

Indian Institute of Technology, Kanpur
Proposal for a New Course

1. Course No: SPA***M **623M**
 2. Course Title: Numerical Techniques in Space Sciences & Engineering
 3. Lectures per week: L=2, Tutorial: T=0, Laboratory: P=1, Additional hours: (0-2) =0 (A), Credits (3*L+2*T+1*P+A)=5
Duration of Course: Half Semester (Odd sem, second Half)
 4. Proposing Department: Space, Planetary and Astronomical Sciences and Engineering.
 5. Proposing Instructor: Sharvari Nadkarni-Ghosh, Rohit Sharma
 6. Other Instructors who may teach this course: Kartick Sarkar, Ishan Sharma
 7. Course Description (A) Objectives: The course aims to introduce students to numerical techniques used in Space, Planetary and Astronomical Sciences and Engineering. (B) Contents (preferably in the form of 5 to 10 broad titles):
 1. **Numerical Integration** (2 lectures, 2 labs)
Newton-Cotes formulae including trapezoidal rule and Simpson's rule, Gaussian quadrature, convergence and scaling of error, Monte Carlo Integration
 2. **Numerical Root finding** (1 lecture, 1 lab)
Bisection method, Newton Raphson method for single and multi-dimensional systems.
 3. **Integration of Ordinary Differential Equations (ODE)** (3 lectures, 3 labs)
Initial Value Problem Forward and backward Euler method, Runge-Kutta Method, Stiff system of equations, implicit vs. explicit schemes, shooting method for the Boundary Value Problem.
 4. **Numerical Interpolation of functions** (1 lecture, 1 lab) Linear and higher order interpolation with polynomials, Spline Interpolation
- (C) Pre-requisites, if any: N/A
- (D) Short summary for including in the Courses of Study Booklet: Numerical integration of functions, numerical root finding, Solving Ordinary differential Equations, Numerical Interpolation

7. Recommended Books:

- Numerical Recipes: The Art of Scientific Computing
Authors: Vertterling, Flannery, Press and Teukolsky.
- Fundamentals of Numerical Computation
Authors: Driscoll and Braun

8. Any other remarks:

Dated: Proposer:

Dated: DUGC/DPGC Convener:

The course is approved/not approved

Chairman, SUGC/SPGC

Dated: *Abhishek
Kedup
Stu157*