**College of Engineering, Pune-5**

**Department of Mathematics**

**( MA15001 ) Linear Algebra**

F.Y. B.Tech. Semester I (All Branches)

Teaching Scheme Examination Scheme

Lectures : 2 hrs / week Internal Test 1: 20 marks

Tutorial: 1 hr / week Internal Test 2: 20 marks

End Sem. Exam: 60 marks

**Objectives :** Basic necessity for the foundation of Engineering and Technology being mathematics, the main aim is, to teach mathematical methodologies and models, develop mathematical skills and enhance thinking power of students.

**Unit I :** Matrices and linear equations: basic properties of matrices, row operations and Gauss elimination, Determinants and their basic properties. Basic concepts in linear algebra: vector spaces, subspaces, linear independence and dependence of vectors, bases, dimensions. Row and Column spaces, rank. Applications to systems of linear equations. **[10 Hrs]**

**Unit II :** Linear mappings, representation by matrices, rank-nullity theorem, Eigen values, Eigen vectors and their basic properties.  **[08 Hrs]**

**Unit III :** Inner product spaces, orthogonality, Gram-Schmidt process, Diagonalization of special matrices, Geometric applications of Linear transformation, quadratic forms: positive definiteness.

**[08 Hrs]**

**Text Book** **:**

* Introduction to Linear Algebra (2nd edition) by Serge Lang, Springer.

**Reference Books** **:**

* Linear Algebra (3rd edition) by Serge Lang, Springer.
* Linear Algebra A geometric approach by S. Kumaresan, Prentice hall of India, New Delhi.
* 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 Lipschutz, 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.
* Linear Algebra and its applications (4th edition) by Gilbert Strang, Cengage Learning (RS).
* Advanced Engineering Mathematics by Chandrika Prasad and Reena Garg, Khanna Publishing Company Private Limited, New Delhi.

-----------------------------------------------------------------------------------------------------------------**Outcomes :** Students will be able to

1. know and recall core knowledge of the syllabus. ( To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
2. understand basic concepts. ( To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
3. analyze the problem and apply the appropriate concept. ( To measure this outcome, questions will be based on applications of core concepts)
4. give reasoning. ( To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
5. apply core concepts to new situations. ( To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

Note:

All the Course outcomes 1 to 3 will be judged by 75% of the questions and outcomes 4 and 5

will be judged by 25 % of questions.