# Government PG College, Ambala Cantt

## Course File(Session 2023-24)

## Name of Assistant Professor: Ms. Neha Rani

## Class: B.A./B.Sc. II Year/3rd semester

## Section: Non Medical & Computer Science

## Subject Code and Name: BM-231/Advanced Calculus

### SYALLBUS

| B.Sc. | B.A. |
|---|---|
| External: 40 | External: 27 |
| Internal: 10 | Internal: 06 |

### Time: 3 Hours

**Note:** Examiner will be required to set nine questions in all. First question will be compulsory, consisting of objective type/short-answer type questions covering the entire syllabus. In addition to that eight more questions will be set, two questions from each Unit. A candidate will be required to answer five questions in all, selecting one question from each unit in addition to compulsory Question No. 1. All questions will carry equal marks.

### UNIT – I

Continuity, Sequential Continuity, Properties of continuous functions, Uniform continuity, Chain rule of differentiability. Mean value theorems: Rolle's Theorem and Lagrange's mean value theorem and their geometrical interpretations. Taylor's Theorem with various forms of remainders, Darboux intermediate value theorem for derivatives, Indeterminate forms.

### UNIT – II

Limit and continuity of real valued functions of two variables. Partial differentiation. Total Differentials: Composite functions & implicit functions. Change of variables. Homogenous

functions & Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables.

## UNIT – III

Differentiability of real valued functions of two variables. Schwarz and Young's theorem. Implicit function theorem. Maxima, Minima and saddle points of two variables. Lagrange's method of multipliers.

## UNIT – IV

Curves: Tangents, Principal normals, Binormals, Serret-Frenet formulae. Locus of the centre of curvature, Spherical curvature, Locus of centre of Spherical curvature, Involutes, evolutes, Bertrand Curves. Surfaces: Tangent planes, one parameter family of surfaces, Envelopes.

### Books Recommended:

1. C. E. Weatherburn: Differential Geometry of three dimensions, Radhe Publishing House, Calcutta

2. Gabriel Klaumber :Mathematical analysis, Mrcel Dekkar, Inc., NewYork,1975

3. R. R. Goldberg: Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970

4. Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad

5. S. C. Malik: Mathematical Analysis, Wiley Eastern Ltd., Allahabad.

6. Shanti Narayan: A Course in Mathemtical Analysis, S. Chand and company, New Delhi

7. Murray, R. Spiegel: Theory and Problems of Advanced Calculus, Schaum Publishing Co., NewYork

**COURSE OBJECTIVES**

The course objectives outlined are as follows:

1. To understand Different indeterminate forms of limit.

2. Calculate functional value in neighbourhood of some point using expensions.

3. To understand the behaviour of curve in space.

4. Continuity and Limits - Prove convergence and divergence of limits using the $\epsilon$-$\delta$ definition.

5. Differentiation - Identify and prove basic facts about derivatives and their properties.

6. To understand the maximum and minimum behaviour of a function of two variables.

**COURSE OUTCOMES**

After the successful completion of the course, students will be able to:

1. The student is expected to learn about the basic principles of multi-variable calculus with proofs.
2. To have full knowledge of calculus involving the fundamental tools such as continuity and differentiability.
3. Students are able to reason rigorously in mathematical arguments. They can follow abstract mathematical arguments and write their own proofs.
4. To know Relationship between the increasing and decreasing behavior of function and the sign of derivative of function.
5. Students are able to effectively communicate mathematics: reading, writing, listening, and speaking. Students make effective use of the library, conduct research and make oral and written presentations of their findings.

# Lesson Plan

From August 2023 to November 2023

| Week No | Scheduled Dates | Topics to be covered |
|---|---|---|
| 1. | 24-29 July | Indeterminate Forms |
| 2. | 31-5 August | Continuity, Sequential Continuity |
| 3. | 7-12 August | Properties of continuous functions, Uniform continuity |
| 4. | 14-19 August | Chain rule of differentiability, Rolle's Theorem and its geometrical interpretations. |
| 5. | 21-26 August | Lagrange's mean value theorem and their geometrical interpretations. |
| 6. | 28-02 September | Taylor's Theorem with various forms of remainders, Darboux intermediate value theorem for derivatives |
| 7. | 4-9 September | Limit and continuity of real valued functions of two variables. |
| 8. | 11-16 September | Partial differentiation. Total Differentials: Composite functions & implicit functions. Change of variables. |
| 9. | 18-23 September | Homogenous functions & Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables. |
| 10. | 25-30 September | Differentiability of real valued functions of two variables. Schwarz and Young's theorem. Implicit function theorem. |
| 11. | 2-7 October | Maxima, Minima and saddle points of two variables. |
| 12. | 9-14 October | Lagrange's method of multipliers. |
| 13. | 16-21 October | Curves: Tangents, Principal normals, Binormals |
| 14. | 23-28 October | Serret-Frenet formulae |
| 15. | 30-04 November | Locus of the centre of curvature, Spherical curvature, Locus of centre of Spherical curvature, Involutes, evolutes, |
| 16. | 06-09 November | Bertrand Curves. Surfaces: Tangent planes, one parameter family of surfaces, Envelopes. |
| 17. | 10-16 November | **Diwali Vacations** |
| 18. | 17--24 November | Final Test, Assignments and REVISION of Contents |
| **Exams Starts** | | |