analytically differential equations based on their order and degree

CO2: Apply appropriate method to solve differential equations of the first order and the first degree

CO3: Apply the acquired knowledge to solve the first order and higher degree differential equations

CO4: Identify a family of orthogonal trajectories for a family of curves

CO5: Apply a suitable method to solve higher-order linear differential equations with constant and variable coefficients

UNIT I: Differential equations of the first order and first degree (12 Hrs.)
Linear differential equations; Differential equations reducible to linear form (Bernouli's equation); Change of variables; Exact differential equations; Non-exact differential equations; Integrating factors: By Inspection, $\frac{1}{Mx+Ny}$, $\frac{1}{Mx-Ny}$, $\int f(x)dx$, $e^{\int f(y)dy}$.

UNIT II: Orthogonal Trajectories: Cartesian form and Polar form. **(5 Hrs.)**

Differential equations of the first order but not of first degree (7 Hrs.)
Equations solvable for p; Equations solvable for y; Equations solvable for x; Equations that do not contain x or y; Clairaut's equation.

UNIT III: Higher order linear differential equations–I (12 Hrs.)

Solution of homogeneous linear differential equations of order 'n' with constant coefficients; Solution of the non-homogeneous linear differential equations with constant coefficients through polynomial operators;

General solution of f(D) y = 0; General solution of f(D) y = Q(x): when

(i) $\frac{1}{f(D)}$ is expressed as partial fractions

(ii) $Q(x) = be^{ax}$

(iii) Q(x) = bSinax (or) bCosax

UNIT IV: Higher order linear differential equations –II (12 Hrs.)

General solution of non-homogeneous linear differential equations with constant coefficients: f(D) y = Q(x) when

(i) $Q(x) = bx^k$

(ii) $Q(x) = e^{ax}V$, V is a function of x

(iii) Q(x) = xV, V is a function of x

(iv) $Q(x) = x^mV$, V is a function of x

UNIT V: Higher order linear differential equations–III (12 Hrs.)

Method of variation of parameters; Linear differential equations with non - constant coefficients: The Cauchy-Euler equation and Legendre equation.

Skill / Hands-on using SciLab: (12 Hrs.)

- Basic SciLab commands
- Simple arithmetic and algebraic operations
- Elementary numeric and simple programming functions
- Graphics: plot, xset, driver, plot2d, plot3d
- ODE solver, ode to evaluate an ordinary differential equation

Co-curricular Activities: (6 Hrs.)

- Problem solving sessions
- Student seminars
- Quiz
- Assignments on applications of Differential Equations

Prescribed text book

- A textbook of B.Sc. Mathematics, Volume-I, Differential Equations by V.Venkateswara Rao, N.Krishna Murthy, B.V.S. S.Sarma and S.Anjaneya Sastry;
  S. Chand & Company Pvt. Ltd., New Delhi, Latest reprint

Reference books

1. Differential Equations and their Applications by Zafar Ahsan , Prentice- Hall of India Pvt. Ltd, New Delhi, 2nd Edition.
2. Ordinary and Partial Differential Equations, Rai Singhania, S. Chand & Company Pvt. Ltd., New Delhi.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA– 8
(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Mathematics | Semester: II
Course Title: Analytical Solid Geometry | Course Code:20MTCCAG25
No.of Hrs:90 | LTP:510 | Credits:5

Objectives

- To emphasize concepts in planes, lines, spheres and cones and describe their properties
- To provide with problem solving techniques
- To enhance analytical, reasoning and technical skills

Course Outcomes

CO1: Distinguish the geometry of planes, lines, spheres and cones and describe their properties

CO2: Explain concepts in planes & lines and solve problems

CO3: Explain concepts in spheres & cones and solve problems

CO4: Analyze methods to solve problems on planes, lines, spheres and cones and apply appropriate method to solve them

CO5: Demonstrate 2D & 3D geometry using GeoGebra in interactive mode

Unit I: The Plane (12 Hrs.)

Equation of plane in terms of its intercepts on the axis, Equation of the plane through the given points, Normal form of a plane; Angle between planes; Length of the perpendicular from a given point to a given plane; Bisectors of angles between two planes; Combined equation of pair of planes **(No Proofs)**

Unit II: The Line (12 Hrs.)

Equation of a line; Angle between a line and a plane; The conditions for a line to lie in a plane; The condition that two given lines are coplanar; The shortest distance between two lines; The length and equation of the line of shortest distance between two straight lines; Length of the perpendicular from a given point to a given line. **(No Proofs)**

Unit III: The Sphere (12 Hrs.)

Definition and equation of sphere; Equation of sphere through four given points; Plane section of a sphere; Intersection of two spheres; Equation of a circle; Sphere through a given circle; Intersection of a sphere and a line; Tangent plane; Touching spheres. Plane of contact; Polar plane, Pole of the polar plane; Conjugate points, Conjugate planes**.**
(No Proofs)

Unit IV: The Sphere and The Cone (12 Hrs.)

Angle of intersection of two spheres; Condition for two spheres to be orthogonal; Power of a point; Radical plane; Coaxal system of spheres; Limiting points **(No Proofs)**

Definition of a cone; Vertex; Guiding curve; Generators; Equation of cone through coordinate axes; Cone and a plane through its vertex; Equation of the cone with a given vertex and guiding curve; Cone with a base curve; Equation of cone with vertex at origin;
(No Proofs)

Unit V: The Cone (12 Hrs.)

Enveloping cone of a sphere; Right circular cone; Equation of the right circular cone with a given vertex, axis and semi-vertical angle; Condition that a cone may have three mutually perpendicular generators; Intersection of a line and a quadric cone; Tangent lines and tangent plane at a point; Condition that a plane may touch a cone; Reciprocal cones.
(No Proofs)

Skill / Hands-on using GeoGebra: (12 Hrs.)

- The Graphics Tools, Commands, Style Bar and Settings
- Graphing, Geometry and 3D Graphics
- Create geometric constructions in 2D and 3D space

Co-curricular Activities: (6 Hrs.)

- Problem solving sessions
- Student seminars
- Quiz
- Assignments on applications of Analytical Solid Geometry

Prescribed text book

- A textbook of B.Sc. Mathematics, Volume-II, Analytical Geometry by V.Venkateswara Rao, N.Krishna Murthy, B.V.S. S.Sarma and S.Anjaneya Sastry;
  S. Chand & Company Pvt. Ltd., New Delhi, Latest reprint

Reference Books

1. Analytical Solid Geometry by Shanti Narayan and P.K. Mittal
   S. Chand & Company Pvt. Ltd. 7th Edition
2. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, Wiley Eastern Ltd., 1999.
3. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman,
   Tata-MC Gran-Hill Publishers Company Ltd., New Delhi.

MARIS STELLACOLLEGE (AUTONOMOUS), VIJAYAWADA– 8
(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Mathematics Semester: III
Course Title: Abstract Algebra Course Code: 20MTCCAA35
No.of Hrs:90 LTP:510 Credits:5

Objectives

- To emphasize basic concepts in groups and rings and describe their applications
- To provide with knowledge on algebraic systems equipped with one and two binary operations and their properties
- To enhance analytical, reasoning and technical skills

Course Outcomes

CO1: Describe structure of group, substructures, cyclic group and their properties

CO2: Analyze a group by the notion of a coset and apply Lagrange's theorem for finite groups.

CO3: Analyze properties of group isomorphism to describe the isomorphic groups and its generalization, group homomorphism

CO4: Classify non abelian group of functions (permutations) and illustrate its characteristics

CO5: Classify algebraic systems equipped with one and two binary operations and describe different types of rings and substructures.

UNIT I:Groups (13Hrs.)

Binary operation, Algebraic structure, Semi group, Monoid, Definition of group, Elementary properties of groups, Finite and Infinite groups, Composition table, Examples of groups, Order of a group, Order of an element of a group

UNIT II: Subgroups & Cosets (13Hrs.)

Definition of subgroup, Examples, Criterion for a nonempty subset to be a subgroup, Criterion for product of two subgroups to be a subgroup, Union and intersection of subgroups

Definition of coset, Elementary properties of cosets, Index of a subgroup of a finite group, Lagrange's theorem.

UNIT III: Normal Subgroups& Homomorphism (13 Hrs.)

Definition of normal subgroup, Proper and improper normal subgroups, Hamilton group, Criteria for a subgroup to be a normal subgroup, Intersection of two normal subgroups, Elementary properties of normal subgroups, Quotient group

Definition of group homomorphism, Image of a homomorphism, Kernel of a homomorphism, Elementary properties of homomorphism, Isomorphism, Automorphism, Examples, Fundamental theorem on homomorphism and applications

UNIT IV: Permutation and Cyclic Groups (13 Hrs.)

Definition of permutation, Permutation multiplication, Inverse of a permutation, Cyclic permutation, Transposition, Even and odd permutations, Cayley's theorem

Definition of cyclic group, Elementary properties of cyclic groups, Classification of cyclic groups

UNIT V:Rings(13Hrs.)

Definition of ring, Basic properties of ring, Boolean ring, Divisors of zero, Cancellation laws in rings, Integral domain, Division ring, Field, The characteristic of a ring, The characteristic of an integral domain, The characteristic of a field, Subring, Ideal

Skill: Applications of Abstract Algebra **:(20 Hrs.)**

Co-curricular Activities: (5 Hrs.)

- Problem solving sessions
- Student seminars
- Quiz
- Assignments on applications of Groups & Rings.

Prescribed Text Book

- A textbook of B.Sc. Mathematics, Volume -3, Abstract Algebra by V.VenkateswaraRao, N.Krishna Murthy, B.V.S.S.Sarma and S.AnjaneyaSastry; S.Chand & Company Pvt.Ltd., New Delhi, Latest reprint.

Reference Books

1. Abstract Algebra by J.B. Fraleigh, Narosa publishing house.
2. Modern Algebra by A.R. Vasishtha, Krishna Prakashan Media (P) Ltd.
3. Rings and Linear Algebra by Pundir&Pundir, PragathiPrakashanMandir.

MARIS STELLACOLLEGE (AUTONOMOUS), VIJAYAWADA–8

(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Mathematics Semester: IV

Course Title: Real Analysis Course Code: 20 MTCCRA45

No.of Hrs.:90 LTP:510 Credits:5

Objectives

- To emphasize basic concepts related to real numbers , real valued and real variable functions and describe their applications
- To provide with knowledge on real number system and properties of real valued and real variable functions
- To enhance analytical, reasoning and technical skills

Course Outcomes

CO1: Identify the nature of a sequence whether bounded, monotonic and convergent by employing relevant results

CO2: Describe the nature of a series by applying a suitable test of convergence

CO3: Illustrate the significance of real number system, real valued and real variable functions, mean value theorems, fundamental theorem and applications

CO4: Identify continuity of a function and type of discontinuity .

CO5: Categorize real valued and real variable functions as continuous, differentiable and integrable by applying principles and results.

UNIT I: Real Numbers &Sequences (13Hrs.)

The algebraic and order properties of $\mathbb{R}$, Absolute value and real line, Completeness property of $\mathbb{R}$, Applications of supremum property; intervals. (**No question is to be set**)

Sequences and their limits, Range and Boundedness of sequences, Limit of a sequence and Convergent sequence, The Cauchy's criterion, Monotone sequences, Necessary and sufficient condition for convergence of monotone sequence, Limit point of a sequence, subsequences, the Bolzano-Weierstrass theorem, Cauchy sequence, Cauchy's general principle of convergence.

UNIT II: Infinite Series (13Hrs.)

Series, Convergence of series, Cauchy's general principle of convergence for series, Tests for convergence of series, Series of Non-Negative Terms, (i) P-test (ii) Cauchy's n^{th} root test or Root Test (iii) D'-Alembert's' Test or Ratio Test (iv) Alternating series-Leibnitz test, Absolute convergence and conditional convergence.

UNIT III: Limits and Continuity (13 Hrs.)

Real valued functions, Boundedness of a function, Limit of a function, Infinite limits, Limits at infinity. (**No question is to be set**).

Continuous functions, Algebra of continuous functions, Continuous functions on intervals, Discontinuity, Types of discontinuity, Uniform continuity.

UNIT IV: Differentiation (13Hrs.)

The derivability of a function at a point, on an interval, Derivability and continuity of a function, Graphical interpretation of the derivative, Mean value theorems, Rolle's theorem, Lagrange's theorem, Cauchy's mean value theorem

UNIT V:Riemann Integration (13 Hrs.)

Riemann Integral, Riemann integrable functions, Darboux's theorem. Necessary and sufficient condition for Riemann integrability, Properties of integrable functions, Fundamental theorem of integral calculus, Integral as a limit of a sum, Mean value theorems.

Skill/ Hands- on using Geo Gebra:(20 Hrs.)

- Limits and continuity of functions using GeoGebra
- Differentiation using GeoGebra
- Integration using GeoGebra

Co- curricular Activities: (5 Hrs.)

- Problem solving sessions
- Student seminars
- Quiz
- Assignments on concepts in Real Analysis

Prescribed Text Book

- A textbook of B.Sc. Mathematics, Volume -4, Real Analysis by V.VenkateswaraRao, N.Krishna Murthy, B.V.S.S. Sarma and S.Anjaneya Sastry; S.Chand & Company Pvt.Ltd., New Delhi, Latest reprint

Reference Books

- Introduction to Real Analysis by Robert G.Bartle and Donlad R. Sherbert, published by John Wiley.
- Elements of Real Analysis as per UGC Syllabus by Shanthi Narayan and Dr. M.D. Raisinghania, published by S. Chand & Company Pvt. Ltd., New Delhi.

MARIS STELLACOLLEGE (AUTONOMOUS), VIJAYAWADA–8

(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Mathematics		Semester:IV
Course Title: Linear Algebra		Course Code: 20 MTCCLA45
No.of Hrs.:90	LTP:510	Credits:5

Objectives

- To emphasize basic concepts in vector spaces, inner product spaces and matrices and describe their applications
- To provide with knowledge on matrices and algebraic systems equipped with internal and external compositions and their properties
- To enhance analytical, reasoning and technical skills

Course Outcomes

CO1: Describe algebraic systems vector space, subspace and inner product space and their properties

CO2: Identify a basis for a finite dimensional vector space and an orthonormal basis for a finite dimensional inner product space

CO3: Analyze a linear transformation on a finite dimensional vector space and determine the dimension of range space and null space

CO4: Apply a suitable technique to find the rank of a matrix and solve a system of linear equations

CO5: Determine the Eigen values and Eigen vectors for a square matrix and apply suitable method to find the inverse of it.

UNIT I: Vector Spaces-I (13 Hrs.)

Vector space, General properties of vector space, n-dimensional vectors, Addition and scalar multiplication of vectors, Internal and external composition, Null space, Subspace, Algebra of subspaces, Linear sum of two subspaces, Linear combination of vectors, Linear span, Linear independence and Linear dependence of vectors.

UNIT II: Vector Spaces-II (13 Hrs.)

Basis of a vector space, Finite dimensional vector space, Basis extension, Coordinates of a basis, Dimension of a vector space, Dimension of a subspace, Quotient space and Dimension of quotient space.

UNIT III: Linear Transformations(13 Hrs.)

Linear transformation (LT), Linear operator, Properties of LT, Sum and product of LTs, Algebra of linear operators, Range and null space of a linear transformation, Rank and Nullity of a linear transformation, Rank-Nullity theorem and applications

UNIT IV: Matrices(13 Hrs.)

Matrices, Elementary properties of matrices, Inverse of a matrix, Rank of a matrix, Linear equations, Characteristic equations, Characteristic values & vectors of a square matrix, Cayley-Hamilton theorem and applications

UNIT V: Inner Product Spaces (13 Hrs.)

Inner product space, Euclidean and unitary spaces, Norm or length of a vector, Schwartz inequality, Triangle Inequality, Parallelogram law, Orthogonality, Ortho normal set, Complete ortho normal set, Gram-Schmidt's orthogonalization process, Bessel's inequality and Parseval's Identity.

Skill/ Hands- on using Geo Gebra /R-Tool:(20 Hrs.)

- Vectors and Matrices
- Arithmetic operations on vectors and matrices
- Transpose, determinant and inverse of a matrix

Co- curricular Activities: (5 Hrs.)

- Problem solving sessions
- Student seminars
- Quiz
- Assignments on applications of Linear Algebra& Matrices

Prescribed Text Book

- A textbook of B.Sc. Mathematics, Volume -5, Linear Algebra by V. VenkateswaraRao, N.Krishna Murthy, B. V. S.S. Sarma and S. AnjaneyaSastry; S.Chand & Company Pvt.Ltd., New Delhi, Latest Reprint.

Reference Books

- Linear Algebra by J.N. Sharma and A.R. Vasishta, published by Krishna PrakashanMandir, Meerut
- Matrices by Shanti Narayana, published by S. Chand Publications.
- Linear Algebra by Kenneth Hoffman and Ray Kunze, published by Pearson Education (low priced edition),New Delhi.
- Linear Algebra by Stephen H. Friedberg et. al. published by Prentice Hall of India Pvt. Ltd. 4thEdition, 2007

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA–8
(Affiliated to Krishna University, Machilipatnam)

Subject: Mathematics **Semester: V/VI**
Course Title: Numerical Methods **Course Code: 20MTSEC11NM5**
No. of Hrs.: 90 **LTP: 501** **Credits: 5**

SYLLABUS

Objectives:

- To emphasize interpolation and other numerical techniques and their applications.
- To provide with knowledge on numerical methods, their accuracy and significance.
- To enhance analytical, reasoning and technical skills.

Course Outcomes:

CO1: Employ calculus of finite differences and interpolation techniques.
CO2: Apply numerical methods to obtain approximate solutions whenever analytical methods are not applicable.
CO3: Identify the significance of numerical methods and analyze the accuracy of employing them.
CO4: Evaluate derivative and integral of a tabulated function using suitable numerical method and compute error.
CO5: Solve 1^{st} order and 1^{st} degree initial value problems applying appropriate numerical method and compute errors.

Unit I: Finite Differences & Interpolation with Equal Intervals (**13 Hrs.**)
Introduction, Forward differences, Backward differences, Central differences, Symbolic relations, n^{th} differences of some functions, Advancing difference formula, Missing terms, Differences of factorial polynomial, Newton's forward and backward formulae for interpolation.

Unit II: Interpolation with Equal and Unequal Intervals (13 Hrs.)
Gauss's forward interpolation formula, Gauss's backward interpolation formula, Stirling's formula, Bessel's formula, Interpolation with unevenly spaced points, Divided differences, Newton's divided differences formula, Lagrange's interpolation formula, Lagrange's inverse interpolation formula.

Unit III: Numerical Differentiation (**13 Hrs.**)

Derivatives using Newton's forward difference formula and Newton's backward difference formula, Derivatives using Stirling's interpolation formula, Derivatives using Newton's divided difference formula, Maximum and minimum values of a tabulated function.

Unit IV: Numerical Integration (**13 Hrs.**)

General quadrature formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule, and Weddle's rule, Euler-McLaurin's formula of summation.

Unit V: Numerical Solution of Ordinary Differential Equations (13 Hrs.)

Introduction, Solution by Taylor's series, Picard's method of successive approximations, Euler's method, Modified Euler's method, Runge- Kutta methods.

Skill/Hands-on: Mini Project (20 Hrs.)

- Applications of numerical methods:
  (i) Interpolation (ii) Numerical Differentiation (iii) Numerical Integration.
- Comparison of solutions obtained by numerical methods and analytical methods.
- Comparison of solutions of 1st order and 1st degree differential equations obtained by numerical methods and analytical methods.

Co-Curricular Activities: (5 Hrs.)

- Problem-solving sessions
- Student seminars
- Quiz & Group discussions

Prescribed Text Book:

1. Calculus of Finite Differences & Numerical Analysis, Revised Edition, P.P. Gupta, G.S. Malik & J.P. Chauhan, Krishna Prakashan Media (P) Ltd.

Reference Books:

1. S. S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India Pvt. Ltd., New Delhi.
2. P. Kandasamy, K. Thilagavathy, Calculus of Finite Differences and Numerical Analysis, S. Chand & Company, Pvt. Ltd., New Delhi.
3. R. Gupta, Numerical Analysis, Laxmi Publications (P) Ltd., New Delhi.

4. H.C Saxena, Finite Differences and Numerical Analysis, S. Chand & Company Pvt. Ltd., New Delhi.
5. Numerical Analysis, G. Sankar Rao, New Age International Publishers.
6. Open Educational Resources / Web Resources.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA–8
(Affiliated to Krishna University, Machilipatnam)

Subject: Mathematics **Semester: V/VI**
Course Title: Special Functions **Course Code: 20MTSEC12SF5**
No. of Hrs.: 90 **LTP: 501** **Credits: 5**

SYLLABUS

Objectives:

- To emphasize properties of some special functions and their applications.
- To provide with knowledge on significance of some special functions.
- To enhance analytical, reasoning and technical skills.

Course Outcomes:

CO1: Apply Beta and Gamma functions to evaluate certain definite integrals.
CO2: Describe Legendre polynomials and their properties.
CO3: Express Bessel functions and their properties.
CO4: Discuss Hermite polynomials and their properties.
CO5: Explain Laguerre polynomials and their properties.

Unit I: Beta & Gamma Functions (13 Hrs.)

Euler's Integrals: Beta and Gamma functions, Elementary properties of Gamma function, Transformations of Gamma function, Another form of Beta function, Relation between Beta and Gamma functions, Transformations of Beta functions, Applications of Beta and Gamma functions, Legendre Duplication formula.

Unit II: Legendre's Equation (13 Hrs.)

Legendre's differential equation, Legendre function of 1^{st} kind, Generating function for Legendre polynomials, Orthogonal properties of Legendre polynomials, Recurrence formulae for Legendre polynomials, Rodrigue's formula for Legendre polynomials, First few Legendre polynomials, Properties of Legendre polynomials.

Unit III: Bessel's Equation (13 Hrs.)

Bessel's differential equation, General solution of Bessel's differential equation, Integration of Bessel's equation in series for n = 0, Recurrence formulae for Bessel's function, Generating function for Bessel's function, Properties of Bessel's functions.

Unit IV: Hermite Polynomials (13 Hrs.)

Hermite differential equation, Hermite polynomials, Generating function for Hermite polynomials, Other forms for Hermite polynomials, Rodrigue's formula for Hermite polynomials, First few Hermite polynomials, Orthogonal properties of Hermite polynomials, Recurrence formulae for Hermite polynomials.

Unit V: Laguerre Polynomials (13 Hrs.)

Laguerre differential equation, Laguerre polynomials, Generating function for Laguerre polynomials, Rodrigue's formula for Laguerre polynomials, First few Laguerre polynomials, Orthogonal property of Laguerre polynomials, Recurrence formulae for Laguerre polynomials.

Skill/Hands-on: Mini Project (20 Hrs.)

Properties and applications of special functions:

(i) Beta & Gamma functions

(ii) Legender, Bessel, Hermite and Laguerre functions.

Co-Curricular Activities: (5 Hrs.)

- Problem-solving sessions
- Student seminars
- Quiz & Group discussions

Prescribed Text Book:

1. Special functions, J. N. Sharma & Dr. R. K. Gupta, Krishna Prakashan Mandir Publications.

Reference Books:

1. Dr. M. D. Raisinghania, Ordinary and Partial Differential Equations, Revised Edition, S. Chand & Company Pvt. Ltd.
2. J. N. Sharma and Dr. R. K. Gupta, Differential Equations with Special Functions, Krishna Prakashan Mandir Publications.
3. Shanti Narayan and Dr. P. K. Mittal, Integral Calculus, S. Chand & Company Pvt. Ltd.
4. George F. Simmons, Differential Equations with Applications and Historical Notes, Tata McGraw-Hill Edition, 1994.
5. Shepley L. Ross, Differential Equations, Second Edition, John Willy & Sons, New York,1974.
6. Open Educational Resources / Web Resources.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA–8
(Affiliated to Krishna University, Machilipatnam)

Subject: Mathematics **Semester: V/VI**
Course Title: Multiple Integrals & Vector Calculus **Course Code: 20MTSEC21MV5**
No. of. Hrs.: 90 **LTP: 501** **Credits: 5**

SYLLABUS

Objectives:

- To emphasize evaluating double and triple integrals of functions over different regions.
- To provide with knowledge on Gauss, Green and Stoke theorems and their significance.
- To enhance analytical, reasoning and technical skills.

Course Outcomes:

CO1: Evaluate double and triple integrals of different functions over different regions.
CO2: Apply double integral to determine plane and surface area, as well as double and triple integral to determine volume.
CO3: Determine gradient of a scalar function, divergence and curl of a vector function and explain their properties.
CO4: Evaluate line, circulation, surface & volume integrals of scalar and vector functions.
CO5: Explain the significance of Gauss, Green and Stoke theorems and apply them to evaluate certain integrals.

Unit I: Multiple Integrals-I **(13 Hrs.)**

Introduction, Double integrals, Evaluation of double integrals, Properties of double integrals; Region of integration, double integration in Polar Co-ordinates, Change of variables in double integrals, Change of order of integration.

Unit II : Multiple Integrals-II **(13 Hrs.)**

Triple integral, Region of integration, Change of variables; Plane areas by double integrals, Surface area by double integral; Volume as a double integral, Volume as a triple integral.

Unit III: Vector Differentiation (13 Hrs.)

Vector differentiation, ordinary derivatives of vectors; Differentiability, Gradient, Divergence, Curl operators; Formulae involving the separators.

Unit IV : Vector Integration (13 Hrs.)

Line Integrals with examples; Surface Integral with examples; Volume integrals with examples.

Unit V : Vector Integration Applications (13 Hrs.)

Gauss theorem and applications of Gauss theorem; Green's theorem in plane and applications of Green's theorem; Stokes's theorem and applications of Stokes theorem.

Skill/Hands-on: Mini Project (20 Hrs.)

- Evaluating double integrals and triple integrals of different functions over different regions.
- Applications of line, circulation, surface and volume integrals
- Applications of Gauss divergence theorem, Green's theorem and Stokes's theorem

Co-Curricular Activities: (5 Hrs.)

- Problem-solving sessions
- Student seminars
- Quiz & Group discussions

Prescribed Text Books:

1. V. Venkateswara Rao, N. Krishnamurthy, B. V. S. S. Sarma and S. Anjaneya Sastry, A text Book of B.Sc., Mathematics Volume-III, S. Chand & Company, Pvt. Ltd., New Delhi
2. Simplified Course in Vector Calculus, M. D. Raisinghania, H. C. Saxena, H. K. Dass.

Reference Books:

1. Dr. M Anitha, Linear Algebra and Vector Calculus for Engineer, Spectrum University Press, Hyderabad.
2. Dr. M. Babu Prasad, Dr. K. Krishna Rao, D. Srinivasulu, Y. Adi Narayana, Engineering Mathematics-II, Spectrum University Press, Hyderabad
3. R. Gupta, Vector Calculus, Laxmi Publications.

4. P. C. Matthews, Vector Calculus, Springer Verlag publications.
5. Open Educational Resources / Web Resources

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8
(Affiliated To Krishna University, Machilipatnam)

Subject: Mathematics **Semester: V / VI**
Course Title: Integral Transforms **Course Code: 20MTSEC22IT5**
No. of. Hrs.: 90 **LTP: 501** **Credits: 5**

SYLLABUS

Objectives:

- To emphasize evaluating Laplace and inverse Laplace transforms of certain functions, derivatives, integrals.
- To provide with knowledge on the significance of Laplace and Fourier transforms and their applications.
- To enhance analytical, reasoning and technical skills.

Course Outcomes:

CO1: Evaluate Laplace and inverse Laplace transforms of certain functions, derivatives and integrals.

CO2: Apply Laplace transforms to solve ordinary differential equations with constant and variable coefficients.

CO3: Solve simultaneous and partial differential equations with boundary conditions using Laplace transforms.

CO4: Employ Laplace transforms to solve integral equations, convert differential equations into integral equations and vice versa.

CO5: Explain properties and significance of Fourier transforms and determine finite Fourier transforms of functions.

Unit I: Laplace Transforms-I (13 Hrs.)

Definition of Laplace transform, Linearity property, Piecewise continuous function, Existence of Laplace transform, Functions of exponential order and ofclass A, First shifting theorem, Second shifting theorem and Change of scale property.

Unit II: Laplace Transforms-II (13 Hrs.)

Laplace transforms of the derivatives, initial value theorem and final valuetheorem; Laplace transforms of integrals; Laplace transform of t^n. f (t), division by t, evolution of integrals by Laplace transforms; Laplace transform of some special functions - namely Dirac delta function, error function, Bessel function and Laplace transform ofperiodic function.

Unit III: Inverse Laplace Transforms (13 Hrs.)

Definition of inverse Laplace transform, Linear property, First shifting theorem, Second shifting theorem, Change of scale property, Use of partial fractions**;** Inverse Laplace

transforms of derivatives, Inverse Laplace transforms of integrals, Multiplication by powers of 'p', Division by 'p'; Convolution, Convolution theorem and Applications.

Unit IV: Applications of Laplace Transforms (13 Hrs.)

Solutions of differential equations with constants coefficients, solutions of differential equations with variable coefficients; Applications of Laplace transforms to integral equations - Abel's integral equation; Converting the differential equations into integral equations, converting the integral equations into differential equations.

Unit V: Fourier Transforms (13 Hrs.)

Integral transforms, Fourier integral theorem (without proof), Fourier sine and cosine integrals; Properties of Fourier transforms, Change of scale property, Shifting property, Modulation theorem, Convolution theorem for Fourier transform, Parseval's Identify, Finite Fourier transforms.

Skill/Hands-on: Mini Project (20 Hrs.)

- Methods of finding Laplace and inverse Laplace transforms
- Evaluation of Laplace and inverse Laplace transforms
- Applications of Laplace and Inverse Laplace transforms to find solutions of ordinary differential equations with constant /variable coefficients
- Applications of convolution theorem to solve integral equations
- Applications of Fourier transforms to solve integral equations
- Applications of Laplace and Fourier transforms

Co-Curricular Activities: (5 Hrs.)

- Problem-solving sessions
- Student seminars
- Quiz & Group discussions

Prescribed Text Books:

1. Integral Transforms by A. R. Vasistha and R. K. Gupta, 34th Edition-2015. Krishna Prakashan Media Pvt.
2. Dr. S. Sreenadh, S. Ranganatham, Dr. M. V. S. S. N. Prasad, Dr. V. Ramesh Babu, Fourier Series and Integral Transforms, S. Chand & Company, Pvt.Ltd., New Delhi.

Reference Books:

1. M. D. Raisinghania, H.C. Saxsena , H.K. Dass, Integral Transforms, S. Chand & Company Pvt. Ltd., New Delhi.
2. Dr. J. K. Goyal, K.P. Gupta, Laplace and Fourier Transforms, Pragathi Prakashan, Meerut.

3. Shanthi Narayana , P.K. Mittal, A Course of Mathematical Analysis, S. Chand & Company Pvt.Ltd., New Delhi.
4. Open Educational Resources / Web Resources

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA–8
(Affiliated to Krishna University, Machilipatnam)

Subject: Mathematics **Semester: V/VI**
Course Title: PDE & Fourier Series **Course Code: 20MTSEC31PF5**
No. of Hrs.:90 **LTP: 501** **Credits: 5**

SYLLABUS

Objectives:

- To emphasize appropriate method of solving PDE of order one.
- To provide with knowledge on various methods of solving PDE of order one and significance of Fourier series expansions.
- To enhance analytical, reasoning and technical skills.

Course Outcomes:

CO1: Classify partial differential equations of order one, describe their formation and solve them using appropriate method.

CO2: Solve Cauchy's problem for first order equations and Lagrange's equations of different types using suitable rule.

CO3: Determine integral surface passing through a given curve and surfaces orthogonal to a given system of surfaces.

CO4: Solve non-linear partial differential equations of order one by Charpit's, Clairaut's and Jacobi's methods.

CO5: Identify Fourier series expansions of some functions, applications of Parseval's theorem and draw conclusions.

Unit I: Introduction of Partial Differential Equations (13 Hrs.)

Partial differential equations, Classification of first-order partial differential equations, Rule I, Derivation of a partial differential equation by the elimination of arbitrary constants; Rule II, derivation of a partial differential equation by the elimination of arbitrary function $\emptyset$ from the equations $\emptyset(u, v) = 0$ where u and v are functions of x, y and z; Cauchy's problem for first-order equations.

Unit II: Linear Partial Differential Equations of Order one: (13 Hrs.)

Lagrange's equations, Lagrange's method of solving $Pp + Qq = R$, where P, Q and R are functions of x, y and z; Type 1 based on Rule I for solving $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$; Type II based on Rule II for solving $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$; Type 3 based on Rule III for solving

$\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$; Type 4 based on Rule IV for solving $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$; Integral Surface passing through a given curve, the Cauchy problem, Surfaces orthogonal to a given system of Surfaces.

Unit III: Non-linear Partial Differential Equations of Order one-I (13 Hrs.)

Complete integral, Particular integral, Singular integral and General integral, Geometrical interpretation of integrals of f (x, y, z, p, q) = 0, Method of getting singular integral from the PDE of the first order, Compatible system of first-order equations; Charpit's method, Standard form I, only p and q present; Standard form II, Clairaut equations.

Unit IV: Non-linear Partial Differential Equations of Order One-II (13 Hrs.)

Standard Form III, only p, q and z present; Standard Form IV, equation of the form $f_1(x, p) = f_2(y, q)$; Jacobi's method, Jacobi's method for solving partial differential equations with three or more independent variables, Jacobi's method for solving a non-linear first order partial differential equations in two independent variables.

Unit V: Fourier Series (13 Hrs.)

Introduction, Euler's formulae for Fourier series expansion of a function f(x), Dirichlet's conditions for Fourier series, convergence of Fourier series; Functions having arbitrary periods, Change of interval, Half range series, Parseval's theorem, Illustrative examples based on Parseval's theorem, Some particular series.

Skill/Hands-on: Mini Project (20 Hrs.)

- Solutions of partial differential equations by using Lagrange's method, Charpit's method, Clairaut's method and Jacobi's method.
- Integral Surface passing through a given curve and Surfaces orthogonal to a given system of Surfaces and draw conclusions.
- Methods of solving PDE of order one
- Fourier series expansions of some functions and applications of Parseval's theorem.

Co-Curricular Activities: (5 Hrs.)

- Problem-solving sessions
- Student seminars
- Quiz & Group discussions

Prescribed Text Books:

1. Dr. M. D. Raisinghania, Ordinary and Partial Differential Equations, 11th Revised Edition, S. Chand & Company Pvt. Ltd., New Delhi.
2. Dr. S. Sreenadh, S. Ranganatham, Dr. M. V. S. S. N. Prasad, Dr. V. Ramesh Babu, Fourier Series and Integral Transforms, S. Chand & Company Pvt. Ltd., New Delhi.

Reference Books:

1. Prof. T. Amaranath, An Elementary Course in Partial Differential Equations, Second Edition, Narosa Publishing House, New Delhi.
2. Fritz John, Partial Differential Equations, Narosa Publishing House, New Delhi, 1979.
3. N. Sneddon, Elements of Partial Differential Equations by McGraw Hill, International Edition,Mathematics Series.
4. Open Educational Resources / Web Resources

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA–8
(Affiliated to Krishna University, Machilipatnam)

Subject: Mathematics **Semester: V/VI**
Course Title: Number Theory **Course Code: 20MTSEC32NT5**
No. of Hrs.: 90 **LTP: 501** **Credits: 5**

SYLLABUS

Objectives:

- To emphasize properties of integers and simple account of classical number theory.
- To expose to the elements of number theory and their significance.
- To enhance analytical, reasoning and technical skills.

Course Outcomes:

CO1: Describe properties of integers, elements of number theory and their significance.

CO2: Solve linear congruences and identify applications of Fermat, Wilson, Euler and Chinese remainder theorems.

CO3: Discuss properties and applications of number theoretic and multiplicative functions.

CO4: Solve quadratic congruences and determine quadratic residues using Euler's criterion.

CO5: Evaluate Legendre symbols using Gauss lemma and quadratic reciprocity law.

UNIT I: Divisibility and Primes (13 Hrs.)

Introduction, Divisibility, The division algorithm, The greatest common divisor, The Euclidean algorithm, The least common multiple, The Diophantine equation ax + by = c, Prime numbers, Properties of primes, The fundamental theorem of arithmetic.
Chapter 2: 2.2 – 2.5; Chapter 3: 3.1

UNIT II: Theory of Congruences (13 Hrs.)

Congruences, Basic properties of congruences, Linear congruences, The Chinese remainder theorem, Applications of Chinese remainder theorem, System of linear congruences, Fermat's little theorem, Wilson's theorem, Applications of Fermat and Wilson theorems, Solutions of congruences.
Chapter 4: 4.2, 4.4; Chapter 5: 5.2 – 5.3

UNIT III: Number Theoretic Functions (13 Hrs.)

Number theoretic functions, The sum, product and number of divisors, Multiplicative functions, Mobius μ-function, The Mobius inversion formula, The greatest integer function.

Chapter 6: 6.1 – 6.3

UNIT IV: Euler's Function (13 Hrs.)

Euler's Phi-function, Euler's theorem, Applications of Euler's theorem, Some properties of the Phi-function, Quadratic residues, Quadratic non-residues, Euler's criterion.

Chapter 7: 7.2 – 7.4; Chapter 9: 9.1

UNIT V: Legendre Symbol and Quadratic Reciprocity (13 Hrs.)

The Legendre symbol and its properties, Evaluation of (-1/p) where 'p' is an odd prime, Gauss's lemma, Evaluation of (2/p) where 'p' is an odd prime, Quadratic reciprocity, Quadratic reciprocity law, Applications of the quadratic reciprocity law

Chapter 9: 9.2 – 9.3

Skill/Hands-on: Mini Project (20 Hrs.)

- Applications of Fermat, Wilson, Euler, Chinese remainder theorems
- Applications of number theoretic and multiplicative functions.
- Applications of the quadratic reciprocity law

Co-Curricular Activities: (5 Hrs.)

- Problem-solving sessions
- Student seminars
- Quiz & Group discussions

Prescribed Text Book:

1. Elementary Number Theory, Seventh Edition, David M. Burton, Tata McGraw-Hill Publishing company Ltd.

Reference books:

1. Basic Number Theory, S. B. Malik, Second Revised Edition, Vikas publishing house Pvt. Ltd.
2. An Introduction to the Theory of Numbers, I. Niven, H. Zukerman, Fifth Edition, John Wiley & sons.

3. Tom M. Apostol, Introduction to Analytic Number theory, Springer International Student Edition.
4. Hardy & Wright, Number Theory, Oxford Univ, Press.
5. Dence, J. B & Dence T.P, Elements of the Theory of Numbers, Academic Press.
6. Open Educational Resources / Web Resources.