Programme: B.Sc Mathematics (Major)

III Semester

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
II	III	5	Group Theory &Problem Solving Sessions (T) Group Theory &Problem Solving Sessions (P)	5	4
		6	Numerical Methods & Problem Solving Sessions (T) Numerical Methods & Problem Solving Sessions (P)	5	4
		7	Laplace Transforms & Problem Solving Sessions (T) Laplace Transforms & Problem Solving Sessions (P)	5	4
		8	Special Functions & Problem Solving Sessions (T) Special Functions & Problem Solving Sessions (P)	5	4

ADIKAVI NANNAYA UNIVERSITY: RAJMAHENDRAVARAM
Single Major B.Sc Mathematics (w.e.f:2023-24A.B)

SEMESTER-III

COURSE 5: GROUP THEORY

Theory Credits: 4 5 hrs/week

Course Outcomes

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

1. acquire the basic knowledge and structure of groups
2. get the significance of the notation of a subgroup and cosets.
3. understand the concept of normal subgroups and properties of normal subgroup
4. study the homomorphisms and isomorphisms with applications.
5. understand the properties of permutation and cyclic groups

Course Content

Unit – 1
Groups

Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group, Composition tables with examples.

Unit – 2
Sub Groups

Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition-examples-criterion for a complex to be a subgroups; Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups. Coset Definition – properties of Cosets – Index of a subgroups of a finite groups – Lagrange's Theorem.

Unit – 3
Normal Subgroups

Normal Subgroups: Definition of normal subgroup – proper and improper normal subgroup–Hamilton group- Criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups Sub group of index 2 is a normal sub group

Unit – 4
Homomorphisms

Quotient groups, Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

Unit – 5
Permutations and Cyclic Groups

Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley's theorem.
Cyclic Groups - Definition of cyclic group – elementary properties – classification of cyclic groups.

Activities

Seminar/ Quiz/ Assignments/ Applications of Group Theory to Real life Problem /Problem Solving Sessions.

Text Book

Modern Algebra by A.R.Vasishtha and A.K.Vasishtha, KrishnaPrakashanMedia Pvt. Ltd., Meerut.

Reference Books

1. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishing house.
2. Modern Algebra by M.L. Khanna, Jai Prakash and Co. Printing Press, Meerut
3. Rings and Linear Algebra by Pundir&Pundir, published by PragathiPrakashan

*****

ADIKAVI NANNAYA UNIVERSITY: RAJMAHENDRAVARAM
Single Major B.Sc Mathematics (w.e.f:2023-24A.B)

SEMESTER-III

COURSE 6: NUMERICAL METHODS

Theory Credits: 4 5 hrs/week

Course Outcomes

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

1. difference between the operators Δ, ∇, E and the relation between them
2. know about the Newton – Gregory Forward and backward interpolation
3. know the Central Difference operators δ, μ, σ and relation between them
4. solve Algebraic and Transcendental equations
5. understand the concept of Curve fitting

Course Content

Unit – 1

The calculus of finite differences

The operators Δ, ∇, E - Fundamental theorem of difference calculus- properties of Δ, ∇, E and problems on them to express any value of the function in terms of the leading terms and the leading differences - relations between E and D - relation between D and Δ - problems on one or more missing terms- Factorial notation- problems on separation of symbols- problems on Factorial notation.

Unit – 2

Interpolation with equal and unequal intervals

Derivations of Newton – Gregory Forward and backward interpolation and problems on them. Divided differences - Newton divided difference formula - Lagrange's and problems on them.

Unit – 3

Central Difference Interpolation formulae

Central Difference operators δ, μ, σ and relation between them - Gauss forward formula for equal intervals - Gauss Backward formula - Stirlings formula - Bessel's formula and problems on the above formulae.

Unit – 4

Solution of Algebraic and Transcendental equation

Method for finding initial approximate value of the root - Bisection method - to find the solution of given equations by using (i) Regula Falsi method (ii) Iteration method (iii) Newton – Raphson's method and problems on them.

Unit – 5

Curve Fitting

Least-squares curve fitting procedures - fitting a straight line-nonlinear curve fitting-curve fitting by a sum of exponentials

Activities

Seminar/ Quiz/ Assignments/ Applications of Numerical methods to Real life Problem /Problem Solving Sessions.

Text Book

Numerical Analysis by G. Shanker Rao, New Age International Publications

Reference Books

1. Applied Numerical Analysis by Curtis F. Gerald and Patrick O. Wheatley, Pearson,(2003) 7th Edition

2.Introductory Methods of Numerical Analysis by S.S. Sastry, (6^{th} Edition) PHI New Delhi 2012

3. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S .R. K. Iyengar and R. K. Jain, New Age International Publishers (2012), 6th edition.

*****

ADIKAVI NANNAYA UNIVERSITY: RAJMAHENDRAVARAM
Single Major B.Sc Mathematics (w.e.f:2023-24A.B)

SEMESTER-III

COURSE 7: LAPLACE TRANSFORMS

Theory Credits: 4 5 hrs/week

Course Outcomes

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

1. understand the definition and properties of Laplace transformations
2. get an idea about first and second shifting theorems and change of scale property
3. understand Laplace transforms of standard functions like Bessel, Error function etc
4. know the reverse transformation of Laplace and properties
5. get the knowledge of application of convolution theorem

Course Content

Unit – 1
LAPLACE TRANSFORMS – I

Definition of Laplace Transform - Linearity Property - Piecewise Continuous Function - Existence of Laplace Transform - Functions of Exponential order and of Class A.

Unit – 2
LAPLACE TRANSFORMS – II

First Shifting Theorem, 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 TRNASFORM – III

Laplace Transform of Integrals - Multiplication by t, Multiplication by t^n - division by t -Laplace transform of Bessel Function - Laplace Transform of Error Function – Laplacetrans form of Sine and Cosine integrals.

Unit – 4
INVERSE LAPLACE TRANSFORMS – 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 TRANSFORMS – 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 - Heaviside's Expansion theorem and its Applications.

Activities

Seminar/ Quiz/ Assignments/ Applications of Laplace Transforms to Real life Problem /Problem Solving Sessions.

Text Book

LaplaceTransforms by A.R.Vasishtha,Dr.R.K.Gupta,KrishnaPrakashanMedia Pvt.Ltd., Meerut.

Reference Books

1. Introduction to Applied Mathematics by Gilbert Strang, Cambridge Press
2. Laplace and Fouries transforms by Dr.J.K. Goyal and K.P. Guptha, PragathiPrakashan, Meerut.

*****

ADIKAVI NANNAYA UNIVERSITY: RAJMAHENDRAVARAM
Single Major B.Sc Mathematics (w.e.f:2023-24A.B)

SEMESTER-III

COURSE 8: SPECIAL FUNCTIONS

Theory Credits: 4 5 hrs/week

Learning Outcomes

After successful completion of the course will be able to

1. Understand the Beta and Gamma functions, their properties and relation between these two functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations.
2. Find power series solutions of ordinary differential equations.
3. Solve Hermite equation and write the Hermite Polynomial of order (degree) n, also Find the generating function for Hermite Polynomials, study the orthogonal properties of Hermite Polynomials and recurrence relations.
4. Solve Legendre equation and write the Legendre equation of first kind, also find the generating function for Legendre Polynomials, understand the orthogonal properties of Legendre Polynomials.
5. Solve Bessel equation and write the Bessel equation of first kind of order n, also find the generating function for Bessel function understand the orthogonal properties of Bessel unction.

Course Content

Unit–1
Beta and Gamma functions, Chebyshev polynomials

Euler'sIntegrals-Betaand Gamma Functions, Elementary properties of GammaFunctions, TransformationofGamma Functions.

Another form of BetaFunction, Relation between BetaandGamma Functions. Chebyshevpolynomials, orthogonalpropertiesofChebyshevpolynomials,recurrence relations, generatingfunctions for Chebyshev polynomials.

Unit–2
PowerseriesandPowerseriessolutionsofordinarydifferentialequations

Introduction, summary of useful results, powerseries, radius of convergence, theorems on Power series Introduction of power series solutions of ordinary differentialequationOrdinary and singular points, regular and irregular singular points, power series solution.

Unit–3
Hermitepolynomials

HermiteDifferential Equations, Solution of HermiteEquation,Hermite polynomials, generating function for Hermite polynomials.OtherformsforHermitePolynomials,RodriguesformulaforHermite Polynomials, to find first fewHermite Polynomials.OrthogonalpropertiesofHermitePolynomials,RecurrenceformulaeforHermitePolynomials.

Unit–4
Legendrepolynomials

Definition,SolutionofLegendre'sequation,Legendrepolynomialofdegree n, generating function of Legendrepolynomials.Definitionof$P_n(x)$and$Q_n(x)$,GeneralsolutionofLegendre'sEquation(derivationsnot required)toshowthat$P_n(x)$isthecoefficientofh^n, in the expansionof $(1-2xh+h^2)^{-1/2}$OrthogonalpropertiesofLegendre'spolynomials,RecurrenceformulasforLegendre's Polynomials.

Unit–5

Bessel'sequation

Definition, Solution of Bessel'sequation,Bessel's function of the firstkind of ordern,Bessel'sfunction of thesecondkindofordern.

IntegrationofBessel'sequationinseriesform=0, Definition of $J_n(x)$ recurrenceformulaefor$J_n(x)$ Generating function for$J_n(x)$,orthogonally of Bessel functions.

Activities

Seminar/ Quiz/ Assignments/ Applications of Special functions to Real life Problem /Problem Solving Sessions.

Text Book

SpecialFunctions by J.N.SharmaandDr.R.K.Gupta,KrishnaPrakashan,

ReferenceBooks

1. Dr.M.D.Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
2. Shanti Narayan and Dr.P.K.Mittal, Integral Calculus, S. Chand &CompanyPvt. Ltd., Ram Nagar, New Delhi-110055.
3. GeorgeF.Simmons,Differential Equations with Applications and Historical Notes, Tata McGRAW-Hill Edition, 1994.

*****