With effect from: 2025-26 (R-25)

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)

Accredited by NAAC with A++ Grade

9-5-81, Ibrahimbagh, Hyderbad-500031, Telangana State

DEPARTMENT OF MATHEMATICS

MATRICES & CALCULUS

For B.E., I- Sem., (CBCS)

(Common to Civil, EEE, ECE and Mechanical Branches)

Instruction: 3 +1 Hours per week	**Sem. End Exam Marks:**60	**Subject Reference Code: U25BS110MA**
Credits: 3	**Sessional Marks:**40	**Duration of Semester End Exam:** 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to:	*At the end of the course students should be able to:*
1. ***Study*** the concepts of rank of a matrix, System of linear equations and LU-Decomposition method.	1. ***Compute*** the rank of a given matrix and solution of a system by LU-Decomposition method.
2. ***Learn*** the concepts of eigen values, eigen vectors and diagonalization.	2. ***Find*** the characteristic equation, eigen values, and eigen vectors and to diagonalize a square matrix using similarity transformation.
3. ***Develop*** a deep understanding of the concepts and applications of Taylor's series, Maclaurin's series, curvature, radius of curvature, centre of curvature, and evolutes.	3. ***Apply*** the concepts of Taylor's series and Maclaurin's series to approximate functions and to find the curvature, radius, centre of curvature and evolutes of curves.
4. ***Learn*** the techniques for finding partial derivatives of functions of several variables, Taylor's series for functions of two variables and methods for finding maxima and minima of functions of several variables.	4. ***Calculate*** partial derivatives of functions of several variables and apply Taylor's series for functions of two variables, analyze functions to find maxima and minima.
5. ***Understand*** the fundamental concepts of infinite series and various tests for convergence.	5. ***Identify*** an appropriate test and determine nature of a series.

UNIT- I (08 classes)

MATRICES-I

Rank of a Matrix- Echelon form - Linearly Dependence and Independence of Vectors – Consistency and Inconsistency of Homogeneous and Non-Homogenous system of linear equations.

UNIT –II (08 classes)

MATRICES-II

Characteristic equation- Cayley - Hamilton Theorem (without proof) -Eigen values and Eigen vectors - Diagonalization using Orthogonal Transformation-Quadratic form- Reduction of Quadratic form to Canonical form.

UNIT – III (08 classes)

DIFFERENTIAL CALCULUS

Taylor's Series – Maclaurin's Series - Curvature - Radius of Curvature – Centre of Curvature – Evolutes (Cartesian and Parametric forms of the curves).

UNIT – IV (08 classes)

MULTIVARIBLE CALCULUS

Limits- Continuity (Concepts) - Partial Derivatives - Higher Order Partial Derivatives - Total Derivates - Derivatives of Composite and implicit functions - Taylor's series of functions of two variables - Maxima and Minima of functions of two variables - Lagrange's Method of multipliers.

UNIT-V (08 classes)

INFINITE SERIES

Introduction to Infinite Series - Nature of the Series – Series of positive terms - Geometric series- p-series test - Comparison tests – Limit form of comparison test - D'Alembert's Ratio Test – Cauchy's n^{th} root test - Alternating Series – Leibnitz test – Absolute Convergence.

Text Books:

1. Advanced Engineering Mathematics, Third Edition, R. K. Jain and S. R. K. Iyengar, Narosa Publishing House.
2. Higher Engineering Mathematics, B. S. Grewal 40th Edition, Khanna Publishers.

Reference Books:

1. Advanced Engineering Mathematics 8th Edition by Erwin Kreyszig, John Wiley & Sons.
2. Differential Calculus by Shanti Narayan, S. Chand & Co
3. Vector Calculus – Schaum's outline series.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc24_ma03/preview
2. https://onlinecourses.nptel.ac.in/noc24_ma31/preview
3. https://onlinecourses.swayam2.ac.in/cec24_ma10/preview

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	: 2	Max. Marks for each Internal Tests	:	30
2	No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5
4	Duration of Internal Tests	: 90 Minutes			

Prof.N.Kishan (OU Nominee)

Prof.M.A.Srinivas (Subject Expert-JNTUH)

Dr.J Raghu Mohan (Subject Expert-BITS, Hyd)

Dr.B.Srivathsa (Industry Expert)

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DEPARTMENT OF MATHEMATICS

CALCULUS & LINEAR ALGEBRA

For B.E., I- Sem., (CBCS)

(Common to CSE, AIML & IT Branches)

Instruction: 3 +1 Hours per week	**Sem. End Exam Marks**: 60	**Subject Reference Code: U25BS120MA**
Credits: 3	**Sessional Marks**: 40	**Duration of Semester End Exam**: 3 Hours

COURSE OBJECTIVES	**COURSE OUTCOMES**
The course will enable the students to:	***At the end of the course students should be able to:***
1. ***Develop*** a deep understanding of the concepts of Improper integrals Beta, Gamma functions and their properties. **2.** ***Learn*** the concepts of limits, continuity, partial derivatives of functions of several variables and derivative of composite functions, Taylor's series for functions of two variables, and maxima and minima of functions of several variables. **3.** ***Study*** the fundamental concepts of vector spaces, vector subspaces, linear dependence and independence of vectors, span, basis of a vector space, dimension of a vector space, and coordinates. **4.** ***Understand*** the fundamental concepts of Linear transformation and their properties. **5.** ***Understand*** of linear algebra concepts, including the rank of a matrix, characteristic equation, eigen values and eigenvectors, Diagonalization using Similarity Transformation.	**1.** ***Evaluate*** Improper integrals using Beta, Gamma functions. **2.** ***Find*** partial derivatives of functions of several variables and apply Taylor's series for functions of two variables and to find maxima and minima of a function of several variables. **3.** ***Analyze*** vector spaces and their subspaces, determine linear dependence and independence of vectors, determine basis of a vector space and compute the dimension of a vector space. **4.** ***Determine*** Linear transformations, their Null space and Range Space, calculating the dimension of these spaces, understanding the Rank and Nullity of a linear transformation, and representing a Linear transformation using a matrix. **5.** ***Find*** the rank of a matrix, eigen values and eigen vectors and to Diagonalize a matrix using similarity transformation to real-world problems.

UNIT- I (08 classes)

SPECIAL FUNCTIONS

Definition of Improper Integrals- Beta function - Gamma function - Relations between Beta & Gamma function - Properties of Beta and Gamma functions.

UNIT –II (08 classes)

MULTIVARIABLE CALCULUS

Limits- Continuity (Concepts) - Partial Derivatives - Higher Order Partial Derivatives - Total Derivatives - Derivatives of Composite and implicit functions - Taylor's series of functions of two variables - Maxima and Minima of functions of two variables - Lagrange's Method of multipliers.

UNIT-III: (08 classes)

VECTOR SPACES

Definition of Vector Space - Vector Subspaces – Linear Dependence and Independence of vectors - Span of a set of vectors - Basis of Vector Space – Dimension of a Vector Space – Co-ordinates.

UNIT-IV (08 classes)

LINEAR TRANSFORMATIONS

Introduction to Linear Transformations- The null space and range of a linear map – Dimension of Null space and Range space - Rank - Nullity theorem (without proof)-Matrix of a Linear Transformation.

UNIT-V (08 classes)

MATRICES

Rank of a Matrix - Characteristic equation - Eigen values and Eigenvectors – Diagonalization using Orthogonal Transformation - Quadratic form - Reduction of Quadratic form to Canonical form.

Text Books:

1. Advanced Engineering Mathematics, Third Edition, R. K. Jain and S. R. K. Iyengar. Narosa Publishing House.
2. Higher Engineering Mathematics, B. S. Grewal 40th Edition, Khanna Publishers.
3. Introduction to Linear algebra with applications, Jim DeFranza, Daniel Gagliardi. Tata McGraw-Hill

Reference Books:

1. Advanced Engineering Mathematics 8th Edition by Erwin Kreyszig, John Wiley & Sons.
2. Differential Calculus by Shanti Narayan, S. Chand & Co
3. Elementary Linear algebra, Anton and Rorres, Wiley India Edition
4. An introduction to Linear Algebra, V.P Mainra, J.L Arora, Affiliated to East-West Press Pvt Ltd

Online Resources:

1. https://onlinecourses.swayam2.ac.in/cec24_ma10/preview
2. https://onlinecourses.nptel.ac.in/noc24_ma31/preview

The break-up of CIE: Internal Tests + Assignments + Quizzes

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3	No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5
4	Duration of Internal Tests	:	90 Minutes			

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DEPARTMENT OF MATHEMATICS

DIFFERENTIAL EQUATIONS & VECTOR CALCULUS

For B.E., II- Sem., (CBCS)

(Common to Civil, EEE, ECE, Mechanical Branches)

Instruction:3+1 Hours per week	**Semester End Exam Marks:60**	**Subject Reference Code: U25BS210MA**
Credits: 3	**Sessional Marks: 40**	**Duration of Semester End Exam: 3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to :	*At the end of the course students should be able to:*
1. ***Understand*** the fundamental concepts and solution of first-order Differential Equations, as well as their applications in modeling real-world phenomena.	1. ***Solve*** various types of first-order Differential Equations, model and analyze physical systems such as LR circuit and find orthogonal trajectories of Cartesian curves.
2. ***Develop*** the ability to solve homogeneous and non-homogeneous Linear differential equations with constant coefficients, and their applications to LCR circuits.	2. ***Solve*** homogeneous and non-homogeneous Linear differential equations with constant coefficients, including those arising in LCR circuits.
3. ***Study*** the concepts of vector differentiation, Directional derivative, Divergence and Curl of a vector point function.	3. ***Find*** the gradient of a scalar point function, divergence and curl of vector field and its applications.
4. ***Learn*** the concepts of evaluation of double integrals and changing the order of integration.	4. ***Evaluate*** the double integrals and also evaluate the double integrals by changing the order of integration and by change of variables.
5. ***Understand*** the concepts Improper integrals Beta, Gamma functions and their properties.	5. ***Evaluate*** Improper integrals using Beta, Gamma functions.

UNIT – I (08 classes)

ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER

Exact differential equations - Integrating factors - Clairaut's equation - Applications: Orthogonal trajectories (Cartesian families) - LR Circuit.

UNIT – II (08 classes)

HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS

Solutions of Homogeneous and Non-Homogeneous linear equations of the form $f(D)y = r(x)$ with constant coefficients [Where $r(x) = e^{ax}$, $\sin(ax + b)$(or) $\cos(ax + b)$, x^k, $e^{ax}V(x)$] - Method of Variation of Parameters- LCR circuits.

UNIT – III (08 classes)

VECTOR CALCULUS

Scalar and Vector point function and their derivatives - Level Surface - Gradient of a scalar point function - Normal to a level surface - Directional Derivative – Divergence and Curl of a Vector Field – Solenoidal and Irrotational vectors - Conservative vector field.

UNIT – IV (08 classes)

DOUBLE INTEGRALS

Double integrals (Cartesian) - Change of order of integration (Cartesian Coordinates) - Change of the Variables (Cartesian to Polar Coordinates in two dimensions).

UNIT – V (08 classes)

SPECIAL FUNCTIONS

Definition of Improper Integrals- Beta function - Gamma function - Relations between Beta & Gamma function - Properties of Beta and Gamma functions.

Text Books:

1. Advanced Engineering Mathematics 3rd Edition, R.K.Jain & S.R.K.Iyengar, Narosa Publishing House.
2. Higher Engineering Mathematics 40thEdition Dr. B.S Grewal, Khanna Publishers.
3. A Text book of Engineering Mathematics, N.P. Bali& Manish Goyal, Laxmi Publications.

Reference Books:

1. Advanced Engineering Mathematics, by Wylie & Barrett, Tata Mc Graw Hill, New Delhi.
2. Advanced Engineering Mathematics, 8th Edition by Erwin Kreyszig, John Wiley & Sons, Inc.
3. Complex Variables and applications, J.W.Brown and R.V.Churchill, 7th Edition, Tata Mc Graw Hill,2004.

Online Resources:

1. https://onlinecourses.swayam2.ac.in/cec24_ma09/preview
2. https://onlinecourses.nptel.ac.in/noc24_ma03/preview

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DEPARTMENT OF MATHEMATICS

ADVANCED CALCULUS

For B.E., II- Sem., (CBCS)

(Common to CSE, CSE-AIML & IT Branches)

Instruction:3+1 Hours per week	**Semester End Exam Marks:**60	**Subject Reference Code: U25BS220MA**
Credits: 3	**Sessional Marks:** 40	**Duration of Semester End Exam:** 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to :	*At the end of the course students should be able to:*
1. ***Understand*** the fundamental concepts and solution of first-order Differential Equations, as well as their applications in modeling real-world phenomena.	1. ***Solve*** various types of first-order Differential Equations, model and analyze physical systems such as LR circuit and find orthogonal trajectories of Cartesian curves.
2. ***Develop*** the ability to solve homogeneous and non-homogeneous Linear differential equations with constant coefficients, and their applications to LCR circuits.	2. ***Solve*** homogeneous and non-homogeneous Linear differential equations with constant coefficients, including those arising in LCR circuits.
3. ***Learn*** the concepts of evaluation of double integrals and changing the order of integration.	3. ***Evaluate*** the double integrals and also evaluate the double integrals by changing the order of integration and by change of variables.
4. ***Study*** the concepts of vector differentiation, Directional derivative, Divergence and Curl of a vector point function.	4. ***Find*** the gradient of a scalar point function, divergence and curl of vector field and its applications.
5. ***Understand*** the fundamental concepts of infinite series and various tests for convergence.	5. **Identify** an appropriate test and determine nature of a series.

UNIT – I (08 classes)

ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER

Exact differential equations - Integrating factors- Clairaut's equation - Applications of First Order Differential Equations - Orthogonal trajectories (Cartesian families) – LR Circuit.

UNIT – II (08 classes)

HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS

Solutions of Homogeneous and Non-Homogeneous linear equations of the form $f(D)y = r(x)$ with constant coefficients [Where $r(x) = e^{ax}$, $\sin(ax + b)$(or) $\cos(ax + b)$, x^k, $e^{ax}V(x)$] - Method of Variation of Parameters – Applications of Linear Differential Equations to LCR circuits.

UNIT – III (08classes)

DOUBLE INTEGRALS

Double integrals (Cartesian) - Change of order of integration (Cartesian Coordinates) - Change of the Variables (Cartesian to polar Coordinates in two dimensions).

UNIT – IV (08 classes)

DIFFERENTIAL CALCULUS

Scalar and Vector point functions - Vector Differentiation - Level Surfaces - Gradient of a scalar point function - Normal to a level surface - Directional Derivative – Divergence and Curl of a Vector Field - Solenoidal and Irrotational vectors- Conservative vector field .

UNIT – V (08 classes)

INFINITE SERIES

Introduction to Infinite Series – Nature of the Series- Series of positive terms-Geometric series- p-series test - Comparison tests – Limit form of comparison test- D'Alembert's Ratio Test – Cauchy's n^{th} root test - Alternating Series – Leibnitz test-Absolute Convergence.

Text Books:

1. Advanced Engineering Mathematics 3rd Edition, R.K. Jain & S.R.K.Iyengar. Narosa Publishing House.
2. Higher Engineering Mathematics 40thEdition Dr. B.S Grewal, Khanna Publishers.
3. A Text book of Engineering Mathematics, N.P. Bali& Manish Goyal, Laxmi Publications.

Reference Books:

1. Advanced Engineering Mathematics, by Wylie & Barrett, Tata Mc Graw Hill, New Delhi.
2. Advanced Engineering Mathematics, 8th Edition by Erwin Kreyszig, John Wiley & Sons, Inc.

Online Resources:

1. https://onlinecourses.swayam2.ac.in/cec24_ma09/preview
2. https://onlinecourses.nptel.ac.in/noc24_ma03/preview

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	:	2	Max. Marks for each Internal Tests	:	30
2	No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5
4	Duration of Internal Tests	:	90 Minutes			

Prof.N.Kishan (OU Nominee)

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DEPARTMENT OF MATHEMATICS

TRANSFORM TECHNIQUES & PARTIAL DIFFERENTIAL EQUATIONS

For B.E., III- Sem., (CBCS)

(Common to Civil, EEE & Mechanical Branches only)

Instruction :3 +1Hours per week	Semester End Exam Marks: 60	Subject Reference Code: U24BS310MA
Credits: 3	Sessional Marks: 40	Duration of Semester End Exam: 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to :	*At the end of the course students should be able to:*
1. ***Understand*** the definition and properties of the Laplace transforms.	1. ***Evaluate*** Laplace transform of functions and apply Laplace transforms to evaluate integrals.
2. ***Understand*** the definition and properties of the inverse Laplace transforms and its applications to Initial Value Problems.	2. ***Find*** Inverse Laplace transforms of functions and apply the Laplace transform to solve linear differential equations.
3. ***Study*** the concept of Fourier series and its applications.	3. ***Compute*** Fourier coefficients and find Fourier series of a function.
4. ***Learn*** the formation Partial Differential Equations and solution of linear and non-linear first order partial differential equations.	4. ***Formulate*** the Partial differential equations and solve the linear and non-linear first order Partial differential equations.
5. ***Study*** the applications of Partial Differential equations.	5. ***Solve*** the one-dimensional wave equation, one-dimensional heat equation.

UNIT-I (8 Hours)

LAPLACE TRANSFORMS:

Introduction to Laplace transforms - Existence of Laplace Transform - Properties of Laplace Transform - First shifting theorem - Second shifting theorem - Change of scale property - Differentiation of Laplace transform - Integration of Laplace Transform - Laplace Transform of Derivatives - Laplace Transform of Integrals.

UNIT-II (9 Hours)

INVERSE LAPLACE TRANSFORMS:

Introduction to Inverse Laplace transforms - Properties of Inverse Laplace Transform-First shifting theorem - Second Shifting theorem -Change of scale theorem - Multiplication with s - Division by s

–Convolution Theorem (without proof)- Applications- Solving Linear Ordinary Differential Equations with constant coefficients upto 2nd order.

UNIT –III (8 Hours)

FOURIER SERIES:

Introduction to Fourier series – Conditions for existence of Fourier expansion – Functions having points of discontinuity – Change of Interval - Fourier series expansions of even and odd functions- Half-Range Sine and Cosine series.

UNIT –IV (8 Hours)

PARTIAL DIFFERENTIAL EQUATIONS:

Formation of first and second order Partial Differential Equations - Solution of First Order Equations – Linear Equation - Lagrange's Equation - Non-linear first order equations – Standard Forms.

UNIT-V (7 Hours)

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS:

Method of Separation of Variables - One Dimensional Wave Equation- One Dimensional Heat Equation (Homogeneous condition).

Text Books:

1. Advanced Engineering Mathematics, Third Edition, R. K. Jain and S. R. K. Iyengar, Narosa Publishing House.
2. Higher Engineering Mathematics, Dr.B.S.Grewal 40th Edition, Khanna Publishers.

Reference Books:

1. Advanced Engineering Mathematics, Kreyszig E, 8th Edition, John Wiley & Sons Ltd. 2006.
2. A text book of Engineering Mathematics by N.P. Bali & Manish Goyal, Laxmi Publication.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc24_ma17/preview
2. https://onlinecourses.nptel.ac.in/noc24_ma37/preview

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	:	2	Max. Marks for each Internal Tests	:	30
2	No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5
4	Duration of Internal Tests	:	90 Minutes			

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DEPARTMENT OF MATHEMATICS

PDE & NUMERICAL METHODS

For B.E., III- Sem., (CBCS)

(For ECE Branch only)

Instruction :3 +1 Hours per week	Semester End Exam Marks: 60	Subject Reference Code: U24BS320MA
Credits: 3	Sessional Marks: 40	Duration of Semester End Exam: 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to :	*At the end of the course students should be able to:*
1. Learn the formation of Partial Differential Equations and solution of linear and non-linear first order partial differential equations.	1. Formulate the Partial differential equations and solve the linear and non-linear first order Partial differential equations.
2. Study the applications of Partial Differential equations.	2. Solve the one-dimensional wave equation, one-dimensional heat equation.
3. Understand the concepts of interpolation and to learn various methods for interpolating data points and approximating functions.	3. Apply Numerical methods to interpolate data points with equal and unequal intervals.
4. Learn numerical techniques for solving first-order ordinary differential equations.	4. Use Numerical techniques to solve first-order ordinary differential equations.
5. Understand the principles of curve fitting using the method of least squares and the concept of correlation.	5. Apply the Method of least squares to fit various curves to the given data and Calculate Karl Pearson's coefficient of correlation.

UNIT –I (08 Hours)

PARTIAL DIFFERENTIAL EQUATIONS:

Formation of first and second order Partial Differential Equations - Solution of First Order Equations – Linear Equation - Lagrange's Equation- Non-linear first order equations -Standard Forms.

UNIT-II (08 Hours)

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS:

Method of Separation of Variables - One Dimensional Wave Equation- One Dimensional Heat Equation (Homogeneous)

UNIT-III (08 Hours)
INTERPOLATION:
Finite Differences- Interpolation- Newton's Forward and Backward Interpolation Formulae Interpolation with unequal intervals – Lagrange's Interpolation Formula – Divided differences- Newton's Divided difference formula.

UNIT –IV (08 Hours)
NUMERICAL SOLUTIONS OF ODE:
Numerical Solutions of Ordinary Differential Equations of first order - Taylor's Series Method - Euler's Method -Modified Euler's Method -Runge-Kutta of 4th order (without proofs).

UNIT-V (08 Hours)
CURVE FITTING:
Curve fitting by the Method of Least Squares - Fitting of Straight Line - Second order curve (Parabola) - Exponential curve ($y = ab^x$) - Correlation – Karl Pearson's Co-efficient of Correlation.

Text Books:
1. Advanced Engineering Mathematics, Third Edition, R. K. Jain and S. R. K. Iyengar, Narosa Publishing House.
2. Higher Engineering Mathematics, Dr.B.S.Grewal, 40th Edition, Khanna Publishers.

Reference Books:
1. Advanced Engineering Mathematics, Kreyszig E, 8th Edition, John Wiley & Sons Ltd, 2006.
2. A text book of Engineering Mathematics by N.P. Bali& Manish Goyal, Laxmi Publication.

Online Resources:
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2. https://onlinecourses.swayam2.ac.in/cec24_ma19/preview

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	: 2	Max. Marks for each Internal Tests	:	30
2	No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5
4	Duration of Internal Tests	: 90 Minutes			

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DEPARTMENT OF MATHEMATICS

DISCRETE MATHEMATICS

For B.E., III- Sem., (CBCS)

(For IT Branch only)

Instruction :3+1 Hours per week	Semester End Exam Marks: 60	Subject Reference Code: U24BS330MA
Credits: 3	Sessional Marks: 40	Duration of Semester End Exam: 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to :	*At the end of the course students should be able to:*
1. ***Understand*** the Propositions and their equivalences, predicates and quantifiers and learn various proof strategies.	1. ***Use*** the logical notation to define and reason about fundamental mathematical concepts and synthesize induction hypothesis and simple Induction proofs.
2. ***Learn*** the basics of counting, combinatorics and various methods of solving Recurrence relations.	2. ***Apply*** the basic principles of counting to solve combinatorial problems and solve recurrence relations, both linear homogeneous and non-homogeneous, using various techniques.
3. ***Study*** the concept of relations, including their properties and representations, equivalence relations, Posets, Hasse diagrams, maximal and minimal elements	3. ***Identify*** various types of relations, represent relations using matrices and graphs, construct Hasse diagrams for Posets, determine maximal and minimal elements in a Poset.
4. ***Understand*** the fundamentals of graph theory, graph isomorphism, and connectivity.	4. ***Apply*** graph terminology to describe the structure of graphs and determine graph isomorphism.
5. ***Understand*** the advanced topics in graph theory, graph colouring, and applications of graph colouring.	5. ***Determine*** the existence of Eulerian and Hamiltonian paths, and the chromatic number of a graph using various techniques of graph colouring.

UNIT – I (8 Hours)

LOGIC: Logic- Logical connectives- Propositional equivalences– Predicates and quantifiers.

MATHEMATICAL REASONING, INDUCTION:

Proof Strategy- Methods of Proofs- Mathematical Induction.

UNIT – II (10 Hours)

COUNTING:

Basics of counting- Pigeonhole principle –Permutations & Combinations- Pascal's Identity- Vandermonde's Identity.

ADVANCED COUNTING TECHNIQUES:
Recurrence relations: Solving Recurrence Relations- Linear Homogeneous and Non-Homogeneous Recurrence relations.

UNIT – III (8 Hours)
RELATIONS:
Relations – Properties -Representing relations - Equivalence Relations - Partial Orderings- Poset-Hasse diagrams – Maximal & Minimal Elements.

UNIT –IV (8 Hours)
GRAPH THEORY-I:
Introduction - Graph Terminology - Types of graphs - Basic theorems - Representing Graphs and Graph Isomorphism – Connectivity.

UNIT –V (8 Hours)
GRAPH THEORY-II:
Euler and Hamiltonian paths – Shortest path problems - Dijkstra's algorithm - Planar graphs-Euler's Formula.

Text Books:

1. Kenneth H. Rosen – Discrete Mathematics and its application – 5th edition, Mc Graw – Hill, 2003.
2. Joel. Mott. Abraham Kandel, T.P. Baker, Discrete Mathematics for Computer Scientist &Mathematicians, Prentiee Hail N.J., 2nd edn, 1986.

Reference Books:

1. Discrete and Combinatorial Mathematics by Ralph P. Grimaldi, Pearson International
2. J.P.Trembly, R.Manohar, Discrete Mathematical Structure with Application to Computer Science, Mc Graw- Hill – 1997.
3. R.K. Bisht, H.S.Dhami - Discrete Mathematics, Oxford University Press, 2015.

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc24_cs58/preview
2. https://onlinecourses.swayam2.ac.in/cec24_ma18/preview

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	: 2	Max. Marks for each Internal Tests	:	30
2	No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5
4	Duration of Internal Tests	: 90 Minutes			

Prof.N.Kishan
(OU Nominee)

Prof.M.A.Srinivas
(Subject Expert-JNTUH)

Dr.J Jagan Mohan
(Subject Expert-BITS, Hyd)

Dr.B.Srivathsa
(Industry Expert)

Dr.T. Sudhakar Rao
(Chairman, BOS)

With effect from: 2025-26 (R-24)

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)

Accredited by NAAC with A++ Grade

9-5-81, Ibrahimbagh, Hyderbad-500031

DEPARTMENT OF MATHEMATICS

TRANSFORM TECHNIQUES, PROBABILITY & STATISTICS

For B.E., III- Sem., (CBCS)

(For CSE Branch only)

Instruction:3+1 Hours per week	**Semester End Exam Marks:**60	**Subject Reference Code: U24BS340MA**
Credits: 3	**Sessional Marks:** 40	**Duration of Semester End Exam:** 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to :	*At the end of the course students should be able to:*
1. ***Study*** the conditions for expansion of function as a Fourier series and expansion of a function as a Fourier series.	1. ***Expand*** a function as a Fourier series in an interval and also expressing even and odd functions as a Fourier series.
2. ***Understand*** the concept of Fourier and inverse Fourier Transform, Fourier Sine and Cosine transform of a function and various properties.	2. ***Determine*** Fourier transform, Fourier sine and cosine transform and inverse Fourier, Sine and Cosine transform of a function.
3. ***Learn*** the properties of Discrete and Continuous Random variables and Normal Distribution.	3. ***Differentiate*** between discrete and continuous random variables and solve the problems on Normal Distribution.
4. ***Analyze*** standard statistical tests employed for small samples	4. **Formulate** Null and Alternative Hypotheses and apply the tests of hypothesis for small samples.
5. ***Understand*** the Method of least squares for fitting of a straight line and second order curves to a given data and also about Correlation between variables.	5. ***Apply*** the Method of least squares for fitting of straight line and second order curves to the given data and also to find co-efficient of correlation and their application problems.

UNIT –I (8 Hours)

FOURIER SERIES

Introduction to Fourier series – Conditions for existence of Fourier expansion – Functions having points of discontinuity – Change of Interval - Fourier series expansions of even and odd functions

UNIT-II (8 Hours)

FOURIER TRANSFORMS

Fourier Transform – Inverse Fourier Transform - Properties of Fourier Transform - Fourier Cosine & Sine Transforms.

UNIT-III (8 Hours)

PROBABILITY DISTRIBUTIONS

Random Variables - Discrete and Continuous Random variables - Mass and density functions- Cumulative distribution function – Definitions of Mean, Median, Mode and Variance of Probability distributions - Continuous Distribution – Normal Distribution – Properties.

UNIT-IV (8 Hours)

TESTS OF HYPOTHESIS

Introduction -Testing of Hypothesis- Null and Alternative Hypothesis -Errors- -Level of Significance-Confidence Intervals -Tests of Significance for small samples - t-test for single mean - F- test for comparison of variances - Chi-square test for goodness of fit.

UNIT-V (8 Hours)

CURVE FITTING

The Method of Least Squares - Fitting of Straight line- Second order curve (Parabola)-Exponential curve- Correlation – Karl Pearson's Co-efficient of Correlation

Text Books:

1. R.K. Jain & S.R.K. Iyengar, Advanced Engineering Mathematics, Third Edition, Narosa Publications, 2007.
2. Higher Engineering Mathematics, Dr.B.S Grewal 40th Edition, Khanna Publishers.

Reference Books:

1. Advanced Engineering Mathematics, Kreyszig E, 8 th Edition, John Wiley & Sons Ltd, 2006.
2. A text book of Engineering Mathematics by N.P.Bali & Manish Goyal, Laxmi Publication.
3. Fundamentals of Mathematical Statistics, Gupta & Kapoor, Sultan chand & sons, New Delhi.

Online resources:

1. https://nptel.ac.in/courses/111106046
2. https://nptel.ac.in/courses/111104519
3. https://ocw.mit.edu/courses/18-440-probability-and-random-variables-spring-2014/

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	: 2	Max. Marks for each Internal Tests	:	30
2	No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5
4	Duration of Internal Tests	: 90 Minutes			

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(OU Nominee)	**(Subject Expert-JNTUH)**	**(Subject Expert-BITS, Hyd)**	**(Industry Expert)**

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DEPARTMENT OF MATHEMATICS

PROBABILITY DISTRIBUTIONS AND INFERENCE THEORY

For B.E., III- Sem., (CBCS)

(For AIML Branch only)

Instruction:3+1 Hours per week	Semester End Exam Marks:60	Subject Reference Code: U24BS350MA
Credits: 3	Sessional Marks: 40	Duration of Semester End Exam: 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to :	*At the end of the course students should be able to:*
1. ***Study*** the fundamental concepts of probability theory.	1. ***Define*** probability and compute probabilities of events and apply Bayes' Theorem to update probabilities based on new information.
2. ***Understand*** random variables and its probability distributions.	2. ***Differentiate*** between discrete and continuous random variables and its distributions.
3. ***Learn*** various probability distributions and their related applications.	3. ***Apply*** various theoretical probability distributions to solve related problems in various applications.
4. ***Study*** the concept of hypothesis testing employed for large samples.	4. ***Formulate*** Null and Alternative Hypotheses and apply the tests of hypothesis for large samples.
5. ***Study*** the various methods of testing small samples.	5. ***Apply*** various methods for Tests of Significance for small samples.

UNIT –I (08 Hours)

PROBABILITY

Basic terminology- Definition of Probability – Addition Law of probability- Independent events- Conditional Probability- Multiplication law of probability - Baye's Theorem- related problems.

UNIT –II (08 Hours)

RANDOM VARIABLES AND DISTRIBUTIONS

Random Variables - Discrete and Continuous Random Variables – Mass and density functions Distribution functions - Definitions of Mean, Median, Mode and Variance of Probability distributions.

UNIT-III (08 Hours)

THEORETICAL DISTRIBUTIONS

Binomial & Poisson distributions & Normal Distribution- Properties-related problems

UNIT-IV (08 Hours)

TESTS OF HYPOTHESIS FOR LARGE SAMPLES

Introduction -Testing of Hypothesis- Null and Alternative Hypothesis -Errors- -Level of Significance –Confidence Intervals - One and two tailed tests - Tests of Significance for large samples – Tests for single mean- Difference of means.

UNIT -V (08 Hours)

TESTS OF HYPOTHESIS FOR SMALL SAMPLES

Tests of Significance for small samples - t-test for single mean and difference of means - F- test for comparison of variances - Chi-square test for goodness of fit.

Text Books:

1. Advanced Engineering Mathematics, Third Edition, R. K. Jain and S. R. K. Iyengar, Narosa Publishing House.
2. Higher Engineering Mathematics, Dr.B.S. S Grewal 40th Edition, Khanna Publishers.
3. Probability & Statistics and Random Process, Third edition, T Veerarajan, Tata McGraw-Hill publishing limited.

Reference Books:

1. Miller & Freund's Probability And Statistics For Engineers, Ninth Edition, Richard A. Johnson, Pearson publishers.
2. A text book of Engineering Mathematics by N.P. Bali & Manish Goyal, Laxmi Publication.
3. Fundamentals of Mathematical Statistics, Gupta & Kapoor, Sultan chand & sons, New Delhi.
4. Probability & Statistics for Engineers, Antony J. Hayter, CENGAGE Learning.

Online Resources:

https://onlinecourses.nptel.ac.in/noc24_ma39/preview

The break-up of CIE: Internal Tests + Assignments + Quizzes

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3	No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5
4	Duration of Internal Tests	:	90 Minutes			

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DEPARTMENT OF MATHEMATICS

NUMERICAL METHODS, PROBABILITY & STATISTICS
For B.E., IV- Sem., (CBCS)
(Common to Civil, EEE & Mechanical Branches)

Instruction:3+1 Hours per week	Semester End Exam Marks:60	Subject Reference Code: 124BS410MA
Credits: 3	Sessional Marks: 40	Duration of Semester End Exam: 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to :	*At the end of the course students should be able to:*
1. ***Understand*** the concepts of interpolation and to learn various methods for interpolating data points and approximating functions.	1. ***Apply*** numerical methods to interpolate data points with equal and unequal intervals.
2. ***Learn*** Numerical techniques for solving first-order ordinary differential equations.	2. ***Use*** Numerical techniques to solve first-order ordinary differential equations.
3. ***Understand*** random variables and its probability distributions	3. ***Differentiate*** between discrete and continuous random variables and apply various probability distributions to solve practical problems
4. ***Study*** the concept of hypothesis testing employed for small samples.	4. ***Formulate*** Null and Alternative Hypotheses and apply the tests of hypothesis for small samples.
5. ***Understand*** the principles of curve fitting using the method of least squares and the concept of correlation.	5. ***Apply*** the method of least squares to fit various curves to the given data and Calculate Karl Pearson's coefficient of correlation.

UNIT –I (08 Hours)
INTERPOLATION
Finite Differences- Interpolation- Newton's Forward and Backward Interpolation Formulae Interpolation with unequal intervals – Lagrange's Interpolation Formula – Divided differences - Newton's Divided difference formula.

UNIT –II (08 Hours)
NUMERICAL SOLUTIONS OF ODE
Numerical Solutions of Ordinary Differential Equations of first order - Taylor's Series Method - Euler's Method – Modified Euler's Method - Runge-Kutta of 4^{th} order (without proofs)

UNIT-III (08 Hours)

PROBABILITY DISTRIBUTIONS

Random Variables - Discrete and Continuous Random Variables – Mass and density functions - Cumulative distribution functions - Definitions of Mean, Median, Mode and Variance of Probability distributions – Continuous Distributions - Normal Distribution – Properties.

UNIT-IV (10 Hours)

TEST OF HYPOTHESIS

Introduction -Testing of Hypothesis- Null and Alternative Hypothesis -Errors- -Level of Significance – Confidence Intervals-Tests of Significance for small samples - t-test for single mean - F- test for comparison of variances.

UNIT-V (08 Hours)

CURVE FITTING

Curve fitting by the Method of Least Squares - Fitting of Straight line-Second order curve (parabola)--Correlation – Karl Pearson's Co-efficient of Correlation.

Text Books:

1 Advanced Engineering Mathematics, Third Edition, R. K. Jain and S. R. K. Iyengar, Narosa Publishing House.

2 Higher Engineering Mathematics, Dr.B.S. S Grewal 40th Edition, Khanna Publishers.

3 Probability, Statistics and Random Processes, T. Veera Rajan, Tata McGraw Hill Education Private Ltd.

Reference Books:

1 Advanced Engineering Mathematics, Kreyszig E, 8th Edition, John Wiley & Sons Ltd, 2006.

2 A text book of Engineering Mathematics by N.P.Bali& Manish Goyal, Laxmi Publication.

3 Fundamentals of Mathematical Statistics, Gupta & Kapoor, Sultan chand& sons, New Delhi.

Online Resources:

1 https://onlinecourses.swayam2.ac.in/cec24_ma19/preview

2 https://onlinecourses.nptel.ac.in/noc24_ma39/preview

The break-up of CIE: Internal Tests + Assignments + Quizzes

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3	No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5
4	Duration of Internal Tests	: 90 Minutes			

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DEPARTMENT OF MATHEMATICS

PROBABILITY & STATISTICS

For B.E., IV- Sem., (CBCS)

(For IT Branch only)

Instruction : 3 +1 Hours per week	**Sem. End Exam Marks**: 60	**Subject Reference Code: U24BS420MA**
Credits: 3	**Sessional Marks**:40	**Duration of Semester End Exam** : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to :	*At the end of the course students should be able to:*
1. ***Study*** the fundamental concepts of probability theory.	1. ***Define*** probability and compute probabilities of events and apply Baye's Theorem to update probabilities based on new information.
2. ***Understand*** random variables and its probability distributions.	2. ***Differentiate*** between discrete and continuous random variables and its distributions.
3. ***Learn*** various probability distributions, and their related applications.	3. ***Apply*** various theoretical probability distributions to solve related problems in various applications.
4. ***Study*** the concept of hypothesis testing employed for large samples.	4. ***Formulate*** Null and Alternative Hypotheses and apply the tests of hypothesis for large samples.
5. ***Study*** the various methods of testing small samples.	5. ***Apply*** various methods for Tests of Significance for small samples.

UNIT –I (08 Hours)

PROBABILITY:

Basic terminology- Definition of Probability – Addition Law of probability- Independent events- Conditional Probability- Multiplication law of probability - Baye's Theorem.

UNIT –II (08 Hours)

RANDOM VARIABLES AND DISTRIBUTIONS:

Random Variables - Discrete and Continuous Random Variables – Mass and density functions - Cumulative distribution functions - Definitions of Mean, Median, Mode and Variance of Probability distributions.

UNIT-III (08 Hours)

THEORETICAL DISTRIBUTIONS: Binomial & Poisson distributions & Normal Distribution-Properties-related problems

UNIT-IV (08 Hours)

TESTS OF HYPOTHESIS FOR LARGE SAMPLES:

Introduction -Testing of Hypothesis- Null and Alternative Hypothesis -Errors- -Level of Significance –Confidence Intervals - One and two tailed tests - Tests of Significance for large samples – Tests for single mean- Difference of means.

UNIT - V (08 Hours)

TESTS OF HYPOTHESIS FOR SMALL SAMPLES:

Tests of Significance for small samples - t-test for single mean and difference of means – F- test for comparison of variances - Chi-square test for goodness of fit.

Text Books:

1 Advanced Engineering Mathematics, Third Edition, R. K. Jain and S. R. K. Iyengar, Narosa Publishing House.
2 Higher Engineering Mathematics, Dr.B.S. S Grewal 40th Edition, Khanna Publishers.
3 Probability & Statistics and Random Process, Third edition, T Veerarajan, Tata McGraw-Hill publishing limited.

Reference Books:

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2. A text book of Engineering Mathematics by N.P. Bali & Manish Goyal, Laxmi Publication.
3. Fundamentals of Mathematical Statistics, Gupta & Kapoor, Sultan chand & sons, New Delhi.
4. Probability & Statistics for Engineers, Antony J. Hayter, CENGAGE Learning.

Online Resources:

1 https://onlinecourses.nptel.ac.in/noc24_ma39/preview

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	: 2	Max. Marks for each Internal Tests	:	30
2	No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5
4	Duration of Internal Tests	: 90 Minutes			

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9-5-81, Ibrahimbagh, Hyderbad-500031

DEPARTMENT OF MATHEMATICS

NUMBER THEORY & BOOLEAN ALGEBRA

(OPEN ELECTIVE)

For B.E., III - Semester – CBCS

(Common to CSE, AIML & IT Branches)

Instruction :3 Hours per week	Semester End Exam Marks: 40	Subject Reference Code: U24OE320MA
Credits: 2	Sessional Marks: 60	Duration of Semester End Exam: 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to :	*At the end of the course students should be able to:*
1. ***Study*** Fundamental Theorem of Arithmetic and GCD using Euclidean Algorithm and also Linear Diophantine Equations and their solutions.	1. ***Calculate*** GCD using Euclidean algorithm and also solve Linear Diophantine Equations in order to implement in RSA encryption.
2. ***Understand*** the concepts of number theory such Congruences and proof of Chinese Remainder theorem.	2. ***Apply*** Chinese Remainder theorem for optimizing cryptographic processes, such as accelerating RSA decryption and the Pollard Rho method to assess and demonstrate the factorization of composite numbers used in cryptographic keys.
3. ***Identify*** Primitive roots for primes and their existence and also to outline the Euler's theorem and Lagrange's theorem.	3. ***Use*** Fermat's Theorem & Wilson's theorem to prove that RSA works accurately and also in discrete log cipher of Cryptography. Also primitive roots in the Diffie-Hellman key exchange protocol of Cryptography
4. ***Familiarize*** with properties of Boolean algebra and to understand Normal Forms.	4. ***Design*** secure hash functions, encryption schemes, and authentication protocols using Boolean functions which are the building blocks of symmetric cryptographic systems.

UNIT – I (6 Hours)

THEORY OF NUMBERS: The Integers and Division- Prime and Composite Numbers -Division Algorithm- Fundamental Theorem of Arithmetic(without proof) –GCD and their properties- Euclidean Algorithm- Linear Diophantine Equations and their solutions.

UNIT – II (8 Hours)

CONGRUENCES: Modular Arithmetic- Introduction to Congruences, Linear Congruence. Chinese Remainder Theorem - System of Linear Congruences in two variables- The Pollard Rho Factoring Method.

UNIT – III (5 Hours)

SOME SPECIAL CONGRUENCES: Fermat's Little Theorem- Wilsons Theorem and its converse Euler's phi-function - Euler's theorem -The order of an integer modulo n, Primitive roots for primes.

UNIT – IV (6 Hours)

BOOLEAN ALGEBRA: Axiomatic definition of Boolean Algebra, Basic theorems and Properties of Boolean Algebra, Boolean Functions, Minterms and Maxterms, Disjunctive normal form and conjunctive normal form.

Text Books:

1. K.H. Rosen: Elementary Number Theory & its Applications. Pearson Addition Wesley
2. Elementary Number Theory | 7th Edition by David Burton, Mc Graw Hill Education
3. Discrete mathematics for computer scientists and mathematicians / by Joe L. Mott. Abraham Kandel and Theodore P. Baker, Prentice Hall Of India Pvt.Ltd., 1986.Edition: 2nd edition, New Delhi.
4. Discrete Mathematics, R.K.Bisht and H.S.Dhami, Oxford Higher Education.

Reference Books:

1. N. Koblitz; A course in Number theory and Cryptography; Springer.
2. Neville Robinns, Beginning Number Theory (2nd Edition), Narosa Publishing House Pvt. Limited, Delhi, 2007.
3. Elementary Number Theory with Applications, Thomas Koshy, 2nd edition, Academic Press, An Imprint of Elsevier, USA, 2007.
4. Basic Number Theory by S.B. Malik,S. Chand publishers
5. Arnold B. H.: Logic and Boolean Algebra, Prentice Hall, 1962.

Online Resources:

1. https://www.classcentral.com/course/openlearn-science-maths-technology-introduction-number-theory-95553
2. https://www.open.edu/openlearn/science-maths-technology/introduction-number-theory/content-section-0?intro=1
3. https://ocw.mit.edu/courses/6-042j-mathematics-for-computer-science-fall-2010/resources/lecture-4-number-theory-i/

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DEPARTMENT OF MATHEMATICS

NUMERICAL METHODS
(OPEN ELECTIVE)
For B.E., IV - Semester – CBCS
(Common to CSE, CSE-AIML & IT Branches)

Instruction : 3 Hours per week	Sem. End Exam Marks : 60	Subject Reference Code : U24OE410MA
Credits : 3	Sessional Marks : 40	Duration of Semester End Exam : 3 Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to :	*At the end of the course students should be able to:*
1. ***Study*** various numerical methods to solve Algebraic and Transcendental equations.	1. ***Apply*** numerical methods to solve Algebraic and Transcendental equations which cannot be solved by traditional algebraic methods
2. ***Learn*** the methods to solve linear system of equations.	2. ***Solve*** linear system of equations using direct and iteration methods.
3. ***Understand*** the numerical methods in interpolation and extrapolation.	3. ***Use*** various numerical methods in interpolation and extrapolation.
4. ***Understand*** the numerical methods in interpolation using central differences.	4. ***Implement*** various numerical methods in interpolation using central differences.
5. ***Understand*** numerical methods in solving ordinary differential equations.	5. ***Find*** numerical solutions of ordinary differential equations.

UNIT – I: (8 Hours)

SOLUTION OF ALGEGBRAIC AND TRANSCENDENTAL EQUATIONS:

Algebraic and Transcendental equations: Bisection method - Newton-Raphson method - Regula-Falsi method.

UNIT – II: (8 Hours)

SOLUTION OF SYSTEM OF LINEAR EQUATIONS:

Direct methods - Gauss elimination method - Factorization method - Iterative methods: Jacobi's method – Gauss-Seidel method - Ill-conditioned system of equations.

UNIT – III: (8 Hours)

NUMERICAL DIFFERENCES - I

Introduction to finite differences - Interpolation- Newton's Forward and Backward Interpolation Formulae - Interpolation with unequal intervals - Lagrange's Interpolation Formula - Divided differences - Newton's divided difference formula.

UNIT – IV: (8 Hours)

NUMERICAL DIFFERENCES - II

Central differences interpolation - Gauss's forwards and backward difference formulae - Stiriling's formula - Bessel's formula.

UNIT – V: (8 Hours)

NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS

Numerical Solutions of Ordinary Differential Equations: Taylor's Series Method - Euler's Method - Modified Euler's Method – Runge-Kutta of 4th order (without proofs).

Text Books:

1. Numerical methods in engineering and science by B.S.Grewal, Khanna publishers
2. Advanced Engineering Mathematics by R.K.Jain & S.R.K.Iyengar, Narosa publishing house.

Reference Books:

1. Numerical Analysis by S.S.Sastry, PHI Ltd.

Online Resources:

https://onlinecourses.swayam2.ac.in/cec24_ma19/preview

The break-up of CIE: Internal Tests + Assignments + Quizzes

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DEPARTMENT OF MATHEMATICS

ALGEBRAIC STRUCTURES

(OPEN ELECTIVE)

For B.E., IV- Sem.,

(Common to CSE, AIML & IT Branches)

Instruction : 3 Hours per week	Sem. End Exam Marks : 60	Subject Reference Code : U24OE420MA
Credits : 3	Sessional Marks : 40	Duration of Semester End Exam : 3 Hrs

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to :	*At the end of the course students should be able to:*
1. ***Study*** the concept of Groups, Finite Groups, Subgroups, Cyclic Groups and their properties.	1. ***Solve*** the problems on Groups and will be equipped to apply them in applications like robotics, computer vision, computer graphics and medical image analysis
2. ***Understand*** Isomorphism – Automorphism of groups and their Properties.	2. ***Implement*** the concepts of automorphism in developing encoding and decoding tools of Cryptography
3. ***Learn*** group Homomorphism and related concepts.	3. ***Apply*** homomorphism in the study of formal languages, automata theory, and compiler design.
4. ***Acquire*** knowledge of Rings, Integral domains and Fields, External and Internal direct products.	4. ***Use*** the knowledge of Ring, Integral domain and Field in coding theory.
5. ***Identify*** Ring Homomorphism, properties and polynomial rings	5. ***Compute*** the programming of modern computer algebra algorithms using ring homomorphism.

UNIT – I: (8 Hours)

GROUPS

Binary operations - Groups – Definition, Elementary properties of Groups, Finite Groups, Subgroups, Cyclic Groups – Properties of Cyclic Groups, Fundamental theorem of Cyclic Groups-Classification of Subgroups of Cyclic Group.

UNIT – II: (8 Hours)

GROUP ISOMORPHISM

Isomorphism – Definition, Properties (without proof)- Automorphism - Cosets -Properties of Cosets (without proof), Lagrange's theorem.

UNIT – III: (8 Hours)

GROUP HOMOMORPHISM

External Direct Product - Definition, Properties(without proof). Normal Subgroups and Factor Groups. Internal Direct Product, Group Homomorphism – Definition, Properties (without proof).

UNIT – IV: (8 Hours)

RINGS

Rings, Properties of Rings (without proof) – Subrings - Integral Domains and Fields - Ideals- Prime and Maximal Ideals.

UNIT – V: (8 Hours)

RING HOMOMORPHISM

Ring Homomorphism - Properties of Ring Homomorphism (without proof) - Polynomial Rings - The Division Algorithm.

Text Books:

Contemporary Abstract Algebra, Joseph A. Gallian, CRC Press

Reference Books:

1. Topics in Algebra, I. N. Herstein, John Wiley & Sons
2. Basic Abstract Algebra, P. B. Bhattacharya, S. K. Jain, S. R. Nagpaul, Cambridge University Press
3. Abstract Algebra, D. S. Dummit, R. M. Foote, John Wiley & Sons, Inc.
4. A First Course in Abstract Algebra, John B. Fraleigh, Pearson Education Limited

Online Resources :

1. **https://ocw.mit.edu/courses/18-703-modern-algebra-spring-2013/**
2. https://onlinecourses.nptel.ac.in/noc19_cs78/preview

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2	No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5
4	Duration of Internal Tests	: 90 Minutes			

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(OU Nominee)	(Subject Expert-JNTUH)	(Subject Expert-BITS, Hyd)	(Industry Expert)

Dr.T. Sudhakar Rao
(Chairman, BOS)

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VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)

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9-5-81, Ibrahimbagh, Hyderbad-500031

DEPARTMENT OF MATHEMATICS

TRANSFORM TECHNIQUES
(OPEN ELECTIVE)

For B.E., V - Semester – CBCS

(Common to CSE, AIML & IT Branches)

Instruction: 3 Hours per week	**Semester End Exam Marks: 60**	**Subject Reference Code: U23OE510MA**
Credits:3	**Sessional Marks: 40**	**Duration of Semester End Exam: 3 Hours**

COURSE OBJECTIVES	**COURSE OUTCOMES**
The course will enable the students to:	*At the end of the course students will be able to:*
1. ***Understand*** the Definition of Laplace and its Properties.	1. ***Evaluate*** Laplace transforms of functions.
2. ***Understand*** the Definition of inverse Laplace Transforms- Properties	2. ***Evaluate*** Inverse Laplace transforms of functions.
3 ***Understand*** the applications of Laplace Transforms.	3. ***Apply*** Laplace transforms to evaluate integrals and to solve ordinary differential equations arising in engineering problems.
4 ***Study*** the Definition of Z- Transforms and its properties	4. ***Evaluate*** Z- transforms of Sequences
5 ***Understand*** the applications of Z-Transforms	5. ***Apply*** Z-transforms to solve ordinary difference equations arising in engineering problems.

UNIT – I: (8 Hours)

LAPLACE TRANSFORMS

Introduction to Laplace transforms - Existence of Laplace Transform –Properties of Laplace Transform-First shifting theorem - Second shifting theorem -Change of scale property – Differentiation of Laplace transform –Integration of Laplace Transform – Laplace Transform of Derivatives - Laplace Transform of Integrals

UNIT – II: (8 Hours)

INVERSE LAPLACE TRANSFORMS

Introduction to Inverse Laplace transforms -Properties of Inverse Laplace Transform-First shifting theorem - Second shifting theorem -Change of scale property- Multiplication with s - Division by s – Convolution Theorem (without proof).

UNIT – III: (8 Hours)

APPLICATIONS OF LAPLACE TRANSFORMS

Applications of Laplace transforms to Initial and Boundary Value Problems upto second order – Laplace transform of periodic functions – Triangular wave – Square wave – Saw tooth wave.

UNIT – IV: (8 Hours)

Z-TRANSFORMS

Introduction - Z-transforms of Standard sequences - Linearity Property – Scaling Property - Shifting Properties- Initial value theorem - Final value theorem – Differentiation of Z-transform.

UNIT – V: (8 Hours)

INVERSE Z-TRANSFORMS

Introduction –Inverse Z-transforms of Standard functions - Convolution Theorem – Application of Z-Transforms to solve Difference Equations.

Text Books:

1. Advanced Engineering Mathematics, Third Edition, R. K. Jain and S. R. K. Iyengar, Narosa Publishing House.
2. Higher Engineering Mathematics, Dr.B.S Grewal 40th Edition, Khanna Publishers.

Reference Books:

1. Advanced Engineering Mathematics, Kreyszig E, 8 th Edition, John Wiley & Sons Ltd, 2006.
2. A text book of Engineering Mathematics by N.P.Bali & Manish Goyal, Laxmi Publication.

Online Resources:

https://onlinecourses.nptel.ac.in/noc24_ma17/preview

The break-up of CIE : Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	: 2	Max. Marks for each Internal Tests	:	30
2	No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5
4	Duration of Internal Tests	: 90 Minutes			

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DEPARTMENT OF MATHEMATICS

ESTIMATION THEORY AND STATISTICAL INFERENCE

(OPEN ELECTIVE)

For B.E., V- Sem., (CBCS)

(Common to CSE, AIML & IT Branches)

Instruction:3 Hours per week	**Sem. End Exam Marks: 60**	**Subject Reference Code:U23OE520MA**
Credits: 3	**Sessional Marks: 40**	**Duration of Semester End Exam: 3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to :	*At the end of the course students should be able to:*
1. ***Study*** the concepts and application of sampling distribution	1. Apply Central Limit Theorem to the real-world problems and calculate and interpret, in testing one sample mean (σ known).
2. ***Describe*** the role of the point estimation, interval estimation and Bayesianestimation about a parameter.	2. ***Apply*** various estimators for estimating the parameters of standard distributions.
3. ***Study*** various methods of testing large samples.	3. ***Infer*** properties of population conducting tests on samples
4. ***Analyze*** standard statistical tests employed for small samples.	4. ***Interpret*** planned and unplanned comparisons for the one-way ANOVA.
5. ***Study*** the difference between non-parametric and parametric tests.	5. ***Solve*** problems on the Sign test, Wilcoxon Signed test, Mann- Whitney U-test.

UNIT – I: (8 Hours)

SAMPLING DISTRIBUTION

Sampling distribution of Mean (σ known)-Sampling distribution of Mean (σ unknown)-Sampling distribution of the Variance-Sampling distribution of differences and sums- Central Limit Theorem and its applications.

UNIT – II: (7 Hours)

ESTIMATION

Introduction- Point estimation- Interval estimation- Bayesian estimation.

UNIT – III: (7 Hours)

TESTING OF HYPOTHESIS FOR LARGE SAMPLES

Introduction -Test of significance for single proportion-Test of significance for two proportions-Standard deviation tests for two samples.

UNIT – IV: (7 Hours)

TESTING OF HYPOTHESIS FOR SMALL SAMPLES

Introduction- Paired Sample t-test- Chi- square test for independence of attributes- Analysis of Variance (ANOVA)

UNIT – V: (7 Hours)

NON-PARAMETRIC TESTS

The Sign test- Wilcoxon Signed Rank test- Mann-Whitney U- test.

Text Books:

1. Miller & Freund's Probability and Statistics for Engineers.
2. Fundamentals of Mathematical Statistics, Gupta & Kapoor, Sultan chand & sons. New Delhi.
3. Applied Statistics and Probability for Engineers by Douglas C. Montgomery and George C. N Runger, International Student Version, 6th Edition, 1 January 2016.

Reference Books:

1 R.K. Jain & S.R.K. Iyengar, Advanced Engineering Mathematics, Third Edition, Narosa Publications, 2007.
2 Higher Engineering Mathematics, Dr.B. S Grewal 40th Edition, Khanna Publishers.
3 Advanced Engineering Mathematics, Kreyszig E, 8th Edition, John Wiley & Sons Ltd, 2006.
4 A text book of Engineering Mathematics by N.P. Bali& Manish Goyal, Laxmi Publication.

Online Resources:

https://onlinecourses.nptel.ac.in/noc24_ma39/preview

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests	: 2	Max. Marks for each Internal Tests	:	30
2	No. of Assignments	: 3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	: 3	Max. Marks for each Quiz Test	:	5
4	Duration of Internal Tests	: 90 Minutes			

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DEPARTMENT OF MATHEMATICS

ADVANCED PROBABILITY & STATISTICAL METHODS

(OPEN ELECTIVE)

For B.E., VI - Semester – CBCS

(Common to CSE, AIML & IT Branches)

Instruction: 3 Hours per week	**Semester End Exam Marks: 60**	**Subject Reference Code: U230E610MA**
Credits:3	**Sessional Marks: 40**	**Duration of Semester End Exam: 3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to:	***At the end of the course students will be able to:***
1. ***Understand*** fitting of a straight line to a given data and measuring Correlation between variables.	1. ***Solve*** problems on fitting of a straight line to the given data and also to find co-efficient of correlation and to determine regression lines and their application problems.
2. ***Study*** the concepts and application of Time series.	2. ***Apply*** concept of Time series to solve the real time problems.
3. ***Distinguish*** the various methods of Designs of Experiments	3. ***Apply*** the methods of Designs of Experiments
4. ***Provide*** the knowledge to the students about Prediction and control by statistical methods Regression and SQC.	4. ***Evaluate*** the performance measures of the systems in networks, transportation systems, production lines.
5. ***Learn*** the concept of pure birth and death models of Queuing theory.	5. ***Apply*** the comprehensive levels of Queuing theory for calculating service time, traffic intensity, queue length etc. in special and general queues.

UNIT – I: (8 Hours)

CORRELATION AND REGRESSION ANALYSIS

Correlation –Scatter diagrams-Spearman's Rank of Correlation-Curve fitting by the Method of Least Squares - Fitting of Straight line - Parabola - Exponential curves: $y = a\, e^{bx}$ & $y = a\, b^{x}$- -- Regression - Lines of Regression - Multiple Regression - Curvilinear regression.

UNIT – II: (8 Hours)

TIME SERIES

Time series and Forecasting: Introduction-Moving averages, weighted average method smoothening of curves forecasting models and Methods.

UNIT – III: (8 Hours)
DESIGN OF EXPERIMENTS
Introduction to Design of experiments - Aim of the Design of experiments - Randomized Block Design (R.B.D) - Latin Square Design (L.S.D) - Comparison of RBD and LSD - Related problems.

UNIT – IV: (8 Hours)
QUEUEING THEORY
Introduction- Input pattern - service pattern- queue discipline - Queue behavior- Kendal's notation. Pure Birth and Death Models - Traffic intensity; (M/M/1: ∞/FIFO)-Model: (M/M/1: N/FIFO)-Model.

UNIT – V: (8 Hours)
STATISTICAL QUALITY CONTROL
Introduction, Methods for preparing control charts, variable charts – mean and range charts. Attribute charts- np, p and c charts.

TEXT BOOKS:
1. Probability, Statistics and Random Processes, T Veera Rajan, Tata McGraw-Hill companies (Seventh edition)
2. Probability & statistics and Random Processes; K.Murugesan & P.Gurusamy -Anuradha publishers
3. Probability & Statistics for Engineers, Miller& John E. Freund, Prentice Hall of India (Third edition)

REFERENCE BOOKS:
1. T.K.V. Iyengar et al, Probability and Statistics, S. Chand Publications, Revised edition.
2. Probability & Statistics for Engineers, Antony J. Hayter, CENGAGE Learning (India edition)

ONLINE SOURCES:
1. https://onlinecourses.nptel.ac.in/noc24_ch03
2. https://onlinecourses.nptel.ac.in/noc24_ma28

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DEPARTMENT OF MATHEMATICS

FOUNDATION TO ENGINEERING MATHEMATICS
BRIDGE COURSE FOR B.E. III-SEMESTER (CBCS)
(Common to all branches)

Instruction: 2 Hours per week	**Semester End Exam Marks: 50**	**Subject Reference Code: UB24BS300MA**
Credits: Nil	**Sessional Marks: Nil**	**Duration of Semester End Exam: 3 Hours**

COURSE OBJECTIVES	COURSE OUTCOMES
The course will enable the students to:	***At the end of the course students will be able to:***
1. ***Study*** the concepts of vector differentiation, Directional derivative, Divergence and Curl of a vector point function.	1. ***Solve*** problems on fitting of a straight line to the given data and also to find co-efficient of correlation and to determine regression lines and their application problems.
2. ***Understand*** the concepts of Descriptive Statistics.	2. ***Apply*** the concepts of Descriptive Statistics to calculate Mean, Median, Mode, Measures of Dispersion, Mean Deviation and Standard Deviation.
3. ***Learn*** the basics of Set theory, Permutations and Combinations and Probability.	3. ***Solve*** the problems on Permutations, Combinations and Probability.
4. ***Understand*** the concept of Rank of a matrix, Echelon form, System of Linear Equations and Eigen Values and Eigen Vectors.	4. ***Compute*** the Rank of a matrix and Eigen values and Eigen vectors of a matrix.

UNIT – I: (8 Hours)

CALCULUS

Differentiation of standard functions (Formulae) - Partial Derivatives – Scalar and Vector point functions -Vector Differentiation-Level Surfaces-Gradient of a scalar point function- Normal to a level surface- Directional Derivative – Divergence and Curl of a Vector field -Solenoidal and Irrotational vector

UNIT – II: (6 Hours)

DESCRIPTIVE STATISTICS

Mean-Median-Mode-Measures of Dispersion: Range-Mean Deviation-Standard Deviation

UNIT –III: (6 Hours)

BASICS OF PROBABILITY

Basics concepts of set theory - Permutations & Combinations - Random event & Experiment- Sample space - Classical definition of Probability - Axioms of probability.

UNIT – IV: (8 Hours)

MATRICES

Rank of matrix- Echelon form - System of Linear Equations- Consistency of Homogeneous and Non-homogeneous system of equations- Eigen values and EigenVectors.

TEXT BOOKS:

1 Advanced Engineering Mathematics, Third Edition, R. K. Jain and S. R. K. Iyengar. Narosa Publishing House.

2 Higher Engineering Mathematics, Dr.B.S. S Grewal 40th Edition, Khanna Publishers.

3 Fundamentals of Mathematical Statistics, S. C. Gupta, V.K. Kapoor, S Chand & Sons

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