Indian Institute of Technology, Kanpur
Proposal for a New Course

1. Course No: ME XXX

2. Course Title: Design of Thermofluid Systems

3. Per Week Lectures: 3 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional Hours [0-2]: 0 (A), Credits (3*L+2*T+P+A): 9
   Duration of Course: Full Semester / ~~Modular~~

4. Proposing Department/IDP: Mechanical Engineering

   Other Departments/IDPs which may be interested in the proposed course: Department of Sustainable Energy Engineering

   Other faculty members interested in teaching the proposed course: Jishnu Bhattacharya (ME) and Laltu Chandra (SEE)

5. Proposing Instructor(s): Umesh Madanan (ME)

6. Course Description:

A) Objectives: This course will help integrate the fundamentals of thermodynamics, fluid mechanics, and heat and mass transfer towards the design, modeling, and analysis of representative energy systems and components. Upon completion of this course, students will be able to analyze system performance, optimize the design of components and subsystems, and evaluate the economics for different applications. The course will also introduce engineering principles and best practices for designing practical systems. This course will present students with uncertain and open-ended real-world problems that will help them develop the quantitative skills required to define and justify engineering assumptions, apply constraints, and formulate a physically consistent approach to analyzing systems.

B) Contents (preferably in the form of 5 to 10 broad titles):

S. No	**Broad Title**	**Topics**	**No. of 50-mins Lectures**
1.	Recap	Revision of fundamentals of thermodynamics, fluid mechanics, and heat transfer	5
2.	Software Introduction	Introduction to Engineering Equation Solver (EES) software	4
3.	Thermodynamic Analyses	Thermodynamic analysis of cycles (power generation, heating and cooling) and systems	5

4.	Improved Systems	Efficiency improvement in power generation and heating and cooling systems	4
5.	Fluid Mechanics Analyses	Fluid flow (piping systems), and prime movers (turbines, compressors, pumps, and fans)	5
6.	Thermofluidic Analyses	Heat exchanger design	5
7.	Special Applications	Waste heat recovery systems (organic Rankine cycles, thermoelectric generators, etc.) and electronics thermal management strategies	6
8.	Design Optimization	Design optimization of energy systems	4

C) Pre-requisites, if any: Thermodynamics (ESO201 or equivalent), Fluid Mechanics (ME231 or equivalent), Advanced Fluid Mechanics (ME331), and Heat and Mass Transfer (ME341)

D) Short summary for including in the Courses of Study Booklet: The course is designed for students interested in learning a new software, Engineering Equation Solver (EES), and how it applies to the design and optimization of various thermofluidic systems. The course will provide a recap on fundamental topics in thermodynamics, fluid mechanics, and heat transfer. Following this, a new software, EES, will be introduced, before advancing to modeling and improving thermofluidics in different systems, including a variety of power-generating, heating/cooling systems, and equipment such as turbines/compressors/pumps, and heat exchangers. Finally, the course will conclude with design optimization for some of the aforementioned energy systems.

7. Recommended books:

   Textbooks:

   1. William S. Janna, Design of Fluid Thermal Systems, 2nd Edition, PWS Publishing Company

   Reference Books:

   1. Heat and Mass Transfer: Fundamentals and Applications by *Y. A. Cengel, A. J. Ghajar* (5th Edition, **ISBN-10**: **9789339223199**, McGraw-Hill, 2017)
   2. Fluid Mechanics *F. M. White* (5th Edition, **ISBN**: **978-0-07-352934-9**, Tata McGraw Hill, 2003)
   3. Thermodynamics: An Engineering Approach by *Y. A. Cengel, M. A. Boles, M.Kanoglu* (9th Edition, **ISBN-10**: **9353165741**, McGraw-Hill, 2019)

8. Any other remarks:

Dated: _____ Proposer: Dr. Umesh Madanan

Dated: _____ DUGC/DPGC Convener: _____

The course is approved / not approved

Chairman, SUGC/SPGC
Dated:_____