Course code	Course Name	L-T-P - Credits	Year of Introduction
MA486	**ADVANCED NUMERICAL COMPUTATIONS**	**3-0-0-3**	**2016**

Prerequisite: NIL

Course Objectives.

1. To understand the role of approximation theory in engineering problems.
2. To familiarize various numerical methods for computation.
3. To understand the role of optimization in problem solving.

Syllabus:

Matrix Computations, Interpolation and approximation, Inner product and Norms, Nonlinear programming, Numerical Solution of Partial differential equations

Expected outcome

At the end of the course the student will be able to

(i) solve the linear system of equations
(ii) find the interpolation and approximations
(iii) apply various optimization methods in non linar programming
(iv) analyse the solution by finding the numerical solution of partial differential equations

Text Books:

1. B S Grewal, Numerical methods in Engineering and Science, Khanna Publishers
2. Sastry S.S., Introductory Methods of Numerical Analysis ,Fifth Edition, PHI, 2012
3. Singiresu .S. Rao, Engineering Optimization: Theory and Practice, 3rd edition,New age international publishers.

References:

1. David K. Ruch and Patrick J. Fleet, Wavelet Theory, An Elementary Approach With Applications, John Wiley, 2009
2. Howard Anton and Chris Rorres, Elementary Linear Algebra, 11th Edition, Wiley India, 2014
3. P. Kandasamy and K Thilagavathi: Numerical methods: S CHAND Publishers.
4. Stephen Andrilli and David Hecker, Elementary Linear Algebra, 4th edition, Academic Press,2010
5. Stevwn C. Chapra and Raymond R. Canale, Numerical methods for engineer, Seventh Edition, McGraw-Hill, 2015.

Module	Syllabus	Hours	End Sem. Exam Marks
I	**Matrix Computations:** Solving linear system: Factorization method, Relaxation method. Singular value decomposition, Matrix Eigen Value problem, Power method, Jacobi's method.	7	15%
II	**Inner product and Norms**: Inner product spaces, properties of inner product, length, distance and norms, Matrix norms, Cauchy–Schwarz inequality, Orthogonality, Gram-Schmidt Process, Orthogonal projection.	7	15%
FIRST INTERNAL EXAMINATION			
III	**Interpolation:** Finite difference operators, interpolation using divided difference. Numerical differentiation: derivatives from difference table (finite difference and divided difference). Evaluation of double integrals Trapezoidal and Simpsons rule.	7	15%

IV	**Nonlinear programming:** One dimensional minimization methods. Unimodal functions. Elimination methods: Unrestricted search method, Fibonacci method, Golden section methods. Interpolation methods: Quadratic interpolation method. Direct root method: Newton method.	7	15%
SECOND INTERNAL EXAMINATION			
V	**Nonlinear programming (Contd.)**: Unconstrained optimization techniques: Direct search method: random search methods, Grid search method, Univariate method. Indirect search methods: Conjugate gradient method(Fletcher –Reeves method), Newton's method, Marquardt method	7	20%
VI	**Numerical Solution of PDE:** Finite difference approximation of partial derivatives, classification of second order P.D.E. Solution of Elliptic equation-Laplace equation. and Poisson equation. Solution of parabolic equation-One dimensional heat equation (Crank Nicholson scheme). Solution of Hyperbolic equation-wave equation.(Method of finite differences)	7	20%
END SEMESTER EXAMINATION			

Question Paper Pattern

(End semester examination)

Time : 3 hours **Maximum marks: 100**

The question paper shall consist of Part A, Part B and Part C.

Part A shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

Part B shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

Part C shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks)