Biostatistics & Biomodelling

Course code:BT41 **Course Credits:** 4:0:0:0
Prerequisite: Basics of Probability and statistics, MAT101 and MAT201 **Contract Hours:** 56
Course coordinator: Dr. Dinesh P. A. & Dr. M. S. Basavaraj

- **Course Objectives:**

The Students will

1) Learn the concepts of Random variable and probability distributions.
2) Learn the concept of stochastic process and genetic applications of probability.
3) Acquire the knowledge of sampling distributions and test of significance of samples.
4) Discuss the concepts of analysis of variance and optimization models relating to Biology and Medicine.
5) Learn to model problems relating to Biology.

Unit I

Random variables and Probability distributions: Random variables, Discrete and continuous random variables, Mean and variance, Binomial distribution , Poisson distribution, Geometric distribution, Exponential distribution, Uniform distribution, Normal distribution.

Unit II

Stochastic Process: Classification, Unique fixed probability vector, Regular stochastic matrix, Transition probability matrix, Markov chain.

Genetic application of probability: Genetic Applications of Probability, Hardy - Weinberg law, multiple alleles and application to blood groups.

Unit III

Sampling and Statistical inference : Sampling Distributions, Standard error, Central limit theorem, Testing of Hypothesis, Level of significance, Confidence limits, One tailed and two tailed tests, Z-Test, Test of significance for large samples – significance for single mean, difference of means, single proportion. Test of significance for small samples, t- distribution, F distribution and Chi-square distribution.

Unit IV

ANOVA and Optmization models: Analysis of variance (One way and Two-way classifications): Case studies of statistical designs of biological experiments (RCBD and RBD), Single and double – blind experiments, Limitations of experiments. Optimization models in Biology and Medicine – Medical diagnosis problem, Hospital diet problem.

Unit V

Biomodeling: Microbial growth in a chemostat, Growth equations of microbial populations, Models of commensalisms, Mutualism, Predation and Mutation. Lotka - Volterra's model for n Interacting species. Basic models for inheritance, Selection and Mutation models, Genetic inbreeding models – Selfing, Sibmating.

Text Books:

1. Marcello Pagano and Kimberlee Gauvreau – Principles of Biostatistics – Thompson Learning – 2nd edition – 2007.
2. Ronald N. Forthofer, EunSul Lee – Introduction to Biostatistics – Academic press – 2006.
3. J. N. Kapur – Mathematical Models in Biology and Medicine- East-West Press Private Ltd. – New Delhi – 2010.

Reference Books:

1. Warren J. Ewens, Gregory R. Grant – Statistical methods in Bioinformatics: An Introduction – Springer publications – 2nd edition – 2006.
2. P. S. S. Sundar Rao and J. Richard – An Introduction to Biostatistics and Research methods - Prentice Hall of India – 5th edition – 2012.
3. Wayne W. Daniel – Biostatistics: A foundation for Analysis in the Health sciences – John Wiley & Sons – 10th edition – 2014.

- **Course Outcomes:**

At the end of the course, the student will be able to

1. Calculate the probability of an event using Binomial, Poisson, Geometric, Exponential, Uniform and Normal distributions.
2. Apply the concept of Markov Chain in prediction of future events and to predict the probable characteristics possessed by the off springs of the n*th* generation genetic blood groups.
3. Choose an appropriate test of significance and make an inference about a population from a sample.
4. Demonstrate the ability to use one way and two way ANOVA.
5. Explain various genetic models and biological phenomena mathematically.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	1										
2	3	1										
3	3	1										
4	3	1										
5	3	1										

Engineering Mathematics-IV

Course Code: ME41 **Course Credits:** 3:1:0:0
Prerequisite: Engineering Mathematics-I & II (MAT101 & MAT201) **Contract Hours:** 42 L+14T = 56
Course Coordinators: Dr. G. Neeraja & Mr. Vijaya Kumar

➢ **Course Objectives:**

The students will

1. Learn the concepts of finite differences, interpolation and it applications.
2. Understand the concepts of continuous and discrete integral transforms in the form of Fourier and Z-transforms.
3. Understand the concepts of PDE and its applications to engineering.
4. Learn the concepts of Random variable and probability distributions.
5. Construct the various tests essentially needed for the testing of small samples for the testing of hypothesis.

Unit I

Finite Differences and Interpolation: Forward, Backward differences, Interpolation, Newton-Gregory Forward and Backward Interpolation formulae, Lagrange interpolation formula and Newton divided difference interpolation formula (no proof).

Numerical Differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson 1/3rd rule, Simpson 3/8th rules.

Unit II

Fourier Transforms: Infinite Fourier transform, Infinite Fourier sine and cosine transforms, properties, Inverse transforms, Convolution theorem, Parseval identities (statements only).

Z-Transforms: Definition, standard Z-transforms, Single sided and double sided, Linearity property, Damping rule, Shifting property, Initial value and Final value theorems, Inverse Z-transforms, Application of Z-transforms to solve difference equations.

Unit III

Partial Differential Equations-: Classification of second order PDE, Application of Fourier transforms to solve Partial Differential equations. Numerical solution of One - dimensional heat and wave equations, Two - dimensional Laplace equation, Poisson equation.

Unit IV

Random Variables: Random Variables (Discrete and Continuous), Probability density function, Cumulative density function, Mean, Variance, Moment generating function..

Probability Distributions: Binomial distribution, Poisson distributions, Normal distribution, Exponential distribution, Gamma distribution, Uniform distribution, Joint probability distribution (both discrete and continuous), Conditional probability, Conditional expectation.

Unit-V

Sampling and Statistical Inference: Sampling, Sampling distributions, Standard error, Weak law of large numbers(without proof), Central limit theorem(no proof), Basics of parametric estimation, Test of Hypothesis for means, Confidence limits for means, Z-test Student's t-distribution, F-distribution, Chi-Square distribution as a test of goodness of fit.

Text Books:

1. B.S.Grewal-Higher Engineering Mathematics-Khanna Publishers-43rd edition-2015.
2. R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye – Probability and Statistics for Engineers and Scientists – Pearson Education – Delhi – 9th edition – 2012.

Reference Books:

1. Erwin Kreyszig – Advanced Engineering Mathematics – Wiley publication – 10th edition-2015.
2. Glyn James- Advanced Modern Engineering Mathematics-PearsonEducation-4th edition-2010
3. Kishor S. Trivedi – Probability & Statistics with reliability, Queuing and Computer Science Applications – John Wiley & Sons – 2nd edition – 2008.
4. Murray R. Spiegel, John Schiller & R. Alu Srinivasan - Probability & Statistics - Schaum's outlines -4th edition - 2013.

- **Course Outcomes:**

At the end of the course, students will be able to

1) Use a given data for equal and unequal intervals to find a polynomial function for estimation. Compute maxima, minima, curvature, radius of curvature, arc length, area, surface area and volume using numerical differentiation and integration.
2) Evaluate Fourier transforms, Fourier sine and Fourier cosine transforms of functions and apply the knowledge of z-transforms to solve difference equations.
3) Solve partial differential equations analytically and numerically.
4) Apply the concept of probability distribution to solve engineering problems.
5) Use the concepts of sampling to make decision about the hypothesis.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	1										
2	3	1										
3	3	1										
4	3	1										
5	3	1										

Engineering Mathematics-IV

Course Code: CH41 **Course Credits:** 3:1:0:0
Prerequisite: Engineering Mathematics-I & II (MAT101 & MAT201) **Contract Hours:** 42 L+14T = 56
Course Coordinators: Dr. G. Neeraja & Mr. Vijaya Kumar

➢ **Course Objectives:**

The students will

3. Learn the concepts of finite differences, interpolation and it applications.
4. Understand the concepts of continuous and discrete integral transforms in the form of Fourier and Z-transforms.
3. Understand the concepts of PDE and its applications to engineering.
4. Learn the concepts of Random variable and probability distributions.
5. Construct the various tests essentially needed for the testing of small samples for the testing of hypothesis.

Unit I

Finite Differences and Interpolation: Forward, Backward differences, Interpolation, Newton-Gregory Forward and Backward Interpolation formulae, Lagrange interpolation formula and Newton divided difference interpolation formula (no proof).

Numerical Differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson 1/3rd rule, Simpson 3/8th rules.

Unit II

Fourier Transforms: Infinite Fourier transform, Infinite Fourier sine and cosine transforms, properties, Inverse transforms, Convolution theorem, Parseval identities (statements only).

Z-Transforms: Definition, standard Z-transforms, Single sided and double sided, Linearity property, Damping rule, Shifting property, Initial value and Final value theorems, Inverse Z-transforms, Application of Z-transforms to solve difference equations.

Unit III

Partial Differential Equations-: Classification of second order PDE, Application of Fourier transforms to solve Partial Differential equations. Numerical solution of One - dimensional heat and wave equations, Two - dimensional Laplace equation, Poisson equation.

Unit IV

Random Variables: Random Variables (Discrete and Continuous), Probability density function, Cumulative density function, Mean, Variance, Moment generating function..

Probability Distributions: Binomial distribution, Poisson distributions, Normal distribution, Exponential distribution, Gamma distribution, Uniform distribution, Joint probability distribution (both discrete and continuous), Conditional probability, Conditional expectation.

Unit-V

Sampling and Statistical Inference: Sampling, Sampling distributions, Standard error, Weak law of large numbers(without proof), Central limit theorem(no proof), Basics of parametric estimation, Test of Hypothesis for means, Confidence limits for means, Z-test Student's t-distribution, F-distribution, Chi-Square distribution as a test of goodness of fit.

Text Books:

1. B.S.Grewal-Higher Engineering Mathematics-Khanna Publishers-43rd edition-2015.
2. R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye – Probability and Statistics for Engineers and Scientists – Pearson Education – Delhi – 9th edition – 2012.

Reference Books:

1. Erwin Kreyszig – Advanced Engineering Mathematics – Wiley publication – 10th edition-2015.
2. Glyn James- Advanced Modern Engineering Mathematics-PearsonEducation-4th edition-2010
3. Kishor S. Trivedi – Probability & Statistics with reliability, Queuing and Computer Science Applications – John Wiley & Sons – 2nd edition – 2008.
4. Murray R. Spiegel, John Schiller & R. Alu Srinivasan - Probability & Statistics - Schaum's outlines -4th edition - 2013.

- **Course Outcomes:**

At the end of the course, students will be able to

1) Use a given data for equal and unequal intervals to find a polynomial function for estimation. Compute maxima, minima, curvature, radius of curvature, arc length, area, surface area and volume using numerical differentiation and integration.
2) Evaluate Fourier transforms, Fourier sine and Fourier cosine transforms of functions and apply the knowledge of z-transforms to solve difference equations.
3) Solve partial differential equations analytically and numerically.
4) Apply the concept of probability distribution to solve engineering problems.
5) Use the concepts of sampling to make decision about the hypothesis.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	1										
2	3	1										
3	3	1										
4	3	1										
5	3	1										

Engineering Mathematics-IV

Course Code:IM41 **Course Credits:** 3:1:0:0
Prerequisite: Engineering Mathematics-I & II (MAT101 & MAT201) **Contract Hours:**42 L+14T = 56
Course Coordinators: Dr. N. L. Ramesh & B. Azghar Pasha

➢ Course Objectives:

The students will

1) Learn the concepts of finite differences, interpolation and it applications.
2) Understand the concepts of continuous and discrete integral transforms in the form of Fourier and Z-transforms.
3) Understand the concepts of PDE and its applications to engineering.
4) Understand the concept of graph theory and matrix representation of graphs.

Unit I

Finite Differences and Interpolation: Forward, Backward differences, Interpolation, Newton-Gregory Forward and Backward Interpolation, formulae, Lagrange interpolation formula and Newton divided difference interpolation formula (no proof).

Numerical Differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson 1/3rd rule, Simpson 3/8th rule.

Unit II

Fourier Transforms: Infinite Fourier transform, Infinite Fourier sine and cosine transforms, properties, Inverse transforms, Convolution theorem, Parseval identities (statements only).

Z-Transforms: Definition, standard Z-transforms, Single sided and double sided, Linearity property, Damping rule, Shifting property, Initial value and Final value theorems, Inverse Z-transforms, Application of Z-transforms to solve difference equations.

Unit III

Partial Differential Equations-II: Classification of second order PDE, Derivation of one dimensional heat and wave equations, Numerical solution of One - dimensional heat and wave equations, Two - dimensional Laplace equation, Poisson equation.

Unit IV

Graph Theory - I: Introduction - Finite and infinite graphs, Incidence and degree, Isolated vertex, Pendant vertex and null graph, Operation on graphs, Walk, Paths and circuits. Connected graphs, disconnected graphs and components. Euler and Hamiltonian graphs. Trees- Properties of trees, Pendant vertices in a tree, Distance and centers in a tree, Rooted and binary trees, Spanning trees, Kruskaland Prims algorithm to find the minimal spanning tree.

Unit V

Graph Theory - II: Matrix Representation of graphs: Adjacency matrix, Incidence matrix, rank of the incidence matrix, path matrix, circuit matrix, fundamental circuit matrix, rank of the circuit matrix, cut-set matrix, fundamental cut-set matrix. Relationships among fundamental incidence, circuit and cut-set matrices.

Text Books:

1. Erwin Kreyszig –Advanced Engineering Mathematics – Wiley publication – 10th edition-2015.
2. NarsinghDeo – Graph Theory with applications to engineering & computer Science- Prentice Hall of India – 2014.

References:

1. B. S. Grewal – Higher Engineering Mathematics – Khanna Publishers – 43rd edition – 2015.
2. Glyn James – Advanced Modern Engineering Mathematics – Pearson Education – 4th edition – 2010.
3. Dennis G. Zill, Michael R. Cullen - Advanced Engineering Mathematics, Jones and Barlett Publishers Inc. – 3rd edition – 2009.
4. Reinhard Diestel-Graph Theory-Springer-4th edition-2010.

- **Course Outcomes:**

At the end of the course, students will be able to

1) Use a given data for equal and unequal intervals to find a polynomial function for estimation. Compute maxima, minima, curvature, radius of curvature, arc length, area, surface area and volume using numerical differentiation and integration.
2) Evaluate Fourier transforms, Fourier sine and Fourier cosine transforms of functions and apply the knowledge of z-transforms to solve difference equations.
3) Solve partial differential equations analytically and numerically.
4) Identify different types of graphs and can determine minimalspanning tree of a given graph.
5) Find matrix representation of graphs.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	1										
2	3	1										
3	3	1										
4	3	1										
5	3	1										

Engineering Mathematics-IV

Course Code: CS41 **Course Credits:** 4:0:0:0
Prerequisite: Engineering Mathematics-I and II (MAT101 & MAT201) **Contract Hours:** 56
Course Coordinators: Dr. N. L. Ramesh & Dr. A. Sreevallabha Reddy

- **Course Objectives:**

The students will

1) Learn the concepts of finite differences, interpolation and it applications.
2) Learn the concepts of Random variables and probability distributions.
3) Learn the concepts of probability distributions involving two random variables.
4) Learn the concepts of stochastic process, Markov chain and queuing theory.
5) Construct the various tests essentially needed for the testing of small samples for the testing of hypothesis.

Unit I

Finite Differences and Interpolation: Forward, Backward differences, Interpolation, Newton-Gregory Forward and Backward Interpolation, formulae, Lagrange interpolation formula and Newton divided difference interpolation formula (no proof).

Numerical Differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson 1/3rd rule, Simpson 3/8th rule.

Unit II

Random Variables: Random Variables (Discrete and Continuous), Probability density function, Cumulative distribution function, Mean, Variance, Moment generating function..

Probability Distributions: Binomial distribution, Poisson distribution, Normal distribution, Exponential distribution, Gamma distribution and Uniform distribution.

Unit III

Joint probability distribution: Joint probability distribution (both discrete and continuous), Conditional probability, Conditional expectation, Simulation of random variable.

Stochastic Processes: Introduction, Classification of stochastic processes, Discrete time processes, Stationary, Ergodicity, Autocorrelation, Power spectral density.

Unit IV

Markov Chain: Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states, Markov and Poisson processes.

Queuing theory: Introduction, Concepts and M/G/1 and M/M/1 queuing systems with numerical illustration.

Unit-V

Sampling and Statistical Inference : Sampling, Sampling distributions, Standard error, Weak law of large numbers(without proof), Central limit theorem, Basics of parametric estimation, Test of Hypothesis for means, Confidence limits for means, Z-test, Student's t-distribution, F-distribution, Chi-Square distribution as a test of goodness of fit.

Text Books:

1. B.S.Grewal - Higher Engineering Mathematics - Khanna Publishers – 43rd edition-2015.
2. R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye – Probability and Statistics for Engineers and Scientists – Pearson Education – Delhi – 9th edition – 2012.

Reference Books:

1. Erwin Kreyszig - Advanced Engineering Mathematics-Wiley-India publishers- 10th edition-2015.
2. Sheldon M. Ross – Probability models for Computer Science – Academic Press – 2009.
3. Murray R Spiegel, John Schiller & R. Alu Srinivasan – Probability and Statistics – Schaum's outlines - 4nd edition-2013.
4. Kishor S. Trivedi – Probability & Statistics with reliability, Queuing and Computer Science Applications – John Wiley & Sons – 2nd edition – 2008.

➢ Course Outcomes

At the end of the Course, students will be able to

1) Use a given data for equal and unequal intervals to find a polynomial function for estimation. Compute maxima, minima, curvature, radius of curvature, arc length, area, surface area and volume using numerical differentiation and integration.
2) Apply the concept of probability distribution to solve engineering problems.
3) Apply the concept of Joint distribution of random variables to understand the basic concepts of stochastic process.
4) Apply the concept of Markov Chain in prediction of future events and in queuing models.
5) Use the concepts of sampling to make decision about the hypothesis.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	1										
2	3	1										
3	3	1										
4	3	1										
5	3	1										

Engineering Mathematics-IV

Course Code: IS41 **Course Credits:** 3:1:0:0
Prerequisite: Engineering Mathematics-I and II (MAT101 & MAT201) **Contract Hours:** 42 L+14T = 56
Course Coordinators: Dr. N. L. Ramesh & Dr. A. Sreevallabha Reddy

➢ **Course Objectives:**

The students will

1) Learn the concepts of finite differences, interpolation and it applications.
2) Learn the concepts of Random variables and probability distributions.
3) Learn the concepts of probability distributions involving two random variables.
4) Learn the concepts of stochastic process, Markov chain and queuing theory.
5) Construct the various tests essentially needed for the testing of small samples for the testing of hypothesis.

Unit I

Finite Differences and Interpolation: Forward, Backward differences, Interpolation, Newton-Gregory Forward and Backward Interpolation, formulae, Lagrange interpolation formula and Newton divided difference interpolation formula (no proof).

Numerical Differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson 1/3rd rule, Simpson 3/8th rule.

Unit II

Random Variables: Random Variables (Discrete and Continuous), Probability density function, Cumulative distribution function, Mean, Variance, Moment generating function..

Probability Distributions: Binomial distribution, Poisson distribution, Normal distribution, Exponential distribution, Gamma distribution and Uniform distribution.

Unit III

Joint probability distribution: Joint probability distribution (both discrete and continuous), Conditional probability, Conditional expectation, Simulation of random variable.

Stochastic Processes: Introduction, Classification of stochastic processes, Discrete time processes, Stationary, Ergodicity, Autocorrelation, Power spectral density.

Unit IV

Markov Chain: Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states, Markov and Poisson processes.

Queuing theory: Introduction, Concepts and M/G/1 and M/M/1 queuing systems with numerical illustration.

Unit-V

Sampling and Statistical Inference : Sampling, Sampling distributions, Standard error, Weak law of large numbers(without proof), Central limit theorem, Basics of parametric estimation, Test of Hypothesis for means, Confidence limits for means, Z-test, Student's t-distribution, F-distribution, Chi-Square distribution as a test of goodness of fit.

Text Books:

1. B.S.Grewal - Higher Engineering Mathematics - Khanna Publishers – 43rd edition-2015.
2. R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye – Probability and Statistics for Engineers and Scientists – Pearson Education – Delhi – 9th edition – 2012.

Reference Books:

1. Erwin Kreyszig - Advanced Engineering Mathematics-Wiley-India publishers- 10th edition-2015.
2. Sheldon M. Ross – Probability models for Computer Science – Academic Press – 2009.
3. Murray R Spiegel, John Schiller & R. Alu Srinivasan – Probability and Statistics – Schaum's outlines - 4nd edition-2013.
4. Kishor S. Trivedi – Probability & Statistics with reliability, Queuing and Computer Science Applications – John Wiley & Sons – 2nd edition – 2008.

➢ Course Outcomes

At the end of the Course, students will be able to

1) Use a given data for equal and unequal intervals to find a polynomial function for estimation. Compute maxima, minima, curvature, radius of curvature, arc length, area, surface area and volume using numerical differentiation and integration.
2) Apply the concept of probability distribution to solve engineering problems.
3) Apply the concept of Joint distribution of random variables to understand the basic concepts of stochastic process.
4) Apply the concept of Markov Chain in prediction of future events and in queuing models.
5) Use the concepts of sampling to make decision about the hypothesis.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	1										
2	3	1										
3	3	1										
4	3	1										
5	3	1										

Engineering Mathematics-IV

Course Code: EC41 **Course Credits:**4:0:0:0
Prerequisite: Engineering Mathematics I and II (MAT101 & MAT201) **Contract Hours:** 56
Course Coordinator: Dr. Monica Anand & Dr. M.V.Govindaraju

➢ Course Objectives:

The students will:

1) Learn the concepts of finite differences, interpolation and it applications.
2) Understand the concepts of continuous and discrete integral transforms in the form of Fourier and Z-transforms.
3) Learn the concepts of random variables and probability distributions.
4) Learn the concepts of stochastic process and Markov chain.
5) Learn the concepts of series solution of differential equations.

Unit I

Finite Differences and Interpolation: Forward, Backward differences, Interpolation, Newton-Gregory Forward and Backward Interpolation, formulae, Lagrange interpolation formula and Newton divided difference interpolation formula (no proof).

Numerical Differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson 1/3rd rule, Simpson 3/8th rule.

Unit II

Fourier Transforms: Infinite Fourier transform, Infinite Fourier sine and cosine transforms, properties, Inverse transform, Convolution theorem, Parseval identity(statements only). Fourier transform of rectangular pulse with graphical representation and its output discussion, Continuous Fourier spectra-Example and physical interpretation.

Z-Transforms: Definition, standard Z-transforms, Single sided and double sided, Linearity property, Damping rule, Shifting property, Initial and final value theorem, Convergence of Z-transforms, Inverse Z-transform, Convolution theorem and problems. Application of Z-transform to solve difference equations.

Unit III

Random Variables: Random Variables (Discrete and Continuous), Probability density function, Cumulative distribution function, Mean, Variance, Moment generating function..

Probability Distributions: Binomial and Poisson distributions, Normal distribution, Exponential distribution, Gamma distribution, Uniform distribution, Joint probability distribution (both discrete and continuous), Conditional probability, Conditional expectation, Simulation of random variables.

Unit IV

Stochastic Processes: Introduction, Classification of stochastic processes, discrete time processes, Stationary, Ergodicity, Autocorrelation, Power spectral density.

Markov Chain: Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states, Markov and Poisson processes.

Unit V

Series Solution of ODEs and Special Functions: Series solution, Frobenius method, Series solution of Bessel differential equation leading to Bessel function of firstkind, Orthogonality of Bessel functions. Series solution of Legendre differential equation leading to Legendre polynomials, Rodrigues's formula**.**

Text Books:

1. B.S.Grewal-Higher Engineering Mathematics-Khanna Publishers-43rd edition-2015.
2. R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye – Probability and Statistics for Engineers and Scientists – Pearson Education – Delhi – 9th edition – 2012.

Reference Books:

1. Erwin Kreyszig –Advanced Engineering Mathematics – Wiley publication – 10th edition-2015
2. Glyn James- Advanced Modern Engineering Mathematics-PearsonEducation-4th edition-2010
3. Kishor S. Trivedi – Probability & Statistics with reliability, Queuing and Computer Science Applications – John Wiley & Sons – 2nd edition – 2008.

➢ Course Outcomes:

At the end of the course, students will be able to

1) Use a given data for equal and unequal intervals to find a polynomial function for estimation. Compute maxima, minima, curvature, radius of curvature, arc length, area, surface area and volume using numerical differentiation and integration.
2) Evaluate Fourier transforms, Fourier sine and Fourier cosine transforms of functions and apply the knowledge of z-transforms to solve difference equations.
3) Apply the concept of probability distribution to solve Engineering problems.
4) Apply the stochastic process and Markov Chain in predictions of future events.
5) Obtain the series solution of ordinary differential equations.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	1										
2	3	1										
3	3	1										
4	3	1										
5	3	1										

Engineering Mathematics-IV

Course Code: EE41 **Course Credits:**4:0:0:0
Prerequisite: Engineering Mathematics I and II (MAT101 & MAT201) **Contract Hours:** 56
Course Coordinator: Dr. Monica Anand & Dr. M.V.Govindaraju

➢ Course Objectives:

The students will:

1) Learn the concepts of finite differences, interpolation and it applications.
2) Understand the concepts of continuous and discrete integral transforms in the form of Fourier and Z-transforms.
3) Learn the concepts of random variables and probability distributions.
4) Learn the concepts of stochastic process and Markov chain.
5) Learn the concepts of series solution of differential equations.

Unit I

Finite Differences and Interpolation: Forward, Backward differences, Interpolation, Newton-Gregory Forward and Backward Interpolation, formulae, Lagrange interpolation formula and Newton divided difference interpolation formula (no proof).

Numerical Differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson 1/3rd rule, Simpson 3/8th rule.

Unit II

Fourier Transforms: Infinite Fourier transform, Infinite Fourier sine and cosine transforms, properties, Inverse transform, Convolution theorem, Parseval identity(statements only). Fourier transform of rectangular pulse with graphical representation and its output discussion, Continuous Fourier spectra-Example and physical interpretation.

Z-Transforms: Definition, standard Z-transforms, Single sided and double sided, Linearity property, Damping rule, Shifting property, Initial and final value theorem, Convergence of Z-transforms, Inverse Z-transform, Convolution theorem and problems. Application of Z-transform to solve difference equations.

Unit III

Random Variables: Random Variables (Discrete and Continuous), Probability density function, Cumulative distribution function, Mean, Variance, Moment generating function..

Probability Distributions: Binomial and Poisson distributions, Normal distribution, Exponential distribution, Gamma distribution, Uniform distribution, Joint probability distribution (both discrete and continuous), Conditional probability, Conditional expectation, Simulation of random variables.

Unit IV

Stochastic Processes: Introduction, Classification of stochastic processes, discrete time processes, Stationary, Ergodicity, Autocorrelation, Power spectral density.

Markov Chain: Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states, Markov and Poisson processes.

Unit V

Series Solution of ODEs and Special Functions: Series solution, Frobenius method, Series solution of Bessel differential equation leading to Bessel function of firstkind, Orthogonality of Bessel functions. Series solution of Legendre differential equation leading to Legendre polynomials, Rodrigues's formula**.**

Text Books:

1. B.S.Grewal-Higher Engineering Mathematics-Khanna Publishers-43rd edition-2015.
2. R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye – Probability and Statistics for Engineers and Scientists – Pearson Education – Delhi – 9th edition – 2012.

Reference Books:

1. Erwin Kreyszig –Advanced Engineering Mathematics – Wiley publication – 10th edition-2015
2. Glyn James- Advanced Modern Engineering Mathematics-PearsonEducation-4th edition-2010
3. Kishor S. Trivedi – Probability & Statistics with reliability, Queuing and Computer Science Applications – John Wiley & Sons – 2nd edition – 2008.

➢ Course Outcomes:

At the end of the course, students will be able to

1) Use a given data for equal and unequal intervals to find a polynomial function for estimation. Compute maxima, minima, curvature, radius of curvature, arc length, area, surface area and volume using numerical differentiation and integration.
2) Evaluate Fourier transforms, Fourier sine and Fourier cosine transforms of functions and apply the knowledge of z-transforms to solve difference equations.
3) Apply the concept of probability distribution to solve Engineering problems.
4) Apply the stochastic process and Markov Chain in predictions of future events.
5) Obtain the series solution of ordinary differential equations.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	1										
2	3	1										
3	3	1										
4	3	1										
5	3	1										

Engineering Mathematics-IV

Course Code: EI41 **Course Credits:**4:0:0:0
Prerequisite: Engineering Mathematics I and II (MAT101 & MAT201) **Contract Hours:** 56
Course Coordinator: Dr. Monica Anand & Dr. M.V.Govindaraju

➢ Course Objectives:

The students will:

1) Learn the concepts of finite differences, interpolation and it applications.
2) Understand the concepts of continuous and discrete integral transforms in the form of Fourier and Z-transforms.
3) Learn the concepts of random variables and probability distributions.
4) Learn the concepts of stochastic process and Markov chain.
5) Learn the concepts of series solution of differential equations.

Unit I

Finite Differences and Interpolation: Forward, Backward differences, Interpolation, Newton-Gregory Forward and Backward Interpolation, formulae, Lagrange interpolation formula and Newton divided difference interpolation formula (no proof).

Numerical Differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson 1/3rd rule, Simpson 3/8th rule.

Unit II

Fourier Transforms: Infinite Fourier transform, Infinite Fourier sine and cosine transforms, properties, Inverse transform, Convolution theorem, Parseval identity(statements only). Fourier transform of rectangular pulse with graphical representation and its output discussion, Continuous Fourier spectra-Example and physical interpretation.

Z-Transforms: Definition, standard Z-transforms, Single sided and double sided, Linearity property, Damping rule, Shifting property, Initial and final value theorem, Convergence of Z-transforms, Inverse Z-transform, Convolution theorem and problems. Application of Z-transform to solve difference equations.

Unit III

Random Variables: Random Variables (Discrete and Continuous), Probability density function, Cumulative distribution function, Mean, Variance, Moment generating function..

Probability Distributions: Binomial and Poisson distributions, Normal distribution, Exponential distribution, Gamma distribution, Uniform distribution, Joint probability distribution (both discrete and continuous), Conditional probability, Conditional expectation, Simulation of random variables.

Unit IV

Stochastic Processes: Introduction, Classification of stochastic processes, discrete time processes, Stationary, Ergodicity, Autocorrelation, Power spectral density.

Markov Chain: Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states, Markov and Poisson processes.

Unit V

Series Solution of ODEs and Special Functions: Series solution, Frobenius method, Series solution of Bessel differential equation leading to Bessel function of firstkind, Orthogonality of Bessel functions. Series solution of Legendre differential equation leading to Legendre polynomials, Rodrigues's formula**.**

Text Books:

1. B.S.Grewal-Higher Engineering Mathematics-Khanna Publishers-43rd edition-2015.
2. R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye – Probability and Statistics for Engineers and Scientists – Pearson Education – Delhi – 9th edition – 2012.

Reference Books:

1. Erwin Kreyszig –Advanced Engineering Mathematics – Wiley publication – 10th edition-2015
2. Glyn James- Advanced Modern Engineering Mathematics-PearsonEducation-4th edition-2010
3. Kishor S. Trivedi – Probability & Statistics with reliability, Queuing and Computer Science Applications – John Wiley & Sons – 2nd edition – 2008.

➢ Course Outcomes:

At the end of the course, students will be able to

1) Use a given data for equal and unequal intervals to find a polynomial function for estimation. Compute maxima, minima, curvature, radius of curvature, arc length, area, surface area and volume using numerical differentiation and integration.
2) Evaluate Fourier transforms, Fourier sine and Fourier cosine transforms of functions and apply the knowledge of z-transforms to solve difference equations.
3) Apply the concept of probability distribution to solve Engineering problems.
4) Apply the stochastic process and Markov Chain in predictions of future events.
5) Obtain the series solution of ordinary differential equations.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	1										
2	3	1										
3	3	1										
4	3	1										
5	3	1										

Engineering Mathematics-IV

Course Code: ML41 **Course Credits:**3:1:0:0
Prerequisite: Engineering Mathematics I and II (MAT101 & MAT201) **Contract Hours:** 42 L+14T = 56
Course Coordinator: Dr. Monica Anand & Dr. M.V.Govindaraju

- **Course Objectives:**

The students will:

1) Learn the concepts of finite differences, interpolation and it applications.
2) Understand the concepts of continuous and discrete integral transforms in the form of Fourier and Z-transforms.
3) Learn the concepts of random variables and probability distributions.
4) Learn the concepts of stochastic process and Markov chain.
5) Learn the concepts of series solution of differential equations.

Unit I

Finite Differences and Interpolation: Forward, Backward differences, Interpolation, Newton-Gregory Forward and Backward Interpolation, formulae, Lagrange interpolation formula and Newton divided difference interpolation formula (no proof).

Numerical Differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson 1/3rd rule, Simpson 3/8th rule.

Unit II

Fourier Transforms: Infinite Fourier transform, Infinite Fourier sine and cosine transforms, properties, Inverse transform, Convolution theorem, Parseval identity(statements only). Fourier transform of rectangular pulse with graphical representation and its output discussion, Continuous Fourier spectra-Example and physical interpretation.

Z-Transforms: Definition, standard Z-transforms, Single sided and double sided, Linearity property, Damping rule, Shifting property, Initial and final value theorem, Convergence of Z-transforms, Inverse Z-transform, Convolution theorem and problems. Application of Z-transform to solve difference equations.

Unit III

Random Variables: Random Variables (Discrete and Continuous), Probability density function, Cumulative distribution function, Mean, Variance, Moment generating function..

Probability Distributions: Binomial and Poisson distributions, Normal distribution, Exponential distribution, Gamma distribution, Uniform distribution, Joint probability distribution (both discrete and continuous), Conditional probability, Conditional expectation, Simulation of random variables.

Unit IV

Stochastic Processes: Introduction, Classification of stochastic processes, discrete time processes, Stationary, Ergodicity, Autocorrelation, Power spectral density.

Markov Chain: Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states, Markov and Poisson processes.

Unit V

Series Solution of ODEs and Special Functions: Series solution, Frobenius method, Series solution of Bessel differential equation leading to Bessel function of firstkind, Orthogonality of Bessel functions. Series solution of Legendre differential equation leading to Legendre polynomials, Rodrigues's formula**.**

Text Books:

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Reference Books:

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3. Kishor S. Trivedi – Probability & Statistics with reliability, Queuing and Computer Science Applications – John Wiley & Sons – 2nd edition – 2008.

➢ Course Outcomes:

At the end of the course, students will be able to

1) Use a given data for equal and unequal intervals to find a polynomial function for estimation. Compute maxima, minima, curvature, radius of curvature, arc length, area, surface area and volume using numerical differentiation and integration.
2) Evaluate Fourier transforms, Fourier sine and Fourier cosine transforms of functions and apply the knowledge of z-transforms to solve difference equations.
3) Apply the concept of probability distribution to solve Engineering problems.
4) Apply the stochastic process and Markov Chain in predictions of future events.
5) Obtain the series solution of ordinary differential equations.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	1										
2	3	1										
3	3	1										
4	3	1										
5	3	1										

Engineering Mathematics-IV

Course Code: TC41 **Course Credits:**3:1:0:0
Prerequisite: Engineering Mathematics I and II (MAT101 & MAT201) **Contract Hours:** 42 L+14T = 56
Course Coordinator: Dr. Monica Anand & Dr. M.V.Govindaraju

- **Course Objectives:**

The students will:

1) Learn the concepts of finite differences, interpolation and it applications.
2) Understand the concepts of continuous and discrete integral transforms in the form of Fourier and Z-transforms.
3) Learn the concepts of random variables and probability distributions.
4) Learn the concepts of stochastic process and Markov chain.
5) Learn the concepts of series solution of differential equations.

Unit I

Finite Differences and Interpolation: Forward, Backward differences, Interpolation, Newton-Gregory Forward and Backward Interpolation, formulae, Lagrange interpolation formula and Newton divided difference interpolation formula (no proof).

Numerical Differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson 1/3rd rule, Simpson 3/8th rule.

Unit II

Fourier Transforms: Infinite Fourier transform, Infinite Fourier sine and cosine transforms, properties, Inverse transform, Convolution theorem, Parseval identity(statements only). Fourier transform of rectangular pulse with graphical representation and its output discussion, Continuous Fourier spectra-Example and physical interpretation.

Z-Transforms: Definition, standard Z-transforms, Single sided and double sided, Linearity property, Damping rule, Shifting property, Initial and final value theorem, Convergence of Z-transforms, Inverse Z-transform, Convolution theorem and problems. Application of Z-transform to solve difference equations.

Unit III

Random Variables: Random Variables (Discrete and Continuous), Probability density function, Cumulative distribution function, Mean, Variance, Moment generating function..

Probability Distributions: Binomial and Poisson distributions, Normal distribution, Exponential distribution, Gamma distribution, Uniform distribution, Joint probability distribution (both discrete and continuous), Conditional probability, Conditional expectation, Simulation of random variables.

Unit IV

Stochastic Processes: Introduction, Classification of stochastic processes, discrete time processes, Stationary, Ergodicity, Autocorrelation, Power spectral density.

Markov Chain: Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states, Markov and Poisson processes.

Unit V

Series Solution of ODEs and Special Functions: Series solution, Frobenius method, Series solution of Bessel differential equation leading to Bessel function of firstkind, Orthogonality of Bessel functions. Series solution of Legendre differential equation leading to Legendre polynomials, Rodrigues's formula**.**

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➢ Course Outcomes:

At the end of the course, students will be able to

1) Use a given data for equal and unequal intervals to find a polynomial function for estimation. Compute maxima, minima, curvature, radius of curvature, arc length, area, surface area and volume using numerical differentiation and integration.
2) Evaluate Fourier transforms, Fourier sine and Fourier cosine transforms of functions and apply the knowledge of z-transforms to solve difference equations.
3) Apply the concept of probability distribution to solve Engineering problems.
4) Apply the stochastic process and Markov Chain in predictions of future events.
5) Obtain the series solution of ordinary differential equations.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	1										
2	3	1										
3	3	1										
4	3	1										
5	3	1										