

Indian Institute of Technology, Kanpur
Proposal for a New Course

1. Course No: SPA***M *622M*
2. Course Title: Mathematical Techniques in Space Sciences & Engineering
3. Lectures per week: 3 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional hours: (0-2): 0 (A), Credits (3*L+2*T+1*P+A): 5
Duration of Course: Half Semester (Odd Sem, First Half)
4. Proposing Department: Space, Planetary and Astronomical Sciences and Engineering.
5. Proposing Instructor: Pankaj Jain
6. Other Instructors who may teach this course: Sharvari Nadkarni-Ghosh, Kartick Sarkar, Rohit Sharma, Ishan Sharma
7. Course Description (A) Objectives: The course aims to introduce students to numerical techniques used in Space Science & Astronomy.
(B) Contents (preferably in the form of 5 to 10 broad titles):
 1. **Vector Analysis** (3 lectures)
Vector differential calculus, gradient, divergence and curl, surface and volume integrals
 2. **Matrix Algebra** (6 lectures)
Introduction to matrices, diagonalization, solution of linear equations using matrices.
 3. **Coordinate Systems** (5 lectures)
Curvilinear coordinates, coordinate transformation, applications to astronomy
 4. **Ordinary differential equations** (6 lectures)
First and second order ODEs and their solutions. Separation of variables method to solve PDEs and various types of boundary conditions - initial value problem vs boundary value problem etc.
- (C) Pre-requisites, if any: N/A
- (D) Short summary for including in the Courses of Study Booklet: vector analysis, vector differential calculus, linear vector spaces, matrices, tensors, coordinate systems, Astronomical coordinate system

transformation, ordinary differential equations, examples from Astronomy

7. Recommended Books:

- Mathematical Methods in Classical and Quantum Physics, T. Dass & S. K. Sharma
- Mathematical Methods for Physicists, G. B. Arfken, H. J. Weber and F. E. Harris, Elsevier, seventh edition.
- Advanced Engineering Mathematics, E. Kreyszig, John Wiley & Sons, tenth edition.

8. Any other remarks:

Dated: Proposer:

Dated: DUGC/DPGC Convener:

The course is approved/not approved

Chairman, SUGC/SPGC

Dated: *Abhejith
Lodh
5/11/21*