



Andhra Pradesh State Council of Higher Education

APPLIED MATHEMATICS MINOR w.e.f. AY 2023-24

:APPLIED MATHEMATICS MINOR

YEAR	SEMESTER	PAPER	Minor	HRS	CREDITS
I	II	1	DIFFERENTIAL EQUATIONS	5	4
II	III	2	SOLID GEOMETRY	5	4
		3	OPTIMIZATION TECHNIQUES	5	4
	IV	4	VECTOR CALCULUS	5	4
III	V	5	LAPLACE TRANSFORMS	5	4
		6	INTEGRAL TRANSFORMS	5	4

II Semester
Course 1: Differential Equations
Credits: 4

Course objectives:

The central objective of differential equations are important for many physical system, one can subject to suitable idealization, formulate a differential equations that describes how the system changes in time, understanding the solutions of differential equation is then of paramount interest.

Course outcomes:

After successful completion of this course, the student will be able to;

1. Will be able to explain to the concept of differential equations.
2. Will be able to solve first order ordinary differential equations.
3. To find orthogonal trajectories.
4. Solve exact differential equations.
5. Convert separable in homogeneous to exact Solve exact differential equations by integrating factors.
6. Solve Bernoulli's differential equations.
7. Solve homogeneous linear differential equations with constant coefficients.
8. Use the method of variation of parameters to find the solution of higher order differential equations.
9. Solve the Cauchy's Euler equation.

UNIT – I –

Differential Equations of first order and first degree :

Linear Differential Equations; Differential Equations Reducible to Linear Form; Exact Differential Equations; Integrating Factors Equations Reducible To Exact Equations by Integrating Factors: 1. $1/Mx+Ny$

2. $1/Mx-Ny$

UNIT – II –

Orthogonal Trajectories.

Cartesian co-ordinates self orthogonal Family of curves. Orthogonal trajectories : polar co-ordinates.

Differential Equations of first order but not of the first degree :

Equations solvable for p; Clairaut's Equation.

UNIT – III -, Higher order linear differential equations-I :

Solution of homogeneous linear differential equations of order n with constant coefficients; Solution of the non- homogeneous linear differential equations with constant coefficients by means of polynomial operators.

General Solution of $f(D)y=0$

General Solution of $f(D)y=Q$ when Q is a function of x.

P.I. of $f(D)y = Q$ when $Q= beax$

P.I. of $f(D)y = Q$ when Q is $b \sin ax$ or $b \cos ax$.

UNIT – IV-

Higher order linear differential equations-II :

Solution of the non-homogeneous linear differential equations with constant coefficients. P.I. of $f(D)y = Q$ when $Q = bx^k$

P.I. of $f(D)y = Q$ when $Q = be^{ax}$ V P.I. of $f(D)y = Q$ when $Q = x^m$

P.I. of $f(D)y = Q$ when $Q = x^m e^{ax}$

UNIT –V –

Higher order linear differential equations-III :

Method of variation of parameters (without non constant coefficient equations) ; The Cauchy-Euler Equation ; Legendre's Equations.

Prescribed Text Book :

1. A text book of mathematics for BA/BSc Vol 1 by N. Krishna Murthy & others, published by S. Chand & Company, New Delhi.

Reference Books :

Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Learning Pvt. Ltd. New Delhi-Second edition.

Ordinary and Partial Differential Equations Raisinghania, published by S. Chand & Company, New Delhi.

Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha-universities press.

Telugu Academy Text Book for Differential Equations.

I-B.Sc A text Book of a Mathematics Deepthi Publications.

III SEMESTER
Course 2: SOLID GEOMETRY

Credits: 4

Course objectives:

Studying solid geometry provides the students with many foundational skills and helps them to build their logical thinking skills, deductive reasoning, analytical reasoning and problem solving skills.

Course outcomes:

After successful completion of this course, the student will be able to;

Will be able to direction cosines and direction ratios.

Identify Plane, system of planes and pair of planes.

Identify right line, coplanar lines and shortest distance.

Knowledge related to concept of sphere and cylinder.

UNIT – I : The Plane :

Equation of plane in terms of its intercepts on the axis, Equations of the plane through the given points, Length of the perpendicular from a given point to a given plane, Distance between parallel planes, System of Planes. Planes bisecting the angles between two Planes. Pair of Planes.

UNIT – II : The Line :

Equation of a line; Angle between a line and a plane; The condition for a line to lie in a plane,

Image of a point in a plane, Image of point in a line coplanar Lines

Shortest distance between two lines; The length and equations of the line of shortest distance between two straight lines.

UNIT – III : Sphere-I :

Definition and equation of the sphere; the sphere through four given points; Plane sections of a sphere; Intersection of two spheres; Equation of a circle; great circle, small circle; Intersection of a sphere and a line.

UNIT – IV : Sphere -II:

Equation of Tangent plane; Angle of intersection of two spheres; Orthogonal spheres; Radical plane; Coaxial system of spheres; Limiting Points.

UNIT – V : Cylinder :

Definition of a cylinder, Equation to the cylinder, Enveloping cylinder, right circular cylinders equation of the right circular cylinder.

Prescribed Text Book :

1. V. Krishna Murthy & Others “A text book of Mathematics for BA/B.Sc Vol 1, Published by S. Chand & Company, New Delhi.

Reference Books :

Scope as in Analytical Solid Geometry by Shanti Narayan and P.K. Mittal Published by S. Chand & Company Ltd. Seventeenth Edition.

Sections :- 2.4, 2.5, 2.6, 2.7, 2.8, 3.1 to 3.7, 6.1 to 6.9, 7.1 to 7.4, 7.6 to 7.8.

P.K. Jain and Khaleel Ahmed, "A text Book of Analytical Geometry of Three Dimensions", Wiley Eastern Ltd., 1999.

Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by Tata-MC Gran-Hill Publishers Company Ltd., New Delhi.

Telugu Academy Text Book for Solid Geometry.

I-B.Sc A text Book of a Mathematics Deepthi Publications.

IV Semester
Course 3: OPTIMIZATION TECHNIQUES

Credits: 4

Course Objective:

The central objective of optimization is —to do thing best under the given circumstances. This general concept has great many applications, for instance, in data analysis, engineering system design, inventory control, man power and resource allocation and building capabilities in the students for analyzing different situations in the industrial/business scenario.

Course Outcomes:

After successful completion of this course, the student will be able to;

Recall the theoretical foundations of various issues related to linear programming modelling to formulate real-world problems as a LP model

Explain the theoretical workings of the graphical, simplex and analytical methods for making effective decision on variables so as to optimize the objective function.

Identify appropriate optimization method to solve complex problems involved in various industries.

Demonstrate the optimized material distribution schedule using transportation model to minimize total distribution cost.

Find the appropriate algorithm for allocation of resources to optimize the process of assignment.

Explain the theoretical workings of sequencing techniques for effective scheduling of jobs on machine.

UNIT-I:

Introduction to Operations Research, Definition of OR, Applications of OR, Limitations of OR, Linear programming problem (LPP), Introduction, Mathematical formulation of the LPP, Applications and Limitation of LPP.

UNIT-II:

Linear Programming Problem – Solution of LPP Using Graphical Method and Simplex Method (□ inequality only).

UNIT-III:

Transportation problem: Mathematical formulation, IBFS of transportation problem using north-west corner rule, least- cost rule and Vogel’s approximation method, Simple problems.

UNIT-IV:

Assignment problem, definition, mathematical formulation of assignment problem, solution of assignment problem using Hungarian algorithm, unbalanced assignment problem, simple problems, Difference between Assignment and transportation Problem.

UNIT-V:

Introduction – Definition – Terminology and Notations Principal Assumptions, Problems with n

Jobs through Two Machines
Problems with n Jobs through Three Machines

Prescribed Text Book:

Operations Research (2nd Edition) by S.Kalavathi, Vikas Publications Towers Pvt. Ltd.

Scope:

UNIT-I: 1.1, 1.2, 1.3, 1.5, 1.6, 1.7

UNIT-II: 2.1, 2.2, 2.2.1, 2.2.2, 3.1, 3.1.1, 4.1, 4.2, 4.3

UNIT-III: 8.1, 8.2, 8.3, 8.4.1, 8.4.2, 8.4.3

UNIT-IV: 9.1, 9.2, 9.2.1, 9.2.2, 9.3, 9.4

UNIT-V: 12.1, 12.2, 12.2.1, 12.2.2, 12.3, 12.4

Reference books:

Operations Research by Kanthiswaroop, P.K.Gupta, Manmohan by Sultan Chand & Sons

Operations Research by SD. Sharma, Published by Kedhar Nath ram Nath – Meerut.

IV Semester
Course 4: VECTOR CALCULUS
Credits: 4

Course Objective:

Vector calculus plays an important role in differential geometry and in study of partial differential equations. It is used extensively in physics and engineering, especially in the description of electromagnetic fields, gravitational fields and fluid flow.

Course Outcomes:

After successful completion of this course, the student will be able to;

We study the calculus of vector fields.

Will be able to discuss line integrals and surface integrals also volume integrals.

It motivates the study of vector differentiation and integration in two and three dimensional spaces.

UNIT – I : Vector Differentiation – I :-

Vector Function of Scalar Variable continuity of a vector function partial differentiation scalar point function vector point function – Gradient of a scalar point Function – Unit normal – Directional Derivative at a Point – Angle between two surfaces.

UNIT – II : Vector Differentiation – II :-

Vector differential Operator – Scalar Differential Operator – Divergence of a vector – Solenoidal vector – Laplacian operator – curl of a vector – Irrotational Vector – Vector identities.

UNIT – III : Vector Integration - I :-

Definition – Integration of a vector – simple problems – smooth curve – Line integral – Tangential Integral – circulation Problems on line Integral. Surface Integral – Flux Problems on Surface Integral.

UNIT – IV : Vector Integration - II :-

Volume Integrals – Gauss Divergence Theorem statement and proof – Applications of Gauss Divergence theorem.

UNIT – V : Vector Integration - III :-

Green's Theorem in a plane Statement and proof – Application of Green's Theorem. Statement and Proof of Stoke Theorem – Application of Stoke Theorem.

Prescribed Text books:

A text Book of B.Sc., Mathematics by B.V.S.S.Sarma and others, published by S. Chand & Company Pvt. Ltd., New Delhi.

Reference Books :-

Vector Calculus by Santhi Narayana, Published by S. Chand & Company Pvt. Ltd., New Delhi.

Vector Calculus by R. Gupta, Published by Laxmi Publications.

Vector Calculus by P.C. Matthews, Published by Springer Verlag publications.

V Semester
Course 5: LAPLACE TRANSFORMS

Credits: 4

Course Objective:

The objective of this course is to familiarize the student with Laplace transforms and inverse Laplace transforms and their applications. Apply Laplace transforms to solve differential equations.

Course Outcomes:

After successful completion of this course, the student will be able to;
Find the Laplace transforms of derivatives, integral and periodic functions.
Will be able to solve initial value problems for linear differential equations.

UNIT – 1: Laplace Transform I : -

Definition of - Integral Transform – Laplace Transform Linearity, Property, Piecewise continuous Functions, Existence of Laplace Transform, Functions of Exponential order, and of Class A. Linear property, First Shifting Theorem.

UNIT – 2: Laplace Transform II : -

Second Shifting Theorem, Change of Scale Property, Laplace Transform of the derivative of $f(t)$, Initial Value theorem and Final Value theorem.

UNIT – 3: Laplace Transform III : -

Laplace Transform of Integrals – Multiplication by t , Multiplication by tn – Division by t .
Laplace transform of Bessel Function Only.

UNIT –4: Inverse Laplace Transform I : -

Definition of Inverse Laplace Transform. Linearity, Property, First Shifting Theorem, Second Shifting Theorem, Change of Scale property, use of partial fractions, Examples.

UNIT –5: Inverse Laplace Transform II : -

Inverse Laplace transforms of Derivatives–Inverse Laplace Transforms of Integrals – Multiplication by Powers of „P’– Division by powers of „P’– Convolution Definition – Convolution Theorem – proof and Applications.

Prescribed Text Books :-

Integral Transforms by A.R. Vasistha and Dr. R.K. Gupta Published by Krishna Prakashan Media Pvt. Ltd. Meerut.

Reference Books :-

Laplace Transforms by A.R. Vasistha and Dr. R.K. Gupta Published by Krishna Prakashan Media Pvt. Ltd. Meerut.

Fourier Series and Integral Transforms by Dr. S. Sreenadh Published by S.Chand and Co., Pvt. Ltd., New Delhi.

Laplace and Fourier Transforms by Dr. J.K. Goyal and K.P. Gupta, Published by Pragathi Prakashan, Meerut.

Integral Transforms by M.D. Raising hania, - H.C. Saxsena and H.K. Dass Published by S. Chand and Co., Pvt.Ltd., New Delhi.

V Semester
Course 6: INTEGRAL TRANSFORMS
Credits: 4

Course Objective:

The objective of this course is to familiarize the student with applications of integral transforms and Fourier transforms and their applications.

Course Outcomes:

After successful completion of this course, the student will be able to;

Understanding and regarding different kind of integral transforms.

Understand Fourier transform and its properties and will be able to solve the examples based on it.

UNIT – 1- Application of Laplace Transform to solutions of Differential Equations : -

Solutions of ordinary Differential Equations.

Solutions of Differential Equations with constants co-efficient.

UNIT – 2 -Application of Laplace Transform : -

Solutions of partial Differential Equations.

UNIT – 3- Application of Laplace Transforms to Integral Equations : -

Definitions : Integral Equations-Abel's, Integral Equation-Integral Equation of Convolution Type, Integro Differential Equations. Application of L.T. to Integral Equations.

UNIT –4 -Fourier Transforms-I : -

Definition of Fourier Transform – Fourier's in Transform – Fourier cosine Transform – Linear Property of Fourier Transform – Change of Scale Property for Fourier Transform – sine Transform and cosine transform shifting property – modulation theorem.

UNIT – 5- Fourier Transform-II : -

Convolution Definition – Convolution Theorem for Fourier transform – parseval's Identity – Relationship between Fourier and Laplace transforms – problems related to Integral Equations.

Prescribed Text Books :-

Integral Transforms by A.R. Vasistha and Dr. R.K. Gupta Published by Krishna Prakashan Media Pvt. Ltd. Meerut.

Reference Books :-

Laplace Transforms by A.R. Vasistha and Dr. R.K. Gupta Published by Krishna Prakashan Media Pvt. Ltd. Meerut.

Fourier Series and Integral Transforms by Dr. S. Sreenadh Published by S.Chand and Co., Pvt. Ltd., New Delhi.

Laplace and Fourier Transforms by Dr. J.K. Goyal and K.P. Gupta, Published by Pragathi Prakashan, Meerut.

Integral Transforms by M.D. Raising hania, - H.C. Saxsena and H.K. Dass Published by S. Chand and Co., Pvt.Ltd., New Delhi