Calculus

Course Title: Calculus

Course Code: SC 107

Credit Structure: 4 Credits (3 lecture hours and 1 tutorial hour per week)

Course Placement: Calculus is a core course for the first year B. Tech. ICT and Computational Science students. It is taught in the first semester itself.

Course Objective: Whenever there is a change in the state of an object or situation then the role of Calculus come into the picture. Calculus which includes multivariate and vector calculus covers a fundamental body of mathematical techniques pervading physical sciences and engineering. This course provides the student solid platform to study and understand other courses in ICT such as Signals and Systems, Electromagnetic Theory, Machine Learning etc. Through the use of the unifying themes of derivatives, integrals, limits, approximations and applications, the content develops into a cohesive whole rather than a collection of topics in Calculus. The contents cover all the essential components of calculus, and are intended to be challenging and demanding.

Course Contents:

- **Calculus of Functions of Single and Several Variables:** Function of one variable and its limits, continuity, differentiation, applications of derivatives, integrals, applications of integrals, Functions of several variables, and its limits, continuity, derivatives and applications of derivatives, multiple integrals and their applications in finding area, surface area, volume.
- **Infinite Sequences and Series:** Sequences, series, Convergence of sequences and series, Power series, Representations of functions as power series.
- **Ordinary and Partial Differential Equations:** Differential equations arise from physical and engineering problems, Solution techniques
- **Calculus of Functions of Complex variables:** Limits, Continuity, Analyticity, Contour integrals, Complex functions as power and Laurent series.

Text Books:

Reference Books:


Course Outcomes: The course emphasizes a multi-representational approach to Calculus, with concepts, results, and problems being expressed graphically, numerically and analytically along with the connections among these presentations. After the end of this course:

- Students should be able to model some physical situations with functions, differential equations or integrals. (P2-Critical thinking, P5-Usage of Modern tools, P12-Analyze the situation and give a decision)
- Student should be able to solve the models created and also determine the reasonableness of solutions, including sign, size, units of measurement and accuracy. (P1-Scholarship of knowledge, P2-Critical Thinking, P3-Problem solving, P4-Research skills)
- Student should be able to communicate mathematics and explain solutions to problems both verbally and in written sentences. (P12-Analyze the situation and give a decision)
- Though not a core of this course, the students should be able to acquire manipulation and computation competence. (P4-Research skills, P12-Analyze the situation and give a decision).
- Students should develop an appreciation of calculus as a coherent body of knowledge and as a human accomplishment. (P12-Analyze the situation and give a decision)
Course Schedule:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Topics</th>
<th>No. of lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Function of one variable: limit, continuity, differentiation, applications of derivatives, definite integrals, applications of definite integrals</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Functions of several variables: limit, continuity, derivatives and applications of derivatives, multiple integrals and their applications in finding area, surface area, volume.</td>
<td>8</td>
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<tr>
<td>3</td>
<td>Power series: Representations of functions as power series, Taylor’s series, Convergence of series</td>
<td>6</td>
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<tr>
<td>4</td>
<td>Differential equations: Differential equations arise from physical and engineering problems, Solution techniques, Linear first order differential equations, Integrating factor, Exactness, Higher order linear homogeneous equations, Higher order linear nonhomogeneous equations</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>Calculus of Functions of Complex variables: Limits, Continuity, Analyticity, Contour integrals, Complex functions as power and Laurent series</td>
<td>10</td>
</tr>
</tbody>
</table>

Evaluation Process and Grading Scheme:

- **Components of evaluation**: 12-14 Tutorials and Assignments, 3 Exams, Attendance
- **Grading Policy**: Tutorials and Assignments 20%  
  3 Exams (20%+20%+40%=80%)