Course-Curriculum

M. Sc. Mathematics- Department of Mathematics

Rayalaseema University KURNOOL - 518007

Choice Based Credit System

w.e.f. (2021-2022)

YEAR	SEMESTER	Marks	NO OF CREDITS
I Year	I Semester	4X100 Marks = 400 Marks 1X100 Marks = 100 Marks 1X 50 Marks = 50 Marks (Lab)	16 (4x4) 3 (1X 3) 1 (1x1) Total 20 credits
	II Semester	4X100 Marks = 400 Marks 1X100 Marks = 100 Marks 1X 50 Marks = 50 Marks (Lab)	16 (4x4) 3 (1X 3) 1 (1x1) Total 20 credits
II Year	III Semester	4X100 Marks = 400 Marks 1X100 Marks = 100 Marks 1X 50 Marks = 50 Marks (Lab)	16 (4x4) 3 (1X 3) 1 (1x1) Total 20 credits
	IV Semester	4X100 Marks = 400 Marks 1X100 Marks = 100 Marks (Project) 1X 50 Marks = 50 Marks (Comprehensive Viva)	16 (4x4) Theory 3(1X3) Project 1(1X1) Comprehensive Viva
Total credits		**2200 Marks**	**80**

Course structure

SEMISTER I				
S.No	**Course Code**	**Name of the Paper**	**Number of credits**	**Number of hours per week**
1	MA 101	Topology	4	4+1=5
2	MA 102	Real Analysis	4	4+1=5
3	MA 103	Linear Algebra and Abstract Algebra	4	4+1=5
4	MA 104	Ordinary Differential Equations	4	4+1=5
5	MA 105	Programming in C	3	3+1 =4 Theory
6	MA 106	C Programming lab	1	2 Lab for each batch

SEMISTER II				
S.No	**Course Code**	**Name of the Paper**	**Number of credits**	**Number of hours per week**
1	MA 201	Functional Analysis	4 (2+2)	4+1=5
2	MA 202	Complex Analysis	4	4+1=5
3	MA 203	Analytical Number Theory	4	4+1=5
4	MA 204	Probability and Statistics (Elective)	4	4+1=5
5	MA 205	Numerical Methods	3	3+1 =4
6	MA 206	Numerical Methods Lab	1	2 Lab for each batch

SEMISTER III				
S.No	**Course Code**	**Name of the Paper**	**Number of credits**	**Number of hours per week**
1	**MA 301**	Mathematical Methods (elective)	4	4+1=5
2	**MA 302**	PCM	4	4+1=5
3	**MA 303**	Discrete Math (Open Elective)	3	3+1=4
4	**MA 304**	PDE	4	4+1=5
5	**MA 305**	Calculus of Variations and Integral Equations	4	4+1=5
6	MA306	Matlab	1	2 Lab hours for each batch

SEMISTER IV				
S.No	**Course Code**	**Name of the Paper**	**Number of credits**	**Number of hours per week**
1	MA 401	Galois Theory	4	4+1=5
2	MA 402	Lebesgue Theory	4	4+1=5
3	MA 403	Operations Research	4	4+1=5
4	MA 404	Graph Theory (MOOCS/ Online/ class) – Can register for the course- Grade points?	4	4+1=5
5	MA 405	Project +Viva	2+1	4+1
6	MA 406	Comprehensive Viva	1	

RAYALASEEMA UNIVERSITY::KURNOOL
DEPARTMENT OF MATHEMATICS
Semester – I: Syllabus
(w.e.f. 2021-2022)

Paper M101: TOPOLOGY

Learning Objectives:

i. To understand and learn Basic notions of metric and topological spaces
ii. To understand Methods and techniques of proving basic theorems on topological spaces and continuous mappings
iii. To understand equivalent methods of introducing topology in a set

UNIT – I

Metric spaces – Open sets – closed sets – convergence – completeness, and Baire's theorem – continuous mapping – spaces of continuous functions – Euclidean and Unitary spaces.

UNIT – II

Topological Spaces – Definition Examples – open bases and open subbases – weak topologies.

UNIT – III

Compact spaces – Product spaces – Tychonoff's theorem and lacally compact spaces – Compactness in Metricspaces – Ascoli's Theorem.

UNIT – IV

Separation – T1- Spaces and Hausdorff Spaces – completely Regular spaces and Normal spaces – Urysohn's lemma – Urysohn's imbedding theorem – Stone-cech compactification - Connected spaces – Components of a space.

Course Outcomes: Upon completion of the course, students should acquire the following skills:

i Define real numbers, identify the convergence and divergence of sequences, explain the limit and continuity of a function at a given point.
ii Construct the geometric model of the set of real numbers.
iii Define the existence of a sequence's limit, if there exists, find the limit.
iv Explain the notion of limit of a function at a given point and if there exists estimate the limit. Define the notion of continuity and obtain the set of points on which a function is continuous.
v Express the notion of metric space, construct the topology by using the metric and using this topology identify the continuity of the functions which are defined between metric spaces.

Text Book:

1. Standard and treatment as in Chapter 2, Articles16-19 of Chapter III, Articles 21-25 of Chapter IV, Articles 26-30 of Chapter V and Articles 31 and 32 of Chapter VI of "Introduction To Topology And Modern Analysis" BY G.F.Simmons, McGraw Hill book company, Inc., International Student edition. (New Editions)

Reference:

1. Topology: James R. Munkres, Second Edition, Pearson publishers.
2. General Topology, Stephen Willard, Third edition, Barnes & Noble publishers

Paper M102: REAL ANALYSIS

Learning Objectives:

i To learn the concepts of basic topological objects such as open sets, closed sets, compact sets and the concept of convergence and also to work comfortably with continuous, differentiable, Riemann integrable functions and Uniform convergence.

ii Knowledge and understanding basic concepts of measure and integration theory.

iii Students acquire basic knowledge of measure theory needed to understand probability theory, statistics and functional analysis

UNIT – I

Reimann – Steiltje's Integral: Definition and Existence of the Integral – Properties of the Integral – Integration and differentiation – Rectifiable Curves.

UNIT – II

Sequences and Series of Functions: Uniform convergence – Uniform convergence and continuity – Uniform convergence and Integration – Uniform convergence and Differentiation – The stone Weierstrass Theorem.

UNIT – III

Multivariable Differential Calculus: The directional derivative – Directional derivatives and continuity – The total derivative expressed in terms of the partial derivatives – The Jacobian matrix – The chain rule – The matrix form of the chain rule – The mean value theorem for differentiable functions – A sufficient condition for differentiability – A sufficient condition for equality of mixed partial derivatives – Taylor's formula for function from $R^n \rightarrow R^1$.

UNIT – IV

Implicit functions and Extremum Problems: Functions with non – zero Jacobian determinant – The Inverse function theorem – The Implicit function theorem – Extremum of real valued functions of several variables – Extremum problem with side conditions.

Course Outcomes

After completing this course, the student will be able to:

- i Locate Sequence and Series comprising convergence sequences, upper and lower limits.
- ii Enumerate the limits of functions, infinite limits and limit at infinity.
- iii Describe the Riemann integral.
- iv Multivariable Differential Calculus is a part of the basic curriculum since it is crucial for understanding the theoretical basis of probability and statistics.
- v Understanding of the theory on the basis of examples of application.
- vi Ability to use abstract methods to solve Extrema problems. Ability to use a wide range of references and critical thinking on implicit and inverse function theorems.
- vii After completing this subject, students will understand the fundamentals of Multivariable Differential Calculus and be acquainted with the proofs of the fundamental theorems underlying the theory of differentiation.

Text Books:

Standard and treatment as in

1. Chapters 6 and 7 (Excluding articles 7.19 to 7.25) of "Principles Of Mathematical Analysis" by Walter Rudin, McGraw Hill International Edition, (Third Edition). (Units 1 and 2)
2. Chapters 12 and 13 of "Mathematical Analysis" By Tom M Apostol Narosa Publishing House. (Units 3 and 4)

Paper M103: ABSTRACT ALGEBRA AND LINEAR ALGEBRA

Learning Objectives:

- i. Understanding Systems of linear equations and vector spaces.
- ii. Knowledge about characteristic values and Cayley Hamilton theorem
- iii. Understanding about simultaneous diagonaliaation with problems
- iv. Basics of algebraic structures, group, types of groups, G-stes, Normal Series, solvable groups nilpotent groups concepts and their applications.
- v. Application of Permutation Groups and Alternating group An

UNIT – I

Systems of linear equations - Moore-Penrose Generalised inverse - Vector spaces - subspaces - characteristic values and vectors - Cayley Hamilton theorem

UNIT – II

Annihilating polynomial - invariant subspaces Simultaneous triangularisation - simultaneous diagonalisation -

UNIT – III

Conjugacy and G-Sets – Normal Series – Solvable groups – Nilpotent group.

UNIT – IV

Direct Products – Finitely generated abelian groups – Invariants of finite abelian group – Sylow theorems-

Learning Outcomes:

- i Secure knowledge of understanding systems of linear equations and vector spaces.
- ii The student will understand how to find characteristic values and applications of Cayley Hamilton theorem.
- iii Understanding about simultaneous diagonaliaation with problems
- iv The student will understand the algebraic structures, group, types of groups, G-stes, Normal Series, solvable groups nilpotent groups.
- v Understand the application of Permutation Groups and Alternating group An. Understand various concepts of finite abelian group.

Text Books :

1. Hoffman and Kunze, Linear Algebra, Prentice Hall of India, New Delhi, 2003.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Publishers, 2011
3. Standard and treatment as in Section 4 of Chapter 5, Chapter 6, Chapter 7, Chapter 8 and Chapter 11 of “ Basic Abstract Algebra” by P.B.Bhattacharya, S.K.Jain and S.R. Nagpal, Cambridge University press, Second edition, 1995. (For Abstract Algebra)

Paper M104: ORDINARY DIFFERENTIAL EQUATIONS

Learning Objectives:

- i. Identify essential characteristics of ordinary differential equations
- ii. Regular singular points
- iii. Develop essential methods of obtaining closed form solutions.
- iv. Solution of Bessels equation
- v. Explore the use of differential equations as models in various applications.
- vi. Explore methods of solving ordinary differential equations
- vii. Understand various stabilities
- viii. Explore the necessary and sufficient and conditions for these stabilities
- ix. Understanding Liapunov second method
- x. Construction of Liapunov Function

UNIT – I

Linear Equations with Regular Singular points – The Euler Equation – Second order equations with regular singular points – an example – the general case – A convergence Proof – The exceptional cases – The Bessel Equation – Regular Singular points at infinity.

UNIT – II

Existence and Uniqueness of solutions to first order equations – Equations with variables separated – Exact Equations – The Method of successive approximations – The Lipschitz condition – convergence of the Successive approximations

UNIT – III

Stability of linear and weakly non-linear systems, continuous dependence and stability properties of linear, non-linear and weakly non-linear systems. Two dimensional systems. (chapter III of text book-2)

UNIT – IV

Stability by Liapunov second method, Autonomous systems, quadratic forms, Krasovski's Method. Construction of Liapunov functions for linear systems with constant coefficients. Selection of total energy function as a Liapunov Function, Stability based on first approximation (Chapter V of text book-2)

Learning Outcomes: Students will be able to:

i Classify ordinary differential equations according to order and linearity, as well as distinguish between initial value problems and boundary value problems.
ii Formulate and solve application problems.
iii Find series solutions about regular-singular points.
iv Effectively write mathematical solutions in a clear and concise manner.
v Locate and use information to solve first and second order ordinary differential equations.
vi Demonstrate ability to think critically by determining and using appropriate techniques for solving a variety of differential equations.
vii Demonstrate an intuitive and computational understanding of differential equations by solving a variety of application problems arising from biology, chemistry, physics, engineering and mathematics.
viii Demonstrate the ability to integrate knowledge and ideas of differential equations in a coherent and meaningful manner for solving real world problems.
ix Demonstrate the ability to integrate knowledge and ideas of differential equations by analyzing their solution to explain the underlying physical processes.
x Develops familiarity with stability, asymptotically stability and unstable concepts.
xi Develops familiarity with various stability properties and necessary and sufficient conditions for local stability analysis.
xii Acquires the knowledge and concepts on stability based on Liapunov second method and ability to apply these to various problems.
xiii Acquires the ability to construct Liapunov functions and explore stability through them.

Text Books :

1. Standard and treatment as in Chapter 4, Articles 1 to 6 of Chapter 5 of "An Introduction To Ordinary Differential Equations " by E.A.Coddington.
2. M.Rama Mohan Rao, Ordinary Differential equations, Theory methods and applications, Affiliated East-West Press Pvt.Ltd., New Delhi. (1980).

Paper M105: PROGRAMMING IN C

Learning Objectives:

i The course is designed to provide complete knowledge of C language.

ii Students will be able to develop logics which will help them to create programs, applications in C.

iii Also by learning the basic programming constructs they can easily switch over to any other language in future

Unit – I

Basics of C Language, Decision Making and Branching: Decision making with IF statement – Simple IF statement – The IF…ELSE statements – The ELSE…IF ladder – The switch statement – The? Operator – The GOTO statement. Decision Making and Looping: The WHILE statement – The DO Statement – The FOR statement and Jumps in loops.

Unit-II

Arrays: One-dimensional arrays – Two – Dimensional arrays, Initializing two – Dimensional arrays and Multidimensional arrays. Handling of Character Strings: Declaring and initializing string variables – Reading Strings from termina – Writing strings to screen – Arithmetic operatiSon on characters – Putting strings together – Comparison of two strings – String – Handling functions and table of strings.

Unit-III

User – Defined Functions : Need for user – defined function – A multi – Function Program – The from of C function – Return values and their types – Calling a function – Category of function – No arguments and no returns values – Arguments but no returns values – Arguments with return values – Handling of non-integers functions – Nesting of functions – Recursion – Functions with arrays – The scope and lifetime of variables in functions and points to remember. Structures and Unions: Structures of definition – Giving values to members – Structure initialization – Comparison of structure variable – Arrays of structures – Arrays within structures – Structures within structures – Structures and functions – Unions and Size of structures.

Unit – IV

Pointers : Understanding pointers – Accessing the address of a variable – Declaring and initializing pointers – Accessing a variable through its pointer – Pointer Expressions – Pointer increments and scale factor – Pointers and arrays – Pointers and character strings – Pointer and functions – Pointers and structures and pointers and pointers.

File Management in C: Defining and Opening a file – Closing a File – Input/Output Operation on files – Error handling during I/O operation – Random accessing to files and command line arguments.

Learning Outcomes:

After the completion of this course, the students will be able to develop applications.

Text Book:

Standard and treatment as in "**PROGRAMMING IN C**" by E.Balagurusamy Chapters 5,6,7,8,9,10,11 and 12.

References:

1. Programming in ANSI C – E. Balagurusamy, Mc Graw Hill.
2. Let us C, Yashvant Kanetkar, 17th Edition, BPB Publications.

RAYALASEEMA UNIVERSITY::KURNOOL
DEPARTMENT OF MATHEMATICS
Semester – II: Syllabus
(w.e.f. 2021-2022)

PAPER MA 201: FUNCTIONAL ANALYSIS

Learning Objectives:

- i To study certain topological-algebraic structures and the methods by which the knowledge of these methods can be applied to analytic problems.
- ii The objectives of the course is the study of the main properties of bounded operators between Banach and Hilbert spaces, the basic results associated to different types of convergences in normed spaces and the spectral theorem and some of its applications

UNIT – I

Banach Spaces: The definition and some examples – Continuous Linear transformations – the Hahn – Banach theorem.

UNIT – II

The natural imbedding of N in N** - The open mapping theorem – The conjugate of an operator.

UNIT – III

Hilbert Spaces : The definition and some simple properties – Orthogonal complements – orthonormal sets – The conjugate space H*.

UNIT – IV

The adjoint of an operator – self-adjoint operators – Normal and Unitary operators – Projections. Finite dimensional spectral theory : Determinants and the spectrum of an operator – The spectral theorem.

Course Outcomes: Upon completion of the course, students should possess the following skills:

- i Understand the basic concepts of graphs, directed graphs, and weighted graphs and able to present a graph by matrices.
- ii Understand the properties of trees and able to find a minimal spanning tree for a given weighted graph. Understand Eulerian and Hamiltonian graphs.

Text Books:

Standard and treatment as in Chapter 9,10 and Sections 2 and 3 of Chapter 11 of "Introduction To Topology And Modern Analysis" by G.F.Simmons, Mc Graw – Hill book company, Inc., International student edition.

Reference:

1. Limaye, Balmohan V., Functional Analysis, second edition, New Age International Publishers Limited, New Delhi, 199
2. Kesavan, S., Functional Analysis, Trim series, Hindustan Book Agency, 2009

PAPER MA 201: COMPLEX ANALYSIS

Learning Objectives:

To understand the modulus of a Complex valued function and results regarding that

i. To understand and develop manipulation skills in the use of Rouche's theorem, Inverse Function theorem, Hardmards three circle theorem.
ii. To understand and learn to use Argument Principle.
iii. To understand the principal of Analytic Continuation and the concerned results and Gamma and Zeta functions, their properties and relationships.
iv. To understand the Harmonic functions on a disc and concerned results, factorization of entire functions having infinite zeros, range of analytic functions and concerned results and univalent functions.

UNIT – I

Complex functions – Basic concepts – continuity of a complex function – Differentiation in the complex plane –Analytic functions - The Cauchy Reimann equations – **Conformal mapping** – Fractional linear transformation- Critical points - fixed points

UNIT – II

Integration in the complex plane: The Integral of a complex function – Basic properties of the integral – Integrals along polygonal curves – Cauchy's Integral theorem – Indefinite complex Integrals Cauch's Integral formula – Infinite differentiability of Analytic functions - Harmonic functions.

UNIT – III

Complex series – convergence vs divergence – Absolute vs conditional convergence – Uniform convergence – Power series – Basic theory – Determination of the radius of convergence – **Taylor series** – The Taylor expansion of an analytic function – Uniqueness theorems – The Maximum modulus principle and its implications. Laurent Series – The Laurent expansion of an analytic function

UNIT – IV

Singularities: – Isolated singular points – Residues – Cauchy residue theorem - logarithmic residues and the Argument Principle – Rouche's Theorem and its implications. Evaluation of improper integrals

Learning Outcomes:

Upon completing the course, students will be able to:

i To learn to recognize the fundamental properties of normed spaces and of the transformations between them.
ii Understand the notions of dot productand Hilbert space and apply the spectral theorem to the resolution of integral equations.
iii Corelate Functional Analysis to problems arising in Partial Differential Equations, Measure Theory and other branches of Mathematics.

Text Book:

Standard and treatment as in Chapter III, Chapter IV, Chapter V, Chapter VI, Chapter VII, Chapter VIII and Chapter X, Chapter XI and article 12.1, 12.2, 12.3 of Text book 1 of the Text "Complex Analysis With Applications" by Richard A. Silverman, Printice – Hall Inc. Englewood cliffs, New Jersey, 1974.

References:

1. Ahlfors, Lars V., Complex Analysis: An Introduction to the Theory of Analytic Functions of One Complex Variable, third edition. International Series in Pure and Applied Mathematics, McGraw-Hill Book Co., New York, 1978.
2. Churchill, Ruel V. and Brown, James Ward, Complex Variables and Applications, fourth edition, McGraw-Hill Book Co., New York, 1984.
3. Conway, John B., Functions of One Complex Variable, II, Graduate Texts in Mathematics, 159, Springer-Verlag, New York, 1995.
4. Narasimhan, Raghavan and Nievergelt, Yves, Complex Analysis in One Variable, second edition, Birkh¨auser Boston, Inc., MA, 2001

PAPER MA 203: ANALYTICAL NUMBER THOERY

Learning Objectives:

i The aim of this course is to give understanding of analytic Number Theory.

ii The students will be able to apply the techniques of big O – notations and the problems of O – notations with the Arithmetic functions.

iii To understand on properties of Congruence's and to salvation of and the proof of their theorems.

iv To understand the Quadratic Residuesand learn techniques of the Jacobi's symbol and Primitive roots.

UNIT-I

Averages of Arithmetical Functions and Dirichlet Multiplication Introduction – The Mobius Function– The Euler totient function– A relation connecting □ and - A product formula for– The Dirichlet product of Arithemetical functions – Dirichlet inverses and the Mobius inversion formula – The Mangoldt function– Multiplicaive functions and Dirichler Multiplication – The inverse of a completely Multiplicatve functions – Livouville's function – The divisor function u(n) - Generalised convolutions – Formal power Series – The Bell Series of an arithmetical functions – Bell Series and Dirichelt multiplication – Derivatives of arithmetical functions – The Selbergindentity.

UNIT-II

Average order of Arithmetical functions introduction – The big O notation – Asymptotic equality of functions – Euler's summation formula Some elementary asymptotic formulas – The average order of d(n) – The average order of the divisor function - The average order –

An application to the distribution of lattice points visible from the origin – The average order of μ(n) and of A(n) – The partial sums of a Dirichelt product – Applications to μ(n) and A(n) – Another identity for the partial sums of Dirichlet Product.

UNIT-III

Congruences Definition and basic properties of congruencies – Residue classes and complete residue systems – Linear congruences – Reduced residue system and the Euler fermat theorem – Polynomial congruences modulo p Lagranges theorem – Application of lagranges theorem – Simulataneous linear congruences – The Chinese remainder theorem – Polynomial congruences with prime power moduli – The Principle of cross classification – A decomposition property of reduced residue system.

UNIT-IV

Quadratic Residues and the Quadratic resiprocity Law Quadratic Residues – Legender Symbol – and its properties Evaluation (-1/P) and (2/P) – Gauss lemma – The Quadratic reciprocity Law – Applications of reciprocity law – The Jacobi's symbol.
Primitive roots the exponent of a number mod m – Primitve roots and reduced residue system – The non existence of Primitive roots mod 2nd for $\alpha \geq 3$.

Course Outcomes: At the end of the course students will to be able to

- i Analyze and prove results presented in analytic number theory.
- ii They will also be able to prove results similar to the ones presented in the course and apply the basic techniques, results and concepts of the course to concrete examples and exercises.
- iii Further will be able understand the interdisciplinary nature with other mathematical branches.
- iv Having the knowledge of partition theory they will be able to understand theoretical physics and combinatorics.

Text Book:
Standard and treatment as in Chapter2.Articles 3.1 to 3.10 of Chapter 3.Chapter 5.Articles 9.1 to 9.7 of chapter 9.Articles 10.1 to 10.3 of Chapter 10. Of the Text **An Introduction to Analyical Number Theory** by Tom M Apostol. Springer verlag International Student edition.

References:

1. 1.George E. Andrews ; Number Theory, W. B. Saunders Company, Philadelphia , London, Toronto.
2. 2.Koblitz, Neal, A Course in Number Theory and Cryptography, Graduate Texts in Mathematics, Springer, 1987.
3. Rosen, M. and Ireland, K., A Classical Introduction to Number Theory, Graduate Texts in Mathematics, Springer, 1982.
4. Bressoud, David, Factorization and Primality Testing, Undergraduate Texts in Mathematics, Springer, 1989.

PAPER MA 204: Mathematical Statistics
(Elective)

Learning Objectives: The objective of this course is to make the students to:

- i Solve problems related to conditional,
- ii Baye'stheorem and joint probability.
- iii Learn about Poission, Exponential and Normal to compute probabilities.
- iv Apply the concept of sampling distribution of the means in general situations and how to use the Central Limit Theorem.
- v Learn about one tail and two tail tests and how to give conclusion about null or alternative hypotheses using the suitable test statistic.
- vi Apply the regression analysis to fit the curves.
- vii Learn classification and various random processes.

UNIT-I

Probability: Sample spaces and Events, Basic set theory, Definition of probability, Axioms of probability, Addition theorem, Multiplication theorem, conditional probability, Baye'sTheorem.
Random Variables: Introduction, Types of random variables, Continuous and Discrete Random variables, Probability distribution function, Probability density function, Joint distribution function, Joint density function, Conditional distribution and density functions, Independent random variables.

UNIT-II

Statistical Analysis: Mathematical Expectation, Variance, Skewness, Moments, Moment generating function, Characteristic function
Discrete Probability Distributions: Discrete Uniform distribution , Binomial distribution, Geometric distribution, Poisson distribution

UNIT-III

Continuous Probability Distributions: Continuous Uniform distribution, Normal distribution, Gamma distribution, Exponentional distribution, and Weibul distribution.
Theory of Estimation: Introduction, Properties of estimators, Neymanns factorization theorem, Methods of Estimation, Maximum likelihood estimation.
Test of Statistical hypothesis(Large sample tests): Introduction, Statistical hypothesis, Procedure of testing hypothesis, Type I and Type II errors, Two tailed and one tailed tests of hypothesis, Large sample tests.

UNIT-IV

Test of Statistical hypothesis (Small sample tests): Introduction, Students t -distribution. F-test for equality of population variances, Chi-square distribution, – Z-test, t-test, F-test, $\chi 2$test.

Regression and Correlation: Correlation analysis, Methods of studying correlation, Correlation of grouped data, Rank correlation, Regression analysis.

Learning Outcomes: After completion of this course, students will be able to

i Understand basic probability axioms and apply Baye's theorem related to engineering problems.
ii Identify the suitable distribution among poission, exponential, normal to compute probabilities.
iii Make use of the sampling distribution of the sample mean in general situations, using the Central Limit Theorem.
iv Decide the null or alternative hypotheses using the suitable test statistic.
v Apply the regression analysis to fit the curves.

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Text Books:

1. Sheldon M Ross, Introduction to Probability and Statistics for Engineers and Scientists, Elsevier Academic Press.
2. Richard A. Johnson, Miller and Freund's Probability and Statistics for Engineers, 7^{th} Edition, , PHI

References:

1. Ronald E Walpole, Reymond H Myers, Sharon L Myers, Keying Ye, Probability and Statistics for Engineers and Scientists, Pearson Education.
2. Kishore S Trivedi, Probability & Statistics with Reliability, Queing, and Computer Science Applications, Eastern Economy Edition.
3. Miller and Freund's Probability and Statistics for Engineers, 7 th Edition, Richard A. Johnson, PHI
4. S.C. Gupta and V.K. Kapoor, "Fundamentals of Mathematical Statistics", Ninth Revised Edition , Sultan Chand & Sons Educational Publishers, 2007.
5. Peter J Brockwell and Johan A Davis, "Time Series: Theory and Methods", Springer Science + Business Media, LLC,

PAPER MA 205: NUMERICAL METHODS

Learning Objectives:

i To apply the knowledge of Numerical Mathematics to solve problems arising in science, engineering and biology.
ii To formulate and model the real-world problems
iii To design, analyze and implement of numerical methods for solving various types of problems, (IVP and BVPs associated with ODEs and PDEs)
iv Create, select and apply appropriate numerical techniques with the understanding of their limitations pertaining to their applications.
v Identify the challenging problems which are difficult to deal with analytically and find their solutions accurately and efficiently.
vi To explore complex systems, physicists, engineers, financiers and mathematicians require computational methods since mathematical models are only rarely solvable algebraically. Numerical methods, based upon sound computational mathematics, are the basic algorithms underpinning computer predictions in modern systems science.

UNIT-I

Solving of algebraic and transcendental equations: Bisection Method, Regula Falsi Method, Iteration Method, Newton-Raphson. Interpolation: Newtons Forward Difference, Newtons

Backward Difference, Stirling, Bessel, Newton's Divided Difference, Lagrange's Method, Introduction to Spline Interpolation.

UNIT – II

Numerical Integration: Trepezoidal, Simpson's 1/3 and 3/8, Romberg

Eigen Values and Eigen Vectors – Solving system of equations by , Jacobi's Iterative Technique and Gauss- Seidal Iterative Technique, The eigenvalue problem – The power method – Jacobi's method – Eigen values of symmetric matrices.

UNIT - III

Solution of Differential equations – Taylor's series method, Euler's method –Modified Euler's method,– – Runge-Kutta Methods, Predictor-corrector methods – Solving systems of differential equations

UNIT - IV

Finite Difference methods for two point Boundary value problems, Partial Differential equations – Hyperbolic equations – Parabolic equations – Elliptic equations .

Course Outcomes:

i Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems

ii Apply numerical methods to obtain approximate solutions to mathematical problems.

iii Derive numerical methods for various mathematical operations and tasks, such as interpolation, integration, the solution of linear and nonlinear equations, and the solution of differential equations and partial differential equations

iv Analyse and evaluate the accuracy of common numerical methods.

Text Book

1. Numerical Methods For Scientific and Engineering Computation, MK Jai, SRK Iyyangar and RK Jain, New Age International (P) Ltd Publishers, 7th Edition, 2019

References

1. Numerical Methods For Mathematics, Science And Engineering, by John H. Mathews(Second edition), Prentice Hall of India Pvt. Ltd. New Delhi, 1994.
2. Introductory Methods of Numerical Analysis, S.S. SASTRY, PHI, Fifth Edition.
3. Numerical Methods for Science and Engineering, Stanton, Ralph G, Prentice-Hall; 2nd edition
4. Numerical Mathematical Analysis, Scarborough J B,Oxford University Press.
5. Stoer, J. and Bulirsch, R., Introduction to Numerical Analysis, Texts in Applied Mathematics, Springer, 2002.