THERMAL ENGINEERING: BASIC AND APPLIED

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IIT Guwahati

PREREQUISITES: Basic UG-level Thermodynamics, Heat Transfer and Basic Fluid Mechanics

INTENDED AUDIENCE: Undergraduate students of Mechanical/power engg/Chemical engg/ electrical engg. (5th semesteronwards) and postgraduate students specializing in the thermal engg; industry personnel associated with power plant and automobile industries; faculty members associated with Mechanical/Chemical engg/ power engg.

INDUSTRY SUPPORT : Power plant, Automobile industries

COURSE OUTLINE : This course focuses on different aspects of applied thermodynamics, which include fundamental analysis of steam power cycle starting from thermodynamics to its application in different practical processes, analysis of the Internal combustion engines, Gas turbine cycle, and the Refrigeration cycle. Thus, this course would provide an understanding on several aspects of thermal engineering from the basics to applied parts and would unveil several physical issues concerning with the fundamental analysis and operational principle.

ABOUT INSTRUCTOR :

Prof. Pranab K. Mondal is an Associate Professor in the department of Mechanical Engineering at Indian Institute of Technology Guwahati since May 2015. He received his undergraduate and postgraduate degree from Jadavpur University, Kolkata, and completed his Ph.D. from Indian Institute of Technology Kharagpur in 2015. He worked as a Research Associate at IIT Khargpur for nearly one year before joining IIT Guwahati. He has taught several courses, including Fluid Mechanics, Applied Thermodynamics, Thermodynamics, Fundamentals of Microfluidics, Experimental Methods in Fluid Mechanics to both undergraduate and post graduate students at IIT Guwahati. Among his principal research interest, encompassing the broad area of Microfluidics has covered various facets of microscale multiphase transport, electrokinetics, microscale transport of heat and experimental microfluidics. He is currently working on droplet-based microfluidics, magnetofluidics, experimental investigations of capillary filling of bio-fluids. He has co-authored more than 140 referred journal and conference publications. He is a regular reviewer of many reputed international journals and also associated with several sponsored projects pertaining to microscale phenomena.

COURSE PLAN :

Week 1 : Review of Thermodynamics: First law and second law for control mass and control volume systems, combined first and second law applied to processes, Numerical problems.
Week 2 : Steam power engineering: Description of steam power plant, application of first and second laws to different devices of power plant; ideal cycle of power plant, Numerical problems.
Week 3 : Steam Power cycles: Rankine cycle and analysis, reheat cycle and analysis, Numerical problems.
Week 4 : Modified steam power cycles: Regenerative steam power cycles, analysis, ideal working fluid for the steam power cycle, Numerical problems.
Week 5 : Second law analysis of steam power cycle: multi-fluid cycle and analysis, second law analysis of steam power cycle, Numerical problems.
Week 6 : Boiler in steam power plant: Types of boiler, different cycles in boiler operation, boiler attachment, problems, Numerical problems.
Week 7 : Flow nozzles: Use of nozzles in steam power plant, flow analysis in nozzle, nozzle efficiency, Numerical problems.
Week 8 : Steam turbine: Steam turbine types, analysis of steam turbine using velocity triangles, types of condenser, cooling tower, Numerical problems.
Week 9 : Internal combustion engine: IC engines, classification, different parts, SI and CI engines, comparison of 2-stroke and 4-stroke engines, carburetor, MEP and fuels, Numerical problems.
Week 10 : Thermal analysis of IC engine: Thermodynamic analysis of SI and CI engines and their analysis, pressure-crank angle diagram, engine efficiencies, Numerical problems.
Week 11 : Gas Turbine cycle: Types of gas turbine engines, thermodynamic cycles, combined cycles, compressor, and multistage compression with intercooling, efficiencies, Numerical problems.
Week 12 : Refrigeration cycle: Vapor compression refrigeration cycle and its analysis, Numerical problems.