Mathematics –III

(PDE, Statistical and Numerical Techniques)

(To be offered to CE and Allied Branches CE/EV)

Subject Code	BAS302/BAS302H/BAS402/BAS402H				
Category	Basic Science Course				
Subject Name	MATHEMATICS-III (Partial Differential Equations, Statistical and Numerical Techniques)				
Scheme and Credits	**L-T-P**	**Theory Marks**	**Sessional**		**Total**	**Credit**
			Test	**Assig/Att.**		
	3—1—0	70	20	10	100	4
Pre- requisites (if any)	Knowledge of Mathematics I and II of B. Tech or equivalent				

Course Outcomes

The objective of this course is to familiarize the students with partial differential equation, their application, statistical and numerical techniques. It aims to present the students with standard concepts and tools at an intermediate to superior level that will provide them well towards undertaking a variety of problems in the discipline.

The students will learn:

- The idea of partial differentiation, its types and their solution.
- The concept of Fourier transform and method of separation of variables to solve partial differential equations.
- To apply the basic ideas of statistics including measures of central tendency, correlation, regression and their properties.
- To apply numerical techniques in solving algebraic equations and data interpolation.
- To apply numerical techniques in solving linear equations, numerical differentiation and numerical integration.

Module I: Partial Differential Equations   8

Origin of Partial Differential Equations, Linear and Non-Linear Partial Differential Equations of first order, Lagrange's Equations method to solve Linear Partial Differential Equations, Charpit's method to solve Non-Linear Partial Differential Equations, Solution of Linear Partial Differential Equation of Higher order with constant coefficients, Equations reducible to linear partial differential equations with constant coefficients.

Module II: Applications of Partial Differential Equations and Fourier Transform   8

Method of separation of variables, Solution of one dimensional heat equation, wave equation, Two dimensional heat equation (only Laplace Equation)and their application, Complex Fourier transform, Fourier sine transform, Fourier cosine transform, Inverse transform, convolution theorem, Application of Fourier Transform to solve partial differential equation.

Module III: Statistical Techniques   **8**

Moments, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves, Correlation and regression, Binomial, Poisson and Normal distributions, Tests of significations: Sampling theory (small & large), Null hypothesis, Alternative hypothesis, testing of hypothesis: Chi-square test, t-test, z-test.

Module IV: Numerical Techniques–I   **8**

Zeroes of transcendental and polynomial equations using Bisection method, Regula-falsi method and Newton-Raphson method, Rate of convergence of above methods. Interpolation: Finite differences, Newton's forward and backward interpolation, Lagrange's and Newton's divided difference formula for unequal intervals.

Module V: Numerical Techniques–II: **8**

Solution of system of linear equations, Matrix Decomposition method, Jacobi method, Gauss-Seidel method. Numerical differentiation, Numerical integration, Trapezoidal rule, Simpson's one third and three-eight rules, Solution of ordinary differential equations by Picard's and fourth-order Runge-Kutta methods.

Text Book:
1. Dr. B.S. Grewal, "Higher Engineering Mathematics", 44[th]Edition, Khanna Publishers, New Dehli.

Reference Books:
1. Peter V. O'Neil, "Advance Engineering Mathematics", SI Edition 8th Edition, Cengage Learning, 2017.
2. B. V. Ramana, Higher Engineering Mathematics, McGraw-Hill Publishing Company Ltd., 2017.
3. S. S. Sastry, "Introductory methods of Numerical solutions", 4th Edition , Prentice Hall of India.
4. Erwin Kreyszig , "Advanced Engineering Mathematics", John Wiley Publications, 1999.
5. R.K.Jain & S.R.K.Iyengar, "Numerical Methods" , New Age International (P) Limited
6. James F. Epperson Mathematical Reviews "An Introduction To Numerical Methods And Analysis" Second Edition, Wiley;

Mathematics –IV

(PDE, Probability and Statistics)

Computer/Electronics/Electrical & Allied Branches, CS/IT, EC/IC, EE/EN,

Mechanical& Allied Branches, (ME/AE/AU/MT/PE/MI/PL)

Textile/Chemical & Allied Branches, TT/TC/CT, CHE/FT

Subject Code	BAS303/ BAS303H/ BAS403/BAS403H				
Category	Basic Science Course				
Subject Name	MATHEMATICS-IV(PDE, Probability and Statistics)				
Scheme and Credits	**L-T-P**	**Theory Marks**	**Sessional**		**Total**	**Credit**
			Test	**Assig/Att.**		
	3—1—0	70	20	10	100	4
Pre- requisites (if any)	Knowledge of Mathematics I and II of B. Tech or equivalent				

Course Outcomes

The objective of this course is to familiarize the students with partial differential equation, their application and statistical techniques. It aims to present the students with standard concepts and tools at an intermediate to superior level that will provide them well towards undertaking a variety of problems in the discipline.

The students will learn:

- The idea of partial differential equation and its different types of solution.
- The concept ofmethod of separation of variables and Fourier transform to solve partial differential equations.
- The basic ideas of statistics including measures of central tendency, correlation, regression and their properties.
- The idea of probability, random variables, discrete and continuous probability distributions and their properties.
- The statistical methods of studying data samples, hypothesis testing and statistical quality control.

Module I: Partial Differential Equations   8

Origin of Partial Differential Equations, Linear and Non-Linear Partial Differential Equations of first order, Lagrange's Equations method to solve Linear Partial Differential Equations, Charpit's method to solve Non-Linear Partial Differential Equations, Solution of Linear Partial Differential Equation of Higher order with constant coefficients, Equations reducible to linear partial differential equations with constant coefficients.

Module II: Applications of Partial Differential Equations and Fourier Transform   8

Method of separation of variables,Solution of one dimensional heat equation, wave equation, Two dimensional heat equation (only Laplace Equation) and their application, Complex Fourier transform, Fourier sine transform, Fourier cosine transform, Inverse transform, convolution theorem, Application of Fourier Transformto solve partial differential equation.

Module III: Statistical Techniques I   8

Overview of Measures of central tendency, Moments, Skewness, Kurtosis, Curve Fitting, Method of least squares, Fitting of straight lines, Fitting of second degree parabola, Exponential curves,Correlation and Rank correlation, Regression Analysis: Regression lines of y on x and x on y.

Module IV: Statistical Techniques II   8

Overview of Probability Random variables (Discrete and Continuous Random variable) Probability mass function and Probability density function, Expectation and variance, Discrete and Continuous Probability distribution: Binomial, Poission and Normal distributions.

Module V: Statistical Techniques III   8

Introduction of Sampling Theory, Hypothesis, Null hypothesis, Alternative hypothesis, Testing a Hypothesis, Level of significance, Confidence limits, Test of significance of difference of means, t-test, Z-test and Chi-square test, Statistical Quality Control (SQC) , Control Charts, Control Charts for variables (X and R Charts), Control Charts for Variables (p, np and C charts).

Text Book:
1. Dr. B.S. Grewal, "Higher Engineering Mathematics", 44[th]Edition, Khanna Publishers, New Dehli.

Reference Book:
1. Peter V. O'Neil, "Advance Engineering Mathematics", SI Edition 8th Edition, Cengage Learning, 2017.
2. B. V. Ramana, Higher Engineering Mathematics, McGraw-Hill Publishing Company Ltd., 2017.
3. S. S. Sastry, "Introductory methods of Numerical solutions", 4th Edition , Prentice Hall of India.
4. Erwin Kreyszig , "Advanced Engineering Mathematics", John Wiley Publications, 1999.
5. R.K.Jain&S.R.K.Iyengar, "Numerical Methods" , New Age International (P) Limited
6. James F. Epperson Mathematical Reviews "An Introduction To Numerical Methods And Analysis" Second Edition, Wiley;
https://perhuaman.files.wordpress.com/2014/07/metodos-numericos.pdf

Mathematics-V

(B. Tech. Bio Technology/Agriculture Engineering) (Effective from the Session: 2023-24)

Subject Code	BAS304 / BAS304H / BAS404 / BAS404H					
Category	Basic Science Course					
Subject Name	MATHEMATICS-V					
Scheme and Credits	**L-T-P**	**Theory Marks**	**Sessional**		**Total**	**Credit**
			Test	**Assig/Att.**		
	3—1—0	70	20	10	100	4
Pre- requisites (if any)	Knowledge of Elementary Mathematics I and II of B. Tech Bio Tech or equivalent					

Course Objectives:

The objective of this course is to familiarize the bio technological engineers with techniques of Integral transforms (Fourier and Z-Transforms), probability distribution, numerical computation, hypothesis testing and ANOVA, Design and Quality control and its applications in real world. It aims to equip the students with standard concepts and tools from B. Tech Bio. Technology/Agriculture Engineering. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines

The students will learn:

- The idea of Fourier Transforms, Z- Transform and application to solve numerical problems.
- The concept of probability distribution and their application.
- The concepts of numerical techniques.
- The concept of hypothesis and ANOVA, t – test, and χ^2 - test.
- The idea of design ,statistical quality control and control charts

Mathematics – V   3L   1T   0P

All India Council for Technical Education Mathematics Course (Agriculture Engineering and Bio-Technology)

MODULE I   (8)

Integral Transforms: Fourier integral, Fourier Transform , Complex Fourier transform, Inverse Transforms, Convolution Theorems (without proof), Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat equations, wave equations and Laplace equations, Z-Transform and its application to solve difference equation.

MODULE II   (9)

Probability Distributions: Review of probability Random variable, Probability mass function, Probability Density Function, Binomial distribution, Poisson distribution, Normal distribution and their applications.

MODULE III   (9)

Numerical Techniques: Zeroes of transcendental and polynomial equations, Bisection method, Regula-falsi method, Newton-Raphson method, Rate of convergence of above methods.

Interpolation: Finite differences, Newton's forward and backward interpolation. Lagrange's and Newton's divided difference formula for unequal intervals.

MODULE IV   (10)

Tests of Hypothesis and ANOVA: Hypothesis tests, Level of significance, critical region, Student's t-test, Chi-square test, (χ^2 – test), F-test, one way and two way analysis of variance.

MODULE V   (9)

Design and Quality control: Principles of experimental design and analysis, completely randomized design, Randomized block design, Latin square design, Statistical quality control, Types of quality control, Control chart for variables, and Control chart for attributes.

Text Books:
1. S.P.Gupta, Statistical Methods, Sultan Chand and Sons Publishers.
2. Georgr W. and William G., Statistical Methods, IBH Publication.
3. Ipsen J et al., Introduction to Biostatistics, Harper and Row Publication.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.

Reference Books:
1. N.T.J Baily, Statistical methods in Biology, English University Press.
2. R. Rangaswami, A text book of Agricultural Statistics, New Age Int. Publication.
3. P.S.S. Sundar Rao: An Introduction to Biostatistics, Prentice Hall.
4. Zar J, Biostatistics, Prentice Hall, London.

COURSE OUTCOMES

	Course Outcome (CO)	Bloom's Knowledge Level (KL)
	At the end of this course, the students will be able to:	
CO 1	Understand the concept of Fourier Transform and Z- Transform to apply for solving with the help of transform problems.	K_2 & K_3
CO 2	Remember the concept of Probability to evaluate Probability distribution.	K_1 & K_3
CO 3	To analyze the concept of numerical techniques to evaluate the zero's of the function interpolation	K_4 & K_5
CO 4	Apply the concept of hypothesis to evaluate various hypothesis testing.	K_3 & K_5
CO 5	Remember the concept of design and statistical quality control to create control charts.	K_1 & K_6

K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5 – Evaluate, K_6 – Create

Evaluation methodology to be followed:
The evaluation and assessment plan consists of the following components:
   a. Class attendance and participation in class discussions etc.
   b. Quiz.
   c. Home-work and assignments.
   d. Sessional examination.
   e. Final examination.

Award of Internal/External Marks:
Assessment procedure will be as follows:
1. These will be comprehensive examinations held on-campus (Sessional)
2. Quiz
   a. Quiz will be of type multiple choice, fill-in-the-blanks or match the columns.
   b. Quiz will be held periodically
3. Home works and assignments
   a. The assignments/home-works may be of multiple choice types or comprehensive type at least one assignment from each Module/Unit.
   b. The grades and detailed solutions of assignments (of both types) will be accessible online after the submission deadline.
4. Final examinations.
   These will be comprehensive external examinations held on-campus or off campus
   (External examination) on dates fixed by the Dr. APJ Abdul Kalam Technical
   University, Lucknow