**Linear Algebra ( MA15001 )**

F.Y.B. Tech. Semester I (All Branches) 2019-20

**Teaching Scheme :** Lectures : 2hrs/week + Tutorial : 1 hr / week

**Examination Scheme :** Continuous evaluation: 40 (20+20) marks, End Sem. Exam : 60 marks

**Text book: 1. (Tb1) - Introduction to Linear Algebra (2nd edition) by Serge Lang, Springer.**

**Unit 1: Matrices and Linear Equations, Vector spaces**

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| **Lesson no.** | **Topic** | **Section nos. and books to be referred** |
| 1 | Matrices and linear equations: basic properties of matrices  | Tb1, Chapter II, section1, section 2 |
| 2  | Homogeneous linear equations and elimination, Theorem 3.1  | Tb1, Chapter II, section 3 |
| 3 | Row operations and Gauss elimination, Theorem 4.1, Theorem 4.2 , examples | Tb1, Chapter II, section 4 |
| 4 | Basic concepts in linear algebra: vector spaces, definitions, subspaces | Tb1, Chapter III, section 1 |
| 5 | Linear Combinations, linear dependence/ independence of vectors | Tb1, Chapter III, section 2, section 4 |
| 6 | Basis and Dimension | Tb1, Chapter III , section 5 |
| 7 | Row and Column spaces, Rank of the matrix | Tb1, Chapter III, section 6 |
| 8 | \* Basic properties of determinants, Theorem 1.1, determinants of order n, Theorem 2.1 (SELF STUDY) | Tb1, Chapter VII, section 1, section 2 |
| 9 | Theorem 2.2, rank of the matrix and sub-determinants, Theorem 3.1, corollary 3.2 and examples | Tb1, Chapter VII, section 3 |
| 10 | \* Applications to system of linear equations (SELF STUDY) |  ( Notes will be provided.) |

**Unit II: Mappings, Rank, Eigen values and Eigen vectors**

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| **Lesson no.** | **Topic** | **Section no. of text book**  |
| 1 | Mappings: Definition and examples | Tb1, Chapter IV, section 1 |
| 2 | Linear mappings: Examples and properties | Tb1, Chapter IV, section 2 |
| 3 | Co-ordinates of a linear map, Proposition (2.1), The vector space of linear maps | Tb1, Chapter IV, section 2 |
| 4 | Kernel and images of a linear map, Theorem 3.1 and 3.2 | Tb1, Chapter IV, section 3 |
| 5 | The rank and linear equations, Theorems: 4.1, 4.2, 4.3, 4.4 | Tb1, Chapter IV, section 4 |
| 6 | Matrix associated with a linear map, change of bases, Eigen values and Eigen vectors | Tb1, Chapter IV, section5. Chapter VIII, section 1 |
| 7 | Eigen values, Eigenvectors and their basic properties, The characteristic polynomial, Theorems: 2.1, 2.2 | Tb1, Chapter VIII, section 1, section 2 |
| 8 | Eigen values and eigenvectors of symmetric matrices, Theorems: 3.1, 3.2, Corollary 3.3, Theorem 3.4 | Tb1, Chapter VIII, $3 |

**Unit III : Inner product spaces, canonical forms. quadratic forms**

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| **Lesson no.** | **Topic** | **Section no. of text book**  |
| 1 | Scalar products, Theorem 1.1 & 1.2 | Tb1, Chapter VI, section 1 |
| 2 | Theorem 1.3 & 1.4, Orthogonal bases | Tb1, Chapter VI, section 1, section 2 |
| 3 | Gram-Schmidth process: Theorem 2.1, corollary 2.2 | Tb1, Chapter VI, section 2 |
| 4 | Theorem 2.3 | Tb1, Chapter VI, section 2 |
| 5 | Diagonalization of symmetric linear map and Theorem 4.1 and examples | Tb1, Chapter VIII, section 4 |
| 6 | \*Geometric applications of linear transformations (SELF STUDY) | ( Notes will be provided.) |
| 7, 8 | Quadratic forms: Positive definiteness | Rb1, page no. 348-358 |

**Topics marked with \* are self study topics. Questions based on these topics will be asked in exams.**

Reference Books :

* **(Rb1) - Linear Algebra and its Applications (4th edition) by Gilbert Strang, Cengage Learning (2006) .**
* Linear Algebra A geometric approach by S. Kumaresan, Prentice hall of India, New Delhi.
* Linear Algebra (3rd edition) by Serge Lang, Springer.
* Elementary Linear Algebra (10th edition) by Howard Anton and Chris Rorres, John Wiley and sons.
* Schaum’s outlines of Linear Algebra (5th edition) by Seymour Lipchitz, Marc Lipson, McGraw-Hill Education (India) Private Limited, New Delhi.
* Linear Algebra by Hoffman and Kunze, (2nd edition) Prentice Hall Publication, New Delhi.
* Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley eastern Ltd.
* Advanced Engineering Mathematics by Chandrika Prasad and Reena Garg, Khanna Publishing Company Private Limited, New Delhi.

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 **Important Note :**

* Two tests T1 and T2 (Each of 20 marks) and end semester examination will be conducted as follows.

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| Exam | Day and Date | Syllabus |
| T1 | To be announced later | Unit 1  |
| T2 | To be announced later |  Unit 2 |
| End Semester Exam | To be announced later | All Units |

* 100% attendance is compulsory.