Indian Institute of Technology Kanpur

Proposal for a Revision

1. **Course No:** ECO611M

2. **Course Title:** Computational Methods in Economics

3. **Per Week Lectures:** 3 (L), Tutorial: 0 (T), Laboratory: 2 (P), Additional Hours: 0 (A)
   Credits: (3-0-2-0) 6   **Duration of Course:** Half Semester

4. **Proposing Department/IDP:** Economic Sciences
   Other Departments/IDPs which may be interested in the proposed course: None

5. **Proposing Instructor(s):** Faculty members of the department of economic sciences

   Level of the Course: PG

6. **Course Description:**
   A) **Objectives:** To introduce computational methods to solve mathematical problems related to economic applications. To illustrate computational methods with the relevant theory in economics. To enable the students to gain a hands-on experience on implementing different solution methods using software, specifically python, for solving problems in economics.

   B) **Contents:**

No.	Broad Title	Topics	No. of lectures
1.	Basics of programming	Introduction to Python: Input output statements, arithmetic operations, string operations, matrix operations, files operations, user defined functions, random number generation. Packages in python: numpy, scipy, matplotlib, random, and other packages.	6
2.	Linear Algebra	Solutions of systems of linear equations: Gauss-Jordan, LU/ QR decompositions. Singular Value Decomposition, Basis of four fundamental subspaces.	3
3.	Numerical Analysis	Solving nonlinear equations. Numerical solutions: Bisection, Newton-Raphson. Optimization: Local descent methods, steepest descent, gradient methods, penalty methods.	4

   C) **Prerequisites:** None.

   D) **Short summary:** This course aims to be a basic course on computation to an economic audience. Computational methods that are useful in addressing economic issues are introduced. Students gain a hands-on experience in implementing the methods in real economic problems, through software demonstration lectures and programming assignments. The emphasis of the course would be in learning the implementation of the methods, and not on the theory behind them. A brief introduction of the methods would be provided, assuming that the theory behind the methods is known to the students.

7. **Recommended books:**

   1. Ivan Idris*, Numpy 1.5 Beginner's Guide*, Packt Publishing, 2011.
   2. Hans Petter Langtangen, *A Primer on Scientific Programming on Python*, Springer, 2011.

3. K Judd, *Numerical methods in Economics*, MIT press.
4. E Sulli and D Mayers, *Introduction to Numerical Analysis*, Cambridge University Press.
5. A Ben-Tal and A Nemirovski, *Lecture Notes: Optimization III. Convex Analysis, Nonlinear Programming Theory, and Nonlinear Programming Algorithms*, https://www2.isye.gatech.edu/~nemirovs/OPTIIILN2023Spring.pdf
6. J Nocedal and S J Wright, *Numerical Optimization*, Springer.

8. **Any other remarks:** None.

Dated: 27/08/2024   Proposer:_Dr. Thirumulanathan D_____

Dated: DUGC/DPGC Convener:_____

The course is approved / not approved

Chairman, SUGC/SPGC

Dated:_____