**College of Engineering, Pune-5.**

**Department of Mathematics**

 **(MA ) Multivariate Calculus and Differential Equations**

S.Y. B. Tech. (for Students Directly admitted to S.Y. after their Diploma)

Semester IV (All Branches)

Teaching Scheme Examination Scheme

Lectures : 4 hrs / week Internal Test 1: 20 marks

Tutorials : 1hr / 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 :** Functions of several variables, level curves and level surfaces, partial and directional derivatives, differentiability, chain rule, local extreme values and saddle points. **[06 Hrs]**

**Unit II :** Double integrals in Cartesian and polar co-ordinates, iterated integrals, change of variables, triple integrals in Cartesian, spherical and cylindrical co-ordinates. **[11 Hrs]**

**Unit III :** Vector differentiation, gradient, divergence and curl, line and surface integrals, path independence, statements and illustrations of theorems of Green, Stokes and Gauss. **[10 Hrs]**

**Unit IV :** Review of first order differential equations, linear differential equations, homogeneous higher order linear differential equations, non-homogeneous higher order linear differential equations with constant coefficients (method of undetermined coefficients and method of variation of parameters). **[09 Hrs]**

**Unit V :** Laplace Transforms, its properties, Unit step function, Dirac delta functions, Convolution Theorem, periodic functions, solving differential equations using Laplace transform. **[07 Hrs]**

**Unit VI :** Partial differential equations with separation of variables, boundary value problems: vibrations of a string, one dimensional heat equation. **[07 Hrs]**

**Text Books** **:**

* Thomas’ Calculus (12th 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** **:**

* Calculus for Scientists and Engineers by K.D Joshi, CRC Press.
* A Course in Multivariate Calculus and Analysis by Sudhir Ghorpade and Balmohan Limaye, Springer Science and Business Media.
* Differential Equations with Applications and Historical notes by George Simmons, Tata Mc-Graw Hill publishing company Ltd, New Delhi.
* Functions of several variables by Wendell Fleming, Springer-Verlag, New York.
* Partial Differential Equations (4th edition) by Fritz John, Springer.
* 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.
* Advanced Engineering Mathematics (2nd edition) by Michael D. Greenberg, Pearson Education.
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**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:

Some topics from the syllabus will be taught from the notes prepared by Prof. K.D. Joshi (Emeritus Professor, COEP).

 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.