Course Code	**EM 212**
Course Title	**Calculus II**
No. of Credits	**2**
Pre-requisites	**None**
Compulsory/Optional	**Compulsory**

Aim(s): To introduce, calculus of functions of several variables, vector valued functions and the use of integral theorems in any orthogonal curvilinear coordinates to solve engineering problems.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

- Sketch level curves and level surfaces of functions of two and three variables, and sketch their surfaces and solids.
- Compute double and triple integrals of scalar functions over any given 2D and 3D regions.
- Compute gradient, divergence and curl of a given functionusing orthogonal. curvilinear coordinates and to solve related problems using cylindrical and spherical coordinates.
- Evaluate line, surface and volume integrals of continuous scalar and vector fields over a given domain and apply integral theorems.

Time Allocation (Hours): Lectures 24 Tutorials 4 Practical Assignments 4

Course content/Course description:

- **Functions of several variables:** Sketching level curves and level surfaces of functions of two and three variables, sketching surfaces and volumes, limit, and continuity of functions of two and three variables;Tangent planes, gradient vector and directional derivative, scalar line integrals.

- **Double and Triple Integration:** Definitions of double and triple integrals, double and triple integrals over rectangular domains, double and triple integrals over any general domains;cylindrical and spherical polar coordinates, Jacobian and its properties, applications of double and triple integrals(change of coordinates).

- **Vector Fields and Vector Operators:** Scalar fields and vector fields, gradient, divergence and curl and theirgeometrical and physical interpretations.

- **Vector and complex line integral:** Line integrals of vector valued functions and path independency of line integrals, simply connected domains and conservative vector fields, Cauchy-Riemann equations and line integrals of complex valued functions, complex line integrals over simply connected domains and Cauchy's theorem.

- **Orthogonal curvilinear coordinates, Surface integrals and Integral Theorems:** Greens Theorem on the plane,surface integrals of scalar fields and vector fields;Stokes' theorem and divergence theorem,area and volume elements in terms of orthogonal curvilinear coordinates;Surface integrals with orthogonal curvilinear coordinates,applications of integral theorems in terms of orthogonal curvilinear coordinates.

Recommended Texts :

- James Stewart, Calculus,5thedition, (2006), Thomson Books/Cole.
- Watson Fulks,Advanced Calculus an Introduction to Analysis,3rd Edition,(1978), John Wiley &SonsInc.
- E. B. Saff and A. D. Sinder,Fundamentals of Complex Analysis with Applications to Engineering, Science, and Mathematics, 3rd edition,(2014), Pearson Education Ltd.

Assessment	**Percentage Mark**
In-course	
Tutorials	10
Mid Semester Examination	30
End-semester	60