

ME5501: Mathematics for Engineers
Mechanical Engineering, IIT Palakkad
2019-20, I Semester

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Class Timings: T 10 – 11 AM, W 12 – 1 PM, F 8 – 9 AM, Room 203 (Transit Campus)

Evaluation:

Test 1:	30
Test 2:	30
End Sem:	40
Pass Marks:	40

Homework will be assigned every alternate Fridays (unless topics covered in two weeks is inadequate). Discussion among peers is strongly encouraged for gaining better understanding. However, do not blindly copy answers.

Course objective:

Upon the successful completion of this course:

- a) Students will acquire sound background on the mathematical techniques and numerical tools for solving system of algebraic and ordinary differential equations.
- b) They will learn the language of indicial notation and tensor operations.
- c) They will be able to analyze data obtained from experiments or field trials. Apply the knowledge to the quality control of engineering products.

Course content (number in the parenthesis indicate approximate number of lectures)

i) Introduction to the course (1)

ii) Linear Algebra (9)

- a) Linear system of equations, Gauss elimination, LU Decomposition, Iterative Methods
- b) Rank of a matrix, Determinants, Inverse of a matrix, Gauss-Jordan elimination
- c) Eigenvalue Problems: Eigenvalues and eigenvectors of a matrix, (using orthogonal matrices and iterative methods)
- d) Symmetric, Skew symmetric and orthogonal matrices
- e) Eigenvectors basis, diagonalization, quadratic forms

iii) Vector and Tensor Calculus (9)

- a) Introduction to Index Notation and Tensors
- b) Tensor product and Dyadic notation
- c) Scalar, vector and tensor fields
- d) Derivatives including tensor derivative of a scalar field, Gradient of scalar and vector fields, Directional Derivative, Divergence, Curl
- e) Green's theorem, Divergence theorem, Stoke's theorem

iv) Ordinary Differential Equations (8)

- a) First order ODEs
- b) Linear ODEs of 2nd and higher order with constant coefficients
- c) System of ODEs
- d) Series solution and Laplace transform methods for ODEs

v) Numerical Methods (9)

- a) Solution of a single non-linear algebraic equation and system of non-linear algebraic equations;
- b) Numerical Integration.
- c) Numerical methods for first order ODEs;
- d) Numerical methods for systems and higher order ODEs

vi) Probability and Statistics (7)

- a) Probability, Random Variables

- b) Probability Distributions
- c) Mean and variance of distributions
- d) Random Sampling, Point estimation of parameters
- e) Acceptance Sampling, Goodness of Fit, Chi square test,
- f) Regression Analysis (linear).

References:

E Kreyszig, 2011. Advanced Engineering Mathematics, John Wiley & Sons, Inc. ISBN 978-0-470-45836-5,

G. Strang, 2005. Linear Algebra and Its Applications, Cengage Learning. ISBN 978-0030105678

A. J. McConnel, 2003. Applications of Tensor Analysis, Dover Publications Inc. ISBN 978-0486603735