

College of Engineering Pune
(An Autonomous Institute of Government of Maharashtra, Pune-411005)
Department of Mathematics

(MA 20002) Vector Calculus and Partial Differential Equations

S.Y. B. Tech. Semester IV (All Branches)

Teaching Scheme

Lectures : 2 hrs / week

Tutorial : 1 hr / week

Examination Scheme

Internal Test 1: 20 marks

Internal Test 2: 20 marks

End Sem. Exam: 60 marks

Unit I : Double integrals in Cartesian and polar co-ordinates, iterated integrals, change of variables, triple integrals in Cartesian, spherical and cylindrical co-ordinates, substitutions in multiple integrals, Applications to Area, Volume, Moments and Center of Mass. **[10 Hrs]**

Unit II : Vector differentiation, gradient, divergence and curl, line and surface integrals, path independence, statements and illustrations of theorems of Green, Stokes and Gauss, arc length parameterization, applications. **[07 Hrs]**

Unit III : Partial differential equations with separation of variables, boundary value problems: vibrations of a string, heat equation, potential equation, vibrations of circular membranes. **[09 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 :

- Advanced Engineering Mathematics by C.R. Wylie, McGraw Hill Publications, 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 (7th edition) by Peter V. O' Neil, Thomson.Brooks / Cole, Singapore.
- Advanced Engineering Mathematics (2nd edition) by Michael D. Greenberg, Pearson Education.
- 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** double / triple integrals, vector differentiation, vector integration, partial differential equations.
2. **understand** basic concepts of co-ordinate systems, iterated integrals, gradient, divergence and curl.
3. **evaluate** multiple integrals, **find** area / mass / volume using multiple integrals, **evaluate** line integrals and surface integrals.
4. **prove** theorems, **apply** Green's / Stoke's / Divergence theorem to different type of problems, **model** one dimensional heat / wave equations, **solve** partial differential equations.
5. **apply** concepts of vector calculus and partial differential equations 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.