

Objective: This course is designed to develop the topics of differential and integral calculus and Group theory. Emphasis is placed on basic concepts of Group theory, limits, continuity, derivative and integration of certain types of functions. Students are expected to have a clear understanding of the ideas of calculus and Group theory as a solid foundation for subsequent courses in chemistry as well as for direct application to real life situation.

Credits Earned: 5 Credits

Course Outcomes: After completion of this course, student will be able to

- Solve various kinds of problems related with one variable polynomials.
- Understand idea of limit, continuity, derivative and integration.
- Recognize the basic concepts such as Groups, Sub-groups, Abelian groups, permutation groups, cyclic groups etc.
- Produce examples and counter examples illustrating the mathematical concepts in the course.

Teaching and Examination Scheme

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial/ Practical Marks | | Total Marks |
|-------------------------|----------|-----------|---------|--------------|-------------|--------------|---------------------------|----------------|-------------|
| Theory | Tutorial | Practical | | ESE (E) | Mid Sem (M) | Internal (I) | Viva (V) | Term work (TW) | |
| 4 | 2 | - | | 50 | 30 | 20 | 25 | 25 | 150 |

Contents:

Chemistry

| Unit | Topics | Contact Hours |
|--------------------|---|---------------|
| 1 | Polynomials Definition of polynomial in one variable; its coefficients with examples and counter examples; degree of a polynomial; zero polynomial; constant, linear, quadratic and cubic polynomials; factors and multiples; roots of a polynomial; use of Remainder theorem and factor theorem; factorisation of $ax^2 + bx + c$, $a \neq 0$ and cubic polynomials; Nature of roots based on discriminant; Relation between roots of the equation and coefficient of the terms in the equation Equations reducible to quadratic form. | 14 |
| 2 | Differential Calculus: Limits and continuity, Intuitive idea of limit; Limit of a function – Concept, fundamental results, important limits; Continuity of a function – at a point, in an interval, discontinuous functions | 10 |
| 3 | Differential Calculus: Differentiation Concept of derivatives, slope, relation between continuity and differentiation. Differentiation techniques – first principle, standard formulae, product rule, quotient rule, chain rule | 10 |
| 4 | Integral Calculus: Integration Concept, integral as anti-derivative, properties of integrals; Integration of some standard functions, Some standard methods of Integration. | 10 |
| 5 | Statistics and Probability: Measure of Central tendency, Histogram etc., Data Interpretation, Measure of Dispersion, Correlation and Regression. Axioms of Probability. | 16 |
| Total Hours | | 60 |

Recommended Books:

1. George B. Thomas, Maurice D. Weir and Joel R. Hass, Thomas' Calculus, 13th Edition. Pearson education, 2014.
2. Shanti Narayan and P K Mittal, Differential Calculus, Reprint. New Delhi: S. Chand and Co. Pvt. Ltd., 2014
3. Shanti Narayan and P K Mittal, Integral Calculus, Reprint. New Delhi: S. Chand and Co. Pvt. Ltd., 2013.
4. I.H. Sheth, Abstract algebra, PHI Learning Pvt. Ltd., 2004.
5. I. N. Herstein, Topics in Algebra, 4th edition New Delhi, India: Vikas Publishing House Pvt. Ltd, 1991.
6. Gorakh Prasad, Differential calculus Benares Mathematical Society, 1944
7. Gorakh Prasad, Integral calculus pothishala, 1967

Suggested Theory distribution:

Chemistry

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|------------|-------|---------|----------|--------|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 20% | 20% | 30% | 15% | 10% | 5% |

Instructional Method:

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

1. <http://www.themathpage.com/>
2. <http://www.abstractmath.org/>
3. <http://ocw.mit.edu/courses/mathematics/>
4. <http://planetmath.org/encyclopedia/TopicsOnCalculus.html>
5. <http://ocw.mit.edu/OcwWeb/Mathematics/18-01Fall-2005/CourseHome/index.html>
6. <http://mathworld.wolfram.com/Calculus.html>