Course Name: **Engineering Mathematics-I**
Course Code: **MA-111**
Course Type: **Core**

Contact Hours/Week: **3L + 1T** Course Credits: **04**

Course Objectives

- To understand matrix algebra and its applicability in different engineering fields
- To incorporate the knowledge of calculus to support their concurrent and subsequent engineering studies
- To have the idea of vector calculus, fundamental theorems & its physical interpretation and applications
- To introduce the fundamental concept of Fourier series and its interpretation

Unit Number	Course Content	Lectures
UNIT-01	**Matrix Algebra** Matrices, Related matrices, Complex matrices (Hermitian and skew-Hermitian matrices, Unitary matrix), Rank of a matrix, Gauss-Jordan method, Normal form of a matrix, Linear dependence and independence of vectors, Consistency of linear system of equations, Solution of linear system of equations, Characteristic equation, Eigen values, Eigen vectors, Properties of eigen values, Cayley-Hamilton theorem and its applications, Reduction to diagonal form, Quadratic form and their reduction to canonical form.	**06 L**
UNIT-02	**Differential Calculus** Review of Limits, Continuity and Differentiability, Mean Value Theorem, Partial Differentiation and its geometrical interpretation, Homogeneous functions, Euler's theorem and its extension, Total differentials, Composite function, Jacobian, Taylor's and Maclaurin's infinite series, Indeterminate forms, Errors and increments, Maxima and minima of functions of two variables, Method of undetermined multipliers. Curve tracing.	**09 L**
UNIT-03	**Integral Calculus** Double Integrals (Cartesian and Polar), Change of Order of Integration, Change of Variables, Applications of Double Integrals. Triple integrals, Change of Variables, Applications of Triple Integrals. Beta and Gamma functions.	**06 L**
UNIT-04	**Vector Calculus** Differentiation of vectors, Curves in space, Velocity and acceleration, Relative velocity and acceleration, Scalar and vector point functions, Vector Operator 'Del' - Del Applied to Scalar Point Functions (Gradient) and its Geometrical Interpretation - Directional Derivative, Del Applied to Vector Point Function (Divergence and Curl) and their Physical Interpretation, Del Applied Twice to Point Function, Del Applied to Products of Point Functions. Integration of Vector, Tangential Line Integral, Normal Surface Integral, Volume integrals, Theorems of Green, Stokes and Gauss (without proofs) and their verifications and applications, Irrotational Fields, Solenoidal Fields.	**09 L**
UNIT-05	**Fourier Series** Euler's formula, Dirichlet's Conditions, Functions Having Points of Discontinuity, Change of interval, Expansion of odd and even periodic functions, Half-range series, Typical wave-forms, Parseval's formula, Practical harmonic analysis.	**06 L**

Course Outcomes

Upon successful completion of the course, the student will be able to

CO1: Understand and analyze the theoretical & practical aspects of matrices, Fourier series and calculus
CO2: Identify an appropriate technique to examine linear system of equations, behavior of series, extreme values of functions and interpret the line, surface and volume integrals
CO3: Learning the limitations, advantages and disadvantages of above mentioned topics. Formulate the problems on related topics and solve analytically
CO4: To apply the analytical techniques to express periodic functions as a Fourier series
CO5: Apply the concepts of matrices and calculus in various engineering problems
CO6: Demonstrate the concepts through examples and applications

Books and References

1. Advanced Engineering Mathematics by E. Kreyszig, John Wiley and Sons, NC, New York.
2. Thomas' Calculus by G.B. Thomas, M.D. Weir, J. Hass, Pearson Education India.
3. Advanced Engineering Mathematics by C.R. Wylie & L. C. Barrett, McGraw Hill.
4. Vector Calculus by C. E. Weatherburn, John Wiley and Sons, NC, New York.
5. Advanced Engineering Mathematics by R.K. Jain and S.R.K. Iyenger, Narosa Pub. House.
6. Differential & Integral Calculus by N. Piskunov, MIR Publications.

Course Name: **Engineering Mathematics-II**
Course Code: **MA-121**
Course Type: **Core**

Contact Hours/Week: **3L + 1T** Course Credits: **04**

Course Objectives

- To introduce the fundamental concepts relevant to Ordinary & Partial Differential Equations, Transform Theory and probability & Statistics
- To able to form and solve the ordinary & partial differential equation using different analytical techniques
- To have the idea of various transformations and their uses in engineering problems
- To incorporate the concept of probability to find the physical significance of various distribution phenomena

Unit Number	Course Content	Lectures
UNIT-01	**Ordinary Differential Equations** Brief review of ordinary differential equations, Exact equations, Equations reducible to exact equations, Equations of the first order and higher degrees, Clairaut's equation. Applications of ODEs in concerned engineering branch. Linear differential equations with constant co-efficient, Complimentary functions and particular integral, Method of variation of parameters, Equations reducible to linear equations with constant co-efficient (Cauchy's and Legendre's linear equations), Initial and Boundary value problems, Simultaneous linear equations with constant co-efficient, Applications of differential equations in concerned engineering branch.	**09 L**
UNIT-02	**Partial Differential Equations** Formulation of Partial Differential Equations (PDE), Solution of PDE, Linear PDE of First Order (Lagrange's Linear Equation), Non-linear Equation of First Order (Standard Forms), Charpit's Method, Homogeneous Linear Equations with Constant Coefficients, Non-homogeneous Linear Equations. Applications of PDE: Method of separation of variables, Solution of one dimensional wave and heat equation and two dimensional Laplace's equation.	**09 L**
UNIT-03	**Transforms Theory** Laplace Transform: Laplace Transforms of standard functions and their properties, Inverse Laplace Transforms, General Properties of inverse Laplace transforms and Convolution Theorem, Laplace Transforms of periodic functions, Dirac-delta Function, Heaviside's Unit Function, Solution of ODE and linear simultaneous differential equations using Laplace transforms. Fourier Transform: Fourier integral representation, Fourier sine, cosine and complex transform, Finite Fourier Transforms and their applications. Z – Transforms: Z–Transforms & its properties, inversion of Z – transform and applications of Z – transform.	**12 L**
UNIT-04	**Probability and Statistics** Review of probability, Conditional probability and sampling theorems, Discrete and Continuous Probability Distribution, Probability Mass & Probability Density Functions, Distribution function, Discrete and Continuous probability distributions, Binomial, Poisson and Normal distributions.	**06 L**

Course Outcomes

Upon successful completion of the course, the student will be able to

CO1: Understand and analysis the theoretical & practical aspects of Ordinary differential equations, PDE, Transform theory and Probability

CO2: Identify an appropriate technique to solve the ODE, PDE

CO3: Learning the limitations, advantages and disadvantages of ODE, PDE, various transforms and probability & Statistics

CO4: Apply the concepts of ODE, PDE, integral transform and probability theory in various engineering problems

CO5: Demonstrate the concepts through examples and applications

Books and References

1. Advanced Engineering Mathematics by E. Kreyszig, John Wiley and Sons, NC, New York.
2. Differential Equations by S. L. Ross, John Wiley & Sons, New York.
3. An Introduction to Probability Theory & its Applications by W. Feller, Wiley.
4. Probability and Statistics for Engineers and Scientists by R.E. Walpole, S. L. Myers and K. Ye, Pearson.
5. Integral Transforms and Their Applications by Lokenath Dennath and Dambaru Bhatta, Chapman and Hall/CRC Press.

Course Name: **Engineering Chemistry**
Course Code: **CY-101**
Course Type: **Core**

Contact Hours/Week: **3L + 1T** Course Credits: **04**

Course Objectives

- Develop an understanding of environmental pollution and hazards due to engineering/technological activities and general measures to control them
- To enable the students to understand about the fundamentals of of characterization techniques of different materials
- To familiarize the students about nanomaterials, their characterization and applications
- To make the students understand the principles of corrosion and its control
- To introduce the fundamentals of lubrication, different types of lubricants and their application

Unit Number	Course Content	Lectures
UNIT-01	**Environmental Science** Specifications of domestic and industrial water, water treatment, water quality parameters, waste/sewage water treatment, BOD, COD, Air quality standard, air pollution and its control, smog formation, photochemical smog, green house effect and Global Warming, Chemical pollutants, Carbon credit, Climate Change, Introduction to Environmental impact assessment	**12L**
UNIT-02	**Characterisation Techniques** Introduction to spectroscopy, UV-Visible spectroscopy- Absorption laws, Instrumentation, formation of absorption bands, Chromophore and auxochrome concept, application of UV-Visible spectroscopy; IR spectroscopy - Principle, selection rules, spectral features of some classes of compounds, important features of IR spectroscopy and application; Introduction to Thermal methods, instrumentation and applications (TGA, DTA, DSC)	**07L**
UNIT-03	**Nanochemistry** Introduction to nanochemistry: dependence of optical, electrical and magnetic properties on size of materials, various nanostructures; spherical nanoparticles, nanotubes, nanofibers, nanorods, etc, synthesis, properties and applications of following nanomaterials - Carbon based nanostructures – CNTs and graphene, semiconductors nanoparticles- TiO_2. Characterization of nanomaterials: atomic force microscopy (AFM), scanning electron microscopy (SEM)	**06L**
UNIT-04	**Corrosion and its Control** Introduction, Types of corrosion-chemical and electrochemical, Mechanisms of corrosion, factors affecting corrosion and different protection methods for corrosion control.	**06L**
UNIT-05	**Lubricants** Introduction, Mechanisms of lubrication, Types of lubricants, properties and different methods for testing of lubricant oils and greases.	**05L**

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1: Understand the various pollution control measures
CO2: Define and analyze engineering problems related to corrosion and metal finishing to achieve a practical solution
CO3: Identify instrumental techniques for analysis of different materials
CO4: Understand basic concepts of nanoscience and the applications of nanomaterials in various fields
CO5: Understand the mechanism of lubrication and choose a lubricant for a suitable application

Books and References

1. Spectrometric Identification of Organic Compounds by R. M. Silverstein, F. X. Webseter, and D. Kiemle, John Wiley & Sons
2. Organic Spectroscopy by W. L. Kemp, Palgrave.
3. Spectroscopy by D. L. Pavia, Cengage.
4. Engineering Chemistry by Jain & Jain, Dhanpat Rai Publishing Co.
5. A text Book of Engineering Chemistry by Shashi Chawla, Dhanpat Rai & Co.
6. Engineering Chemistry by S.Vairam and S. Ramesh, Wiley.
7. Nanotechnology, Principles and Practices by Sulabha K .Kulkarni, Capital Publishing Company.
8. Introduction to Environmental Engineering by M. Davis, D. Cornwell, Mcgraw-hill.

Course Name: **Basic Electrical Engineering**
Course Code: **EE-101**
Course Type: **Core**

Contact Hours/Week: **3L + 1T** Course Credits: **04**

Course Objectives

- To impart knowledge about the electrical quantities and to understand the impact of electricity in a global and societal context.
- To introduce the fundamental concepts relevant to DC and AC circuits and network theorems.
- Highlight the importance of electromagnetism and transformers in transmission and distribution of electric power.
- To explain the working principle, construction, applications of DC machines, AC machines & measuring instruments.

Unit Number	Course Content	Lectures
UNIT-01	**Analysis of DC Circuits:** Linear and non-linear circuits, circuit elements, various sources and source transformation, star delta transformation, solution of DC circuits using Kirchoff's laws, signal wave forms and passive elements specifications, Network theorems, response of first order circuits for DC excitation.	**07L**
UNIT-02	**AC Circuits, Domestic Electric Wiring & Storage Batteries:** Generation of AC sinusoidal voltage and currents, average and r.m.s. values, Form factor and peak factor, phasor representation in polar, rectangular and exponential forms, terminal relationship for pure passive elements and their combination in series and parallel, analysis of single phase series, parallel and series-parallel circuits, active and reactive power, power factor and volt-amperes, frequency response and Q-factor, analysis of balanced three phase AC circuits, concept of voltage, current and power in three phase balanced circuits, Basics of Domestic Electric Wiring and Storage Batteries.	**11L**
UNIT-03	**Electromagnetic Circuits and Transformer:** Magnetic circuit concept, B-H curves characteristics of magnetic materials, practical magnetic circuits, magnetic circuits with DC and AC excitation, hysteresis and eddy current losses, Magnetic force, self and mutual inductances, Faraday's laws, Lenz's Law, statically and dynamically induced emfs, energy stored in magnetic fields, Principle of Transformer operation, construction and equivalent circuit of transformer.	**09L**
UNIT-04	**Measuring Instruments:** Introduction to galvanometer (Moving coil and moving iron), ammeter, voltmeter, wattmeter, energy meter, use of shunt and multiplier.	**05L**
UNIT-05	**Electrical Machines:** Fundamentals of DC and AC machines.	**04L**

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1: Identify and predict the behavior of any electrical and magnetic circuit
CO2: Formulate and solve complex AC and DC circuits
CO3: Realize the requirement of transformers in transmission and distribution of electric power and other applications
CO4: Identify the type of electrical machines used for that particular application

Books and References

1. Fundamental of Electric Circuits by Charles K Alexander and Matthew N. O. Sadiku, TMH Publication.
2. Electrical Engineering Fundamentals by Vincent Del Toro, PHI Publication.
3. Basic Electrical Engineering by V N Mittal & Arvind Mittal, TMH Publication.
4. Basic Electrical Technology by A.E. Fitzgerald, McGraw Hill Publication.
5. Electrical Estimating and Costing by N Alagappan and B Ekambaram, TMH Publication.