MATHEMATICS I
EG401SH

Lecture: 3 Year: I
Tutorial: 2 Part: A

COURSE OBJECTIVES: It is assumed that incoming students have a good grounding in algebra, some knowledge of trigonometry and analytic geometry and previous to calculus. By the end of the course, students will have seen the development of all of the elementary functions, ranging from polynomials to the inverse hyperbolic functions. In parallel, the calculus will be developed, making use of the increasing richness of the available functions. The student's skills in differentiation and integration will thus be progressively improved. Simple applications of the calculus will be explored from time to time. The course will conclude with brief discussion of conic sections and coordinate transformations.

1. Review. (5 hours)
- 1.1 Limit, Continuity.
- 1.2 Derivability of functions of a single variable. Derivative rules and formulas.
- 1.3 Integration rules and standard integrals.

2. **Derivative (9 hours)**
- 2.1 Higher order derivatives.
- 2.2 Maxima and Minima.
- 2.3 Mean value theorems.
- 2.4 Taylor and Maclaurin series.
- 2.5 Tangent and Normal.
- 2.6 Curvature.
- 2.7 Asymptotes.
- 2.8 Curve tracing.

3 Antiderivatives. (12 hours)
- 3.1 Definite integrals.
- 3.2 Fundamental theorem of integral calculus.
- 3.3 Improper integrals.
- 3.4 Reduction formulae for integrals, Beta and Gamma functions,

4 Applications of Integral (8 hours)
- 4.1 Areas
- 4.2. Lengths
- 4.3 Volumes.
- 4.4 Surfaces

5 Ordinary differential equations (5 hours)
- 5.1 Differential equations of first and second orders.
- 5.2 Linear equations with constant cofficients.

6. Analytic Geometry of two dimensions (6 hours)
- 6.1 Translation and rotation of axes.
- 6.2 Parabola.
- 6.3 Ellipse.
- 6.4 Hyperbola.
- 6.5 Central conics.

Textbook

1. E.W. Swokowski, "Calculus With Analytic Geometry", Second Alternate Edition, PWS-Kent Publishing Co., Boston.

MATHEMATICS II
EG471SH

Lecture: 3 Year:1
Tutorial: 2 Part: B

COURSE OBJECTIVES: It is assumed that students have taken Mathematics I or an equivalent introduction to calculus as a prerequisite. Major topics to be covered are (a) two and three-dimensional vectors and some associated linear algebra (b) infinite series (c) first order differential equations.

1. **Plane curves and Polar coordinates.** **(4 hours)**

   1.1 Plane curves**.**
   1.2 Parametric equations.
   1.3 Polar coordinates.
   1.4 Integrals in Polar Coordinates.

2. **Calculus of Several Variables**. **(6 hours)**

   2.1 Calculus of two or more variables.
   2.2 Partial derivatives.
   2.3 Total differential coefficients.
   2.4 Extrema of functions of two or three variables.

3. **Multiple intergals.** **(4 hours)**

   3.1 Multiple intergals.
   3.2 Uses in areas.
   3.3 Volumes.
   3.4 Centroids.

4. **Analytic Geometry of 3-D** **(7 hours)**

   4.1 Analytic Geometry of three dimensions-planes.
   4.2 Straight lines.
   4.3 Standard equations of sphere.
   4.4 Cylinder and cone.

5. **Infinite series** **(9 hours)**

   5.1 Infinite series and sequences.
   5.2 Convergence
   5.3 Ratio, root, integral tests.
   5.4 Absolute convergence
   5.5 Power series.
   5.6 Radius of convergence.

6. **Vectors in two and three dimensions** **(5 hours)**

   6.1 Two and three dimensional Vectors.
   6.2 Scalar products.
   6.3 Vector products
   6.4 Linesand planes.

7. **OrdinaryLinear differential equations** **(10 hours)**

   7.1 Homogeneous Linear differential equations of second order.
   7.2 General solution.
   7.3 Initial value problems.
   7.4 Non homogeneous equations.
   7.5 Solution in series, Legendre, Bessel equations.

Textbook:

1.0 E.W. Swokowski, "Calculus With Analytic Geometry", Second Alternate Edition, PWS-Kent Publishing Co., Boston.

Reference Books:

1.0 E. Kreyszig, "Advance Engineering Mathematics", Fifth Edition, Wiley, New York.

MATHEMATICS III
EG501SH

Lecture: 3 Year: II
Tutorial: 2 Part: A

COURSE OBJECTIVES: The purpose of this course is to round out the student's preparation for more sophisticated applications with an introduction to linear algebra, a continuation of the study of ordinary differential equations and an introduction to vector calculus.

1. **Matrices and determinants** **(8 hours)**
   - 1.1 Matrix and determinants.
   - 1.2 Vector spaces
   - 1.3 Linear transformations
   - 1.4 System of linear equations, Gauss elimination.
   - 1.5 Rank, matrix inversion.
   - 1.6 Eigen values, eigen vectors.

2 **Fourier series** **(4 hours)**
   - 2.1 Fourier series,
   - 2.2 Periodic functions
   - 2.3 Odd and even functions.
   - 2.4 Fourier series for arbitrary range.
   - 2.5 Half range Fourier series.

3. **Laplace transforms** **(8 hours)**
   - 3.1 Laplace transforms.
   - 3.2 Standard L- transforms.
   - 3.3 Inverse laplace transforms.
   - 3.4 Applications.

4 **Vector Calculus** **(7 hours)**
   - 4.1 Vector Calculus.
   - 4.2 Differentiation and Integration of Vectors.
   - 4.3 Divergence.
   - 4.4 Gradient curl.

5 **Line, surface and volume integrals** **(18 hours)**
   - 5.1 Line integrals.
   - 5.2 Surface and volume integrals.
   - 5.3 Integral transformation theorems- Stoke's, Gauss and Green's theorems.

Textbook:

1.0 E. Kreszig, "Advanced Engineering Mathematics", Fifth Edition, Wiley, New York.
2.0 M.M. Guterman and Z.N. Nitecki, "Differential Equations, a First Course", 2nd Edition, Saunders, New York.

APPLIED MATHEMATICS
EG561SH

Lecture: 3 Year: II
Tutorial: 2 Part: B

Course objectives: This course focuses on several branches of applied mathematics. The student is exposed to complex variable theory and a study of the Fourier and Z transforms, topics of current importance in signal processing. The course concludes with studies of the wave and diffusion equations in cartesian, cylindrical and polar coordinates.

1. **Complex Variables** **(10 hours)**
   - 1.1 Function of Complex Variables.
   - 1.2 Taylor series.
   - 1.3 Laurent series.
   - 1.4 Singularities, Zeros and poles.
   - 1.5 Complex integration
   - 1.6 Residues.

2 **Z-transforms** **(8 hours)**
   - 2.1 Ideas of Z-transforms.
   - 2.2 Difference equations.

3 **The Fourier integral** **(8 hours)**
   - 3.1 The Fourier integral
   - 3.2 The inverse Fourier integral formula.
   - 3.3 Frequency and phase spectra.
   - 3.4 The delta function.

4 **Partial differential equations** **(10 hours)**
   - 4.1 Basic concepts.
   - 4.2 Wave equation.
   - 4.3 Diffusion equation.
   - 4.4 The Laplace equation in 2 and 3 dimensions.
   - 4.5 Polar coordinates.
   - 4.6 Cylindrical coordinates.
   - 4.7 Spherical coordinates.
   - 4.8 Bessels and Legendre equations.

5. **Linear Programming** **(9 hours)**
   - 5.1 The simplex method.
   - 5.2 The canonical forms of solutions.
   - 5.3 Optimal values.

Textbook:

1.0 E.Kreyszig, “Advanced Engineering Mathematics”, Fifth Edition, Wiley, New York.

Reference for Z-Transform:

1.0 A.V. Oppenheim, “Discrete-Time Signal Processing”, Prentice Hall, 1990.
2.0 K.Ogota, “Discrete-Time Control Systems”, Prentice Hall, Englewood Cliffs, New Jersey, 1987.

PROBABILITY AND STATISTICS
EG671SH

Lecture: 3 Year: 3
Tutorial: 1 Part: B

Course Objectives: To provide the student with a practical knowledge of the principles and concepts of probability and statistics and their application to simple engineering problems.

1. **Introduction and Descriptive Statistics:** (4 hours)
   1.1. An overview of probability and statistics
   1.2. Pictorial and tabular methods in descriptive statistics
   1.3. Measures of location: mean, median, quartiles, percentiles, etc.
   1.4. Measures of variability

2. **Probability:** (4 hours)
   2.1. Sample spaces and events
   2.2. Axioms, interpretations and properties of probability
   2.3. Counting techniques
   2.4. Conditional probability
   2.5. Independence

3. **Discrete Random Variables and Probability Distributions:** (6 hours)
   3.1. Random variables
   3.2. Probability distributions for random variables
   3.3. Expected values of discrete random variables
   3.4. The binomial probability distribution
   3.5. The hypergeometric and negative binomial distributions
   3.6. The Poisson probability distribution

4. **Continuous Random Variables and Probability Distributions:** (6 hours)
   4.1. Continuous random variables and probability density functions
   4.2. Cumulative distribution functions and expected values
   4.3. The Normal Distribution
   4.4. The Gamma Distribution
   4.5. Chi-Squared Distribution

5. **Joint Probability Distributions and Random Samples:** (4 hours)
   5.1. Jointly distributed random variables
   5.2. Expected values, covariance and correlation
   5.3. Sums and averages of random variables
   5.4. The central limit theorem

6. **Point Estimation:** (2 hours)

7. Some general concepts of point estimation
8. Methods of point estimation

11 **Interval Estimation:** (3 hours)

11.0 Basic properties of Confidence Interval
11.1 Large-sample Confidence interval for population Mean and Proportion
11.2 A Confidence intervals for the mean of Normal Population
11.3 Confidence interval for the Variance and Standard Deviation of a Normal Population

12 **Hypothesis Testing Procedures Based on a Single Sample:** (5 hours)

12.0 Hypothesis and Test Procedure
12.1 Tests about the mean of a Normal Population
12.2 Large-sample Test for population mean
12.3 Large-sample Test for a population proportion
12.4 The t-test
12.5 Some comments on selecting a test procedure

13 **Hypothesis Testing Based on Two Samples:** (4 hours)

13.0 z-tests for differences between two population means
13.1 The sample t-test
13.2 Analysis of paired Data
13.3 Testing for differences between population proportions

14 **Simple Linear Regression and Correlation:** (4 hours)

14.0 The simple linear probabilistic model and principle of least square
14.1 Correlation, Correlation coefficient and coefficient of determination
14.2 Linear and non-linear Regression
14.3 Line of Regression and coefficient of Regression

14.4 **The Analysis of categorical Data**: (3 hours)
14.5 Goodness of Fit tests when category Probablilities are completely specified
  14.5.1 Goodness of fit for composite Hypothesis
  14.5.2 Two way contengency Tables

Textbook:

1.0 Jay L.Devore, “Probability and Statistics for Engineering and the Sciences”, Brooks/Cole publishing Company, Monterey, California, 1982.

Reference Book:

11 Murray R. Spiegel, "Theory and Problems of Probability and Statistics", McGraw Hill, Singapore
12 D. C. Sancheti and V. K. Kapoor, "Statistics", Sultan Chand and Sons, Educational Publishers, India
13 S. C. Gupta,"Fundamental of Statistics", Himalaya Publishing House, India
14 Jeetendra P. Aryal and Arun Gautam, "Quanatative Technique Vol. II", Vidhyarthy Pustak Bhandar, Nepal
15 S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Son, India