IIT Mandi
Proposal for a New Course

Course number   : IC 113
Course Name   : Complex and Vector Calculus
Credit Distribution   : *(1.5-0.5-0-2)*
Intended for   : B. Tech. 1st Year
Prerequisite   : Math 1
Mutual Exclusion   : (None)

1. Preamble:

This course is designed to provide exposure of the concept of complex analysis and vector calculus. The principal aim of unit 1 is to make students understand the central concept of complex analysis: Limit, continuity and differentiability of functions of complex variables, Cauchy- Riemann equation, Cauchy's integral formula, Taylor and Laurent series, different types of singularity etc. Unit 2 aims at equipping the students with the knowledge of double integral and its application, Fubini's theorem that allows to interchange integration with respect to x and y variables and explaining how multiple integral problems can be transformed into polar, cylindrical and spherical coordinates.

2. Course Modules with quantitative lecture hours:

Unit 1: Complex variable: Limit, continuity, differentiability and analyticity of functions, Cauchy-Riemann equations, line integrals in complex plane, Cauchy integral theorem, independence of path, existence of indefinite integral, Cauchy's integral formula, derivatives of analytic functions, Taylor's series, Laurent's series, Zeros and singularities, Residue theorem, evaluation of real integral [10 Lectures]

Unit 2: Integration: Riemann integral, Double integral and its applications, Fubini's theorem, Volumes and Areas, Change of variable in double integral. Special cases: Polar coordinates, Triple integral, Applications, Change of variable in triple integral. Special cases: Cylindrical and Spherical coordinates, Surface area, Surface integral, Line integrals, Green's theorem, Vector fields Divergence and Curl of a vector field, Stoke's theorem, The divergence theorem. [11 Lectures]

3. **Text books:**

   1. **Thomas and Finney, Calculus and Analytical Geometry, 9th Edition, Addison and Wesley Publishing Company, 1996.**
   2. **R. V. Churchill and J. W. Brown, Complex Variables and Applications, 9th Editions, 2021.**

4. **References:**

   1. *E. Kreyszig, Advanced Engineering Mathematics, 10th Edition.*
   2. *S. Ponnusamy, Foundations of Complex Analysis, 2nd Edition, Narosa, 1995.*
   3. *J. E. Marsden, A. J. Tromba and A. Weinstein, Basic Multivariable Calculus, Springer, 1993.*

5. **Similarity with the existing courses:**
   (Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.				

6. Justification of new course proposal if cumulative similarity content is >30%: