Detailed Syllabus
IV Semester (2018-19)

15UMAC400	**Engineering Mathematics-IV (4 - 0 - 0) 4 : 52 Hrs.**

Course Learning Objectives:

Learn to solve algebraic and transcendental equations numerically. Learn the concepts of finite differences and its applications. Learn the concept of special functions. Learn fitting of a curve, correlation, regression for a statistical data. Learn the basic concepts of probability, random variables and probability distributions. Learn the concepts of stochastic process and Markov chain.

Course outcomes:

COs	**Description of the course outcomes:** At the end of course the students will be able to	**Mapping to POs (1-12)**		
		Mastering 3	**Moderate 2**	**Introductory 1**
CO-1	Solve the problems of algebraic and transcendental equations using numerical methods.		1	
CO-2	Use numerical methods to solve first order differential equations.		1	
CO-3	Derive the solution of Bessel's differential equation, Legendre's differential equation.			1
CO-4	Analysis the bivariate statistical data and calculate correlation and regression. Apply concepts of probability to solve engineering problems.		13,14,15,16	1
CO-5	Recite Markov chains and describe stochastic process.		13,14,15,16	1,2

POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PO-13	PO-14	PO-15	PO-16

Mapping Level	.4	1											2	2	2	2

1 -> Introductory (Slight); 2 -> Reinforce (Moderate); 3 -> Mastering (Substantial)

Contents:

1. **Numerical Methods**

   Roots of equations: Regula Falsi method, Newton- Raphson Method, Finite differences: Forward, Backward and central differences. Newton Gregory forward and backward interpolation formulae. Striling's and Bessel's interpolation formulae. Lagrange's interpolation formulae. Numerical integration: Simpson's $1/3^{rd}$ rule and Weddle's rule, Solutions to Engineering problems. **10 Hrs**

2. **Numerical solution of O.D.E**

   Numerical solution of ordinary differential equations of first order and first degree, Picards method. Taylor's series method, modified Euler's method, Runge-Kutta method of fourth order. Milne's predictor and corrector methods (no derivations of formulae).

   Numerical solution of simultaneous first order ordinary differential equations: Picards method, Runge-Kutta method of fourth- order. **10Hrs**

3. **Special functions**

   Introduction to series solution, Series solution of Bessel's differential equation leading to Bessel function of first kind, orthogonal property of Bessel function, Series solution of Legendre's leading to Legendre's polynomial, Rodrigues formula.

   8 Hrs

4. **Statistics and probability**

   Curve fitting by the method of least squares: $y = a+bx$, $y = a+bx+cx^2$, $y = ab^x$, Correlation and regression.

   Random Variables: Discrete and continuous random variables-PDF-CDF-Binomial, Poisson, exponential and Normal distribution. Joint probability distribution of two discrete random variables.

   Sampling: Sampling distribution, standard error, test of hypothesis for means and population, confidence limits for means. *t*-Students distribution as a test of goodness of fit. **14 Hrs.**

5. Markov Chains

Markov chains –Introduction, probability vectors,Stochastic Matrices, Fixed points and Regular stochastic matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states. **10 Hrs.**

Reference Books:

1. Jain, Iyengar and Jain, Numerical Methods for Engg.&Scientist,PHI, 3rd edition, 2005.
2. Gupta S C and Kapoor V K, Fundamentals of Mathematical Statistics, 9th edition, Sultan Chand & Sons, New Delhi, 2002.
3. B. S.Grewal,Higher Engineering Mathematics-Khanna Publishers –40th edition– 2007.
4. Kreyszig E., Advanced Engineering Mathematics,8th edition, John Wiley & sons,2007.