College of Engineering Pune
(An Autonomous Institute of Government of Maharashtra, Pune-411005)
Department of Mathematics
(MA-19003) Univariate Calculus
F.Y. B. Tech. Semester II (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 : Review of limits, continuity and differentiability of univariate functions, Mean value theorems, Taylor's theorem, local extrema, increasing and decreasing functions, concavity, points of inflection, Jensen's inequality. **[05 Hrs]**

Unit II : Integrals as limits of Riemann sums, fundamental theorem of calculus, logarithm and exponential functions through integrals, integrals by special techniques: reduction formulae, arc length, solids of revolution, surface area, improper integrals, Gamma and Beta functions, tests for convergence. **[07 Hrs]**

Unit III : Sequences, recursively defined sequences, limits, subsequences, monotone sequences, infinite series, tests for convergence (Geometric series, p-series test, Ratio test, Root test, Comparison test, Leibnitz's test for alternating series), absolute convergence, power series and its convergence. Fourier series: definition, full and half range expansions of functions of arbitrary period. **[14 Hrs]**

Text Books :

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

Reference Books :

- Calculus for Scientists and Engineers by K.D Joshi, CRC Press.
- A Course in Calculus and Real Analysis (1^{st} 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 (7^{th} 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. **list** continuity / differentiability conditions for functions of single variable, **state** mean value theorems, **know** sequence and series.
2. **understand** basic concepts of Riemann sums, fundamental theorem of calculus, convergence of sequence and series.
3. **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, **find** Fourier series expansions.
5. **apply** concepts of 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.