College of Engineering Pune
(An Autonomous Institute of Government of Maharashtra, Pune-411005)
Department of Mathematics
(MA 16003) Linear Algebra and Univariate Calculus
S.Y. B. Tech. (for Students Directly admitted to S.Y. after their Diploma)
Semester III (All Branches)

Teaching Scheme	Examination Scheme
Lectures : 4 hrs / week	Internal Test 1: 20 marks
Tutorial : 1 hr / week	Internal Test 2: 20 marks
	End Sem. Exam: 60 marks

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. Rank of a matrix . Applications to systems of linear equations. **[15 Hrs]**

Unit II : Rank-nullity theorem, Eigen values, Eigen vectors and their basic properties, diagonalization. **[12 Hrs]**

Unit III : Review of limits, continuity and differentiability, Mean value theorems, Taylor's theorem, local extrema, increasing and decreasing functions, concavity, points of inflection. **[12 Hrs]**

Unit IV : Surface area, integrals by special techniques: reduction formulae, arc length, solids of revolution, improper integrals, tests for convergence, Gamma and Beta functions. **[13 Hrs]**

Text Books :

- Thomas' Calculus (14th edition) by Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education.
- Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley eastern Ltd.

Reference Books :

- Introduction to Linear Algebra (2nd edition) by Serge Lang, Springer.
- Elementary Linear Algebra (10th edition) by Howard Anton and Chris Rorres, John Wiley and sons.
- Calculus for Scientists and Engineers by K.D Joshi, CRC Press.
- A Course in Calculus and Real Analysis (1st edition) by Sudhir Ghorpade and Balmohan Limaye, Springer-Verlag, New York.

- Advanced Engineering Mathematics by C.R. Wylie, McGraw Hill Publications, New Delhi.
- Advanced Engineering Mathematics (7th edition) by Peter V. O' Neil, Thomson.Brooks / Cole, Singapore.
- Differential Calculus by Shanti Narayan, S. Chand and company, New Delhi.
- Applied Mathematics Vol. I (Reprint July 2014) by P.N. Wartikar and J.N. Wartikar, Pune Vidyarthi Griha Prakashan Pune.
- Advanced Engineering Mathematics by Chandrika Prasad and Reena Garg, Khanna Publishing Company Private Limited, New Delhi.

Outcomes : Students will be able to

1. **know** matrices, linear equations, and determinants, **recall** basic vector algebra, differentiability of functions of single variable, and mean value theorems.
2. **understand** basic concepts such as vector spaces, linear dependence / independence of vectors, basis.
3. **analyze** and **calculate** eigen values, eigen vectors, rank nullity of a matrix, **sketch** function graphs, **evaluate** improper integrals, **calculate** integrals using special techniques, **apply** various tests of convergence.
4. **prove** theorems, **evaluate** length / area / volume using single integrals.
5. **apply** concepts of linear algebra and univariate calculus to various applications including real life problems.

Note 1 :
- To measure CO1, questions may be of the type- define, identify, state, match, list, name etc.
- To measure CO2, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.
- To measure CO3, questions will be based on applications of core concepts.
- To measure CO4, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.

- To measure CO5, some questions may be based on self-study topics and also comprehension of unseen passages.

Note 2 :

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.