INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

INTRODUCTION OF NEW COURSE

<table>
<tr><td>course Title</td><td>Gas Dynamics and Propulsive Systems</td><td>Course Code</td><td colspan="4"></td></tr>
<tr><td>Dept./ Specialization</td><td>Mechanical</td><td>Structure (LTPC)</td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>To be offered for</td><td>UG / PG</td><td>Status</td><td colspan="2">Core ☐</td><td colspan="2">Elective ■</td></tr>
<tr><td>Faculty Proposing the course</td><td>Dr S Jayavel</td><td>Type</td><td colspan="2">■</td><td colspan="2"><s>Modification</s></td></tr>
<tr><td>With effect from</td><td>Dec 2021</td><td></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Recommendation from the DAC: Recommended</td><td>Date of DAC</td><td colspan="4">01-06-2021</td></tr>
<tr><td>External Expert(s)</td><td colspan="6">Prof Shaligram Tiwari</td></tr>
<tr><td>Prerequisite</td><td colspan="3">Fluid Mechanics and Heat Transfer</td><td>Submitted for approval</td><td colspan="2">46th Senate</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To teach the phenomenon of shock waves and its effect on flow. To gain basic knowledge about jet propulsion and Rocket Propulsion.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Upon completion of this course, the students will be able to apply gas dynamics principles in the Jet and Space Propulsion</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Fundamentals of Compressible Flow: Basic equations of compressible flow: Continuity equation, Energy equation and Momentum equation; stagnation states, Mach wave and Mach cones, effect of Mach number on compressibility (L6 / T2)

Flow through variable area duct: One dimensional isentropic flow in duct of varying cross sectional area; flow through convergent and convergent-divergent nozzles, analysis of flow through nozzle by using property tables, analysis of flow through diffuser; critical properties and choking of nozzle (L6 / T2)

Normal shock waves: Development of shock wave, thickness of shock wave, strength of shockwave, Prandtl relation, Rankine-Hugoniot relation, variation of flow parameter across the normal shock (L6 / T2)

Flow in constant area duct with friction (Fanno flow): Fanno flow equation and its solution, relation of flow properties with length, graphical presentation of flow properties, experimental coefficient of friction, preliminary design of the duct (L6 / T2)

Flow in constant area duct with heat transfer (Rayleigh flow): Rayleigh flow equations and its solution, variation of flow properties with length of duct, analysis for maximum heat transfer, preliminary design of the duct (L6 / T2)

Air-Breathing Engines: Thrust and Efficiency, The Ramjet, Turbojet Engines, Turbofan Engines, Turboprop and Turboshaft Engines, Typical Engine Performance, Engine-Aircraft Matching, Subsonic Inlets, Supersonic Inlets, Gas Turbine Combustors, Afterburners and Ramjet Combustors, Supersonic Combustion, Exhaust Nozzles (L6 / T2)

Rocket Engines: Performance of Rocket Vehicles, Chemical Rocket Thrust Chambers, Chemical Rocket Propellants: Combustion and Expansion, Electrical Rocket Propulsion (L6 / T2)</td></tr>
<tr><td>Text Book</td><td colspan="6">1. Yahya, S. M. Fundamentals of compressible flow: SI units with aircraft and rocket propulsion. New Age International, 2003.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Babu, V. (2008). Fundamentals of gas dynamics. Ane Books India.
2. Zucker, Robert D., and Oscar Biblarz. Fundamentals of gas dynamics. John Wiley & Sons, 2019.</td></tr>
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