Course Title: COMPLEX ANALYSIS, STATISTICS, PROBABILITY AND NUMERICAL TECHNIQUES			
Course Code: P18MA41	Semester: IV	L:T:P:H: 4:0:0:4	Credits: 4-0-0
Contact Period-Lecturer: 52Hrs. Exam: 3Hrs		Weightage:CIE:50%; SEE:50%	

(Common to all Branches)

Unit-1

Numerical Methods-II: Solution of algebraic and transcendental equations: Bisection method, Regula-Falsi & Newton-Raphson method. Fixed point iteration method: Aitken's Δ^2 - process - Illustrative examples only. Numerical solution of ordinary differential equations (ODE's): Numerical solutions of ODE's of first order and first degree – Introduction. Taylor's series method. Modified Euler's method, Runge - Kutta method of fourth order, Milne's and Adams-Bashforth predictor & corrector methods (All formulae without proof). Illustrative examples only.

Self-Study Component: Solution of second order ordinary differential equations using Runge-Kutta methods. Solution of first order simultaneous differential equations.

10 Hours

Unit-2

Numerical methods for system of linear equations- Gauss-Jacobi and Gauss- Seidel iterative methods. Relaxation method. Determination of largest Eigen value and corresponding Eigen vector by power method.Series solutions of ODE's and special functions:Power series solution of a second order ODE, Series solution-Frobenius method. Series solution of Bessel's differential equation leading to $J_n(x)$. Expansions for $J_{1/2}(x) and J_{-1/2}(x)$. Series solutions of Legendre's differential equation leading to $P_n(x)$- Legendre's polynomials. Rodrigue's formula (No Proof) - simple illustrative examples.

Self-Study Component: Basics of Series solutions of ODE's; analytic, singular point and basic recurrence relations.

10 Hours.

Unit-3

Complex Analysis: Introduction to functions of complex variables. Definitions- limit, continuity and differentiability. Analytic functions. Cauchy - Riemann equations in Cartesian and polar forms (no proof). Construction of analytic function using Milne-Thomson method. Harmonic functions –Problems. Applications of analytic function to flow problems. Conformal transformation – Definitions and Discussion of Transformations: w=z², w =e^z and w= $z + \frac{1}{z}$ ($z \neq 0$) and related problems. Bilinear transformation.

Self-Study Component: Derivation of Cauchy- Riemann equation in Cartesian and polar form.

11 Hours

Unit-4

Complex integration: complex line integrals. Cauchy theorem, Cauchy integral formula. Taylor's and Laurent's series (Statements only) and illustrative examples. Singularities, poles and residues. Cauchy residue theorem (statement only). Illustrative examples.Statistics: Brief review of measures of central tendency and dispersion. Moments, skewness and kurtosis. Curve fitting – least square method: $y = a + bx; y = ax^b, y = ab^x$ and $y = ax^2 + bx + c$. Correlation and **regression**.

Self-Study Component: Derivation of Cauchy theorem, Cauchy integral formula and Cauchy's residue theorem.Fit an equation of the **curves** of the type : $y = ae^{bx}$,

11 Hours

Unit-5

Probability Theory: Brief review of elementary probability theory. Random variables (discrete and continuous)-Introduction to probability distributions- probability mass/density functions and cumulative probability density functions – Illustrative examples. Discrete probability distributions- Binomial and Poisson's distributions; Continuous probability distributions - exponential and normal distributions. (No derivation of mean and variance). Illustrative examples from engineering and industrial fields.

Joint probability distributions and Markov chains: Concept of joint probability. Joint probability Distributions of discrete random variables. Expectation, Covariance, correlation coefficient – illustrativeExamples. Continuous joint probability distributions. Probability vectors, stochastic matrices. Fixed pointand regular stochastic matrices.

Self-Study Component : Basic definitions of probability and problems up to Bayes' theorem. Derivation of Mean and SD of Binomial &Poisson distribution.

10 Hours

Text Books:
1. **Higher Engineering Mathematics:** B.S. Grewal, Khanna Publishers, New Delhi, 42nd Ed. 2012.
2. **Advanced Engineering Mathematics: -** E. Kreyszig, John Wiley & Sons, 10th Ed., 2011

References:
1. **T. Veerarajan:** Engineering Mathematics, Tata McGraw-Hill Pub., 2003.
2. **Introductory Methods of Numerical Analysis: -** S.S.Sastry, PHI, 3rd Ed.2000.
3. **Linear Algebra and its applications: -** David C.Lay, Pearson Education Ltd., 3rd Edition, 2003.
4. **Seymour Lipschutz:Probability:-,** Schaum's outline series, McGraw-Hill Pub., 2nd Ed, 2002.
5. **Higher Engineering Mathematics: -** B.V. RAMANA, McGraw Hill Education, 2007

Course Articulation Matrix
Mapping of Course Outcomes (CO) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

Sem: 4		Course code : P18MAES41	Title : Engineering Mathematics –IV											
CO's		Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO-1		Solve algebraic, transcendental and ordinary differential equations arising in various engineering flow and design data problems, using numerical techniques along with physical interpretation of the solutions associated with initial/boundary conditions (UNIT-I)	2	2	-	-	-	-	-	-	-	-	-	-

CO-2	Learn logical thinking and analytical /geometrical skills in linear algebra through vector spaces, basis, dimension and linear transformations along with construction a matrix of linear transformations with respect change of Bases of same or different dimensions. Understand iterative methods in linear algebra such as Gauss-Jacobi, Gauss -Seidel, Relaxation and Power method and their practical utility in engineering fields(UNIT-II)	3	3	-	-	-	-	-	-	-	-	-	-
CO-3	Understand the basics of functions of complex variables, analytic functions, conformal and bilinear transformations, complex integration, line / surface / volume integrals and residue theorems with their scientific / engineering importance (UNIT-III)	3	3	-	-	-	-	-	-	-	-	-	-
CO-4	Apply the basic tools of statistics to understand curve fitting, moments, skewness, kurtosis, correlation and regression, for frequency distributions; explore the idea of probability, probability distributions, required in the analysis of engineering experiments (UNIT-IV)	2	2	-	-	-	-	-	-	-	-	-	-
CO-5	Apply the basic concepts of probability distributions to understand concept of joint probability and to find expectation covariance, correlation coefficient etc. and to understand probability vector, stochastic matrix etc. Obtain series solution of essential ODE's such as Bessel's and Legendre's differential equations and understand their scientific/engineering utility (UNIT-V)	3	3	-	-	-	-	-	-	-	-	-	-

Note: - Each unit contains two full questions of 20 marks each. Students are required to Answer any **five**full questions choosing at least **one** full question from each unit.