

A.P. State Council of Higher Education  
Semester-wise Revised Syllabus under CBCS, 2020-21

Course Code:

Four-year B.A. /B.Sc. (Hons)  
Domain Subject: **MATHEMATICS**  
IV Year B.A./B.Sc.(Hons)– Semester – V

Max Marks: 100

**Course-6B: Multiple integrals and applications of Vector calculus**  
(Skill Enhancement Course (Elective), 5 credits)

**I. Learning Outcomes:**

Students after successful completion of the course will be able to

1. Learn multiple integrals as a natural extension of definite integral to a function of two variables in the case of double integral / three variables in the case of triple integral.
2. Learn applications in terms of finding surface area by double integral and volume by triple integral.
3. Determine the gradient, divergence and curl of a vector and vector identities.
4. Evaluate line, surface and volume integrals.
5. understand relation between surface and volume integrals (Gauss divergence theorem), relation between line integral and volume integral (Green's theorem), relation between line and surface integral (Stokes theorem)

**II. Syllabus:** (Hours: Teaching: 75 (incl. unit tests etc.05), Training: 15)

**Unit – 1: Multiple integrals-I** (15h)

1. Introduction, Double integrals, Evaluation of double integrals, Properties of double integrals.
2. Region of integration, double integration in Polar Co-ordinates,
3. Change of variables in double integrals, change of order of integration.

**Unit – 2: Multiple integrals-II** (15h)

1. Triple integral, region of integration, change of variables.
2. Plane areas by double integrals, surface area by double integral.
3. Volume as a double integral, volume as a triple integral.

**Unit – 3: Vector differentiation** (15h)

1. Vector differentiation, ordinary derivatives of vectors.
2. Differentiability, Gradient, Divergence, Curl operators,
3. Formulae involving the separators.

**Unit – 4: Vector integration** (15h)

1. Line Integrals with examples.
2. Surface Integral with examples.
3. Volume integral with examples.

## Unit – 5: Vector integration applications

(15h)

1. Gauss theorem and applications of Gauss theorem.
2. Green's theorem in plane and applications of Green's theorem.
3. Stokes's theorem and applications of Stokes theorem.

### III. Reference Books:

1. Dr.M Anitha, Linear Algebra and Vector Calculus for Engineer, Spectrum University Press, SR Nagar, Hyderabad-500038, INDIA.
2. Dr.M.Babu Prasad, Dr.K.Krishna Rao, D.Srinivasulu, Y.AdiNarayana, Engineering Mathematics-II, Spectrum University Press, SR Nagar, Hyderabad-500038,INDIA.
3. V.Venkateswararao, N. Krishnamurthy, B.V.S.S.Sarma and S.Anjaneya Sastry, A text Book of B.Sc., Mathematics Volume-III, S. Chand & Company, Pvt. Ltd., Ram Nagar, New Delhi-110055.
4. R.Gupta, Vector Calculus, Laxmi Publications.
5. P.C.Matthews, Vector Calculus, Springer Verlag publications.
6. Web resources suggested by the teacher and college librarian including reading material.

### IV. Co-Curricular Activities:

#### A) Mandatory:

1. **For Teacher:** Teacher shall train students in the following skills for 15 hours, by taking Relevant outside data (Field/Web).

1. The methods of evaluating double integrals and triple integrals in the class room and train to evaluate

These integrals of different functions over different regions.

2. Applications of line integral, surface integral and volume integral.
3. Applications of Gauss divergence theorem, Green's theorem and Stokes's theorem.

2. **For Student: Fieldwork/Project work** Each student individually shall undertake Fieldwork/Project work and submit a

report not exceeding 10 pages in the given format on the work-done in the areas like the following, by choosing any one of the following aspects.

1. Going through the web sources like Open Educational Resources to find the values of double and triple integrals of specific functions in a given region and make conclusions. (or)
2. Going through the web sources like Open Educational Resources to evaluate line integral, surface integral and volume integral and apply Gauss divergence theorem, Green's theorem and Stokes theorem and make conclusions.

3. **Max. Marks for Fieldwork/Project work Report: 05.**

4. **Suggested Format for Fieldwork/Project work Report:** Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

#### 4. Unit tests (IE).

#### b) Suggested Co-Curricular Activities:

1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
2. Visits to research organizations, Statistical Cells, Universities, ISI etc.