Indian Institute of Technology, Kanpur

Proposal for a New Course

1. **Course No:** CE4**

2. **Course Title:** Hydraulic Turbomachines

3. **Per Week Lectures:** 2 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional Hours [0-2]: 0 (A)

Credits: 2-0-0-0 (6)

Duration of Course: Full Semester

4. **Proposing Department/IDP:** Civil Engineering

   Other Departments/IDPs which may be interested in the proposed course: Mechanical Engineering, Aerospace Engineering

   Other faculty members interested in teaching the proposed course: None

5. **Proposing Instructor(s):** Chunendra K Sahu (Hydraulics and Water Resources group)

6. **Course Description:** UG course for 3rd or 4th year students

A) ***Objectives***: This course is designed as an elective course to acquaint an undergraduate student in civil engineering with the basic principles of Hydraulic Turbomachines. Students will learn about the functioning of pumps, compressors and turbines and their classifications. They will also learn the designing and optimization of Hydraulic Turbomachines.

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

S. No	Broad Title	Topics	No. of Lectures
1	Introduction	Continuity and momentum equations in cartesian and cylindrical coordinates, Laws of Thermodynamics, Dimensional analysis, Euler's equation of turbomachine	3
2	Turbomachines classification	Historical development of turbomachines, Pumps, Compressors, Turbines. Axial flow, Radial flow, Centrifugal flow, Mixed flow	2
3	Two-dimensional cascades	Cascade forces, Lift and Drag, Turbine cascade, Compressor cascade, Stalling	3
4	Axial flow turbines	Velocity triangle, Thermodynamics, Stage loss and efficiency, Multistage turbines, Three dimensional flows, radial equilibrium	5
5	Axial flow compressors and fans	Velocity triangle, Thermodynamics, Stage loss and efficiency, Multistage compressors, Design of an axial compressor, performance parameters	5
6	Centrifugal pumps, fans and compressors	Velocity triangle, Pressure ratio and head change, Slip factor, Diffuser, Stage loss, Choking	3
7	Hydraulic turbines	The Pelton turbine, Reaction turbines, The Francis turbines, The Kaplan turbines	6
8	Introduction to wind, gas and steam turbines	Type of wind turbines, Wind power output, Blade element theory, Working principles of radial gas turbines and steam turbines	4

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S. No	Broad Title	Topics	No. of Lectures
Total			26

C) **Pre-requisites, if any:** Courses on Fluid Mechanics or Engineering Hydraulics

D) **Short summary for including in the Courses of Study Booklet:** Introduction, Turbomachines classification, Two-dimensional cascades, Axial flow turbines, compressors and fans, Centrifugal pumps, fans and compressors, Hydraulic turbines, Introduction to wind, gas and steam turbines.

7. Recommended books:

Reference book

1. **Dixon, S.L. (2013). Fluid Mechanics and Thermodynamics of Turbomachinery, 7th Edition, Butterworth Heinemann.**
2. **Yahya, S.M. (2017), Turbines, Compressors and Fans, 4th Edition, McGraw-Hill.**
3. **Korpela, S. A. (2012), Principles of Turbomachinery, 1st Edition, Wiley-Blackwell.**

Proposer: Chunendra K Sahu

Dated: 17/05/2024

DUGC Convener:

Dated:_____

The course is approved / not approved

Chairperson, SUGC

Dated:_____

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