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

INTRODUCTION OF NEW COURSE

<table>
<tr><td>Course Title</td><td>Computational Fluid Dynamics</td><td>Course Code</td><td colspan="4"></td></tr>
<tr><td>Dept./ Specialization</td><td>Mechanical Engg</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">New</td><td colspan="2">Modification</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">Heat Transfer and Fluid Mechanics</td><td colspan="2">Submitted for approval</td><td>46th Senate</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To educate students in the area of computational fluid dynamics and heat transfer
• To train students to identify, formulate and solve interdisciplinary problems in fluid dynamics and heat transfer via computational techniques</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Students will be able to solve advanced multi-disciplinary problems involving fluid mechanics, heat transfer and related transport process phenomena using appropriate CFD techniques.
• Students will be able to analyse the results obtained from the CFD techniques.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Conservation equations: mass, momentum and energy equations. General description. Non-dimensionalized form. Stream function and vorticity equations. Poisson equation. (L6 / T2)

Classification of equations: Parabolic, elliptic and hyperbolic. Boundary and initial conditions. Mesh generation, types of mesh and mesh quality. (L6 / T2)

Finite Difference Technique: Finite difference approximation, accuracy, treatment of boundary conditions, explicit and implicit methods. Consistency, stability and convergence. Relaxation factors. (L6 / T2)

Finite Volume Technique: Diffusion problem, Convection problem, Convection-diffusion problem. (L6 / T2)

Methods of Solution: Iterative methods, matrix inversion methods, ADI method, pressure-velocity coupling, colocated and staggered grids, Marker-and-Cell (MAC) method, SIMPLE algorithm. (L6 / T2)

Turbulence modeling: Reynolds averaged Navier-Stokes equations, RANS modeling, introduction to LES. (L6 / T2)

Introduction to commercial software to simulate flow problems. (L6 / T2)</td></tr>
<tr><td>Text Book</td><td colspan="6">1. Pletcher, Richard H., John C. Tannehill, and Dale Anderson. Computational fluid mechanics and heat transfer. CRC press, 2012.
2. Versteeg, Henk Kaarle, and Weeratunge Malalasekera. An introduction to computational fluid dynamics: the finite volume method. Pearson education, 2007.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Ferziger, Joel H., Milovan Perić, and Robert L. Street. Computational methods for fluid dynamics. Berlin: springer, 2002.
2. Chung, T. J. Computational fluid dynamics. Cambridge university press, 2002.</td></tr>
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