EMAT102L:Linear Algebra and Ordinary Differential Equations

Instructors:
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Course content for Linear Algebra

- Review of Matrices, Review of Basic properties of determinant, Cofactor expansion, Invertible matrices, Determinant method for finding inverse of a matrix, Cramer's Rule, Rank of a matrix, Elementary matrices, Gauss-Jordon method for finding inverse of a matrix, System of linear equations, Gauss elimination method, Solvability of system of linear equations.
- Vector space, Subspace and Examples, Linear span, Linear independence and dependence and Examples, Basis, Dimension, Extension of a basis of a subspace, Intersection and sum of two subspace, Examples.
- Linear transformation, Kernel and Range of a linear map, Rank-Nullity Theorem, Row and column spaces, some applications,
- Inner product, Cauchy-Schwartz inequality.

Course content for Linear Algebra

- Orthogonal basis, Gram-Schmidt orthogonalization process, Orthogonal projection, Orthogonal complement, Projection theorem, Fundamental subspaces. Fundamental subspaces and their relations, An application (Least square solutions and least square fittings).
- Eigen-values, Eigen- Vectors, Characterization of a diagonalizable matrix, Diagonalization: Example, An application. Diagonalization of a real symmetric matrix, Representation of a real linear map by matrices.

Course content for Ordinary Differential Equations

- Introduction to DE, Order of DE, First Order ODE $F(x, y, y') = 0$. Concept of solution (general solution, singular solution, implicit solution etc.) Geometrical interpretations (direction fields), Separable form, Reduction to separable form, Exact equations, Integrating factors, Linear equations, Bernoulli equation, orthogonal trajectories, Picard's existence and uniqueness theorem (without proof), Picard's iteration method, Second order linear ODE: fundamental system and general solutions of homogeneous equations, Wronskian, Reduction of order, Characteristic equations: real distinct roots, complex roots, repeated roots, Non-homogeneous equations: Undetermined coefficients and Variation of parameters.

Course content for Ordinary Differential Equations

- Extension to higher order differential equations, Euler-Cauchy equation, Real analytic solutions of Linear second order equations, Linear system of Differential equations: Fundamental matrix and Linearly independent solutions,Laplace transform: Laplace and inverse Laplace transforms, First shifting theorem, Existence, Transforms of derivative and integral,Laplace transform: Differentiation and Integration of transforms, unit step function, Second shifting theorem, Laplace transform: Convolution and applications, Initial value problems.

Text and references

- Linear Algebra - G. Strang, "Introduction to linear algebra", 4th Edition, Brooks/Cole India, 2006, ISBN: 978-0030105678, 0030105676.
- Linear Algebra - K. Hoffman and R. Kunze, "Linear Algebra", 2nd Edition, Prentice Hall India, 2004, ISBN: 9789332550070, 9332550077.
- Ordinary Differential Equations - E. Kreyszig, "Advanced Engineering Mathematics", John Wiley Sons, 10th edition,2010, ISBN: 978-0470458365,0470458364.
- Ordinary Differential Equations - G.F. Simmons, "Differential equations with applications and historical notes", 2nd Edition, 2002, ISBN: 978-0070530713, 0070530718.
- Ordinary Differential Equations- E. A. Coddington, "An Introduction to Ordinary Differential Equations", Dover Publication, 1989,ISBN: 9780486659428.
- Ordinary Differential Equations - S. L. Ross, "Differential Equations", 3rd Edition, Wiley India, 1984, ISBN: 9788126515370, 8126515376.

Evaluation policy

Evaluation policy of the course

- Quiz Tests: 30
- Mid Term: 30
- End Term: 40