



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

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SCHOOL OF MECHANICAL ENGINEERING
DEPARTMENT OF AERONAUTICAL ENGINEERING

1.3.3 Value-added courses offered during 2023 - 2024

S. No.	Title	Event Dates	Number of students enrolled	Number of Students completed	Page No.
1	Practical Computational Fluid Dynamics	15 Mar 2024 to 21 Mar 2024	70	70	2
2	Fabrication of Heterogeneous Materials	06 Sep 2023 to 12 Sep 2023	70	70	9



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COURSE 1: PRACTICAL COMPUTATIONAL FLUID DYNAMICS

POSTER:



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INSTITUTE OF SCIENCE AND TECHNOLOGY

Department of Aeronautical Engineering
School of Mechanical Engineering

&

OPTIMUZ TECH SERVICES

Organizes

AICTE Skill Development Program on

PRACTICAL COMPUTATIONAL FLUID DYNAMICS



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Dr. T. Anand
Assistant Professor, Aeronautical

Dr. Logeshwar Patnayak
Assistant Professor, Aeronautical



UG AERONAUTICAL STUDENTS
&
CFD ASPIRATEUR



15 Mar 2024
To
21 Mar 2024
6 Days



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Course Schedule

AICTE Funded SDP

Practical Computational Fluid Dynamics Schedule

March 15-21

15

9:00AM to 3.15 PM

Introduction to CFD

Conservation equation; mass; momentum and energy equations; convective forms of the equations and general description

16

9:00AM to 3.15 PM

Classification and Overview of Numerical Methods

Classification into various types of equation; parabolic elliptic and hyperbolic

17

9:00AM to 3.15 PM

Numerical Grid Generation

Numerical grid generation; basic ideas; transformation and mapping

18

9:00AM to 3.15 PM

Navier-Stokes Equations

Explicit and implicit methods; SIMPLE type methods; fractional step methods

20

9:00AM to 3.15 PM

Methods of Solution

Solution of finite difference equations; iterative methods; matrix inversion methods; ADI method; operator splitting; fast Fourier transform

21

9:00AM to 3.15 PM

Turbulence modeling

Reynolds averaged Navier-Stokes equations, RANS modeling, DNS and LES

Department of Aeronautical

Venue: IRC Auditorium

AICTE SDP – “Fabrication of Heterogenous Materials” Course Syllabus

Course Outline

Computational fluid dynamics (CFD) has become an essential tool in analysis and design of thermal and fluid flow systems in a wide range of industries. A few prominent areas of applications of CFD include meteorology, transport systems (aerospace, automobile, highspeed trains), energy systems, environment, electronics, bio-medical (design of life support and drug delivery systems), etc. The correct use of CFD as a design analysis or diagnostic tool requires a thorough understanding of underlying physics, mathematical modeling, and numerical techniques. The user must be fully aware of the properties and limitations of the numerical techniques incorporated in CFD software. This course aims to provide precisely these insights of CFD.

Contents:

- Mathematical modeling: Governing equations of fluid flow and heat transfer;
- Introduction to discretization methods: Finite difference and finite volume methods for heat transfer problems;
- Time stepping methods for unsteady problems;
- Solution techniques for system of algebraic equations;
- Grid generation techniques;
- Solution techniques for Navier-Stokes equation; Finite element method for heat transfer and fluid flow problems;
- Turbulence modeling.

Course Outcomes:

Fundamental Understanding of Fluid Dynamics: Develop a comprehensive understanding of the fundamental principles of fluid dynamics, including conservation equations (mass, momentum, and energy), boundary layers, turbulence, and vorticity.

Numerical Methods Knowledge: Gain knowledge of numerical methods and algorithms used in CFD simulations, including finite difference, finite volume, and finite element methods, and understand their strengths and limitations.

Software Proficiency: Acquire proficiency in using CFD software tools and packages commonly used in industry and research, such as ANSYS Fluent, COMSOL, OpenFOAM, or others.

Mesh Generation: Learn how to create, refine, and manipulate grids or meshes for CFD simulations, and understand their impact on simulation accuracy and computational cost.



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Boundary Conditions: Understand and apply appropriate boundary conditions in CFD simulations, including inlet/outlet conditions, wall conditions, and far-field conditions.

Solver Selection and Setup: Gain the ability to select appropriate numerical solvers and set up CFD simulations for specific problems, such as steady-state or transient simulations, laminar or turbulent flows, and multiphase flows.

Modeling Turbulence: Learn how to model turbulent flows using techniques like the Reynolds-Averaged Navier-Stokes (RANS) equations or Large Eddy Simulation (LES) and understand the strengths and limitations of different turbulence models.

Verification and Validation: Understand techniques for verifying and validating CFD simulations, including grid independence studies and comparison with experimental data.

Post-Processing and Visualization: Develop skills in post-processing and visualizing CFD results, including contour plots, vector plots, and streamlines, and the interpretation of simulation data.



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LIST OF STUDENTS PARTICIPATED

S. No.	Reg. Number	Student Name
1	41260001	AYUSH SRIVASTAVA
2	41260002	AGNES PRATHEDSHA JOHN J M
3	41260003	AJITH RAJKUMAR
4	41260004	AMSARATHANAA S
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69	41260951	MUSTAFA RAZA. T.K.S
70	41260952	ROHITH. A

Certificate of Participant:





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COURSE 2: FABRICATION OF HETEROGENOUS MATERIALS

POSTER:



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Department of Aeronautical Engineering
School of Mechanical Engineering

&

AERO HIGH TECH



Organizes
AICTE Skill Development Program on
FABRICATION OF
HETEROGENOUS MATERIALS



RAJA BHUPALAN NAGARAJAN

FOUNDER

AERO HIGH TECH, CHENNAI

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UG AERONAUTICAL STUDENTS



06 Sep 2023
To
12 Sep 2023
6 Days



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Course Schedule

AICTE Funded SDP

Fabrication of Heterogenous Materials Schedule

September 06 - 12

06

9:00AM to 3.15 PM

Fundamentals of Composites

Engineering Applications of Composite Materials.

07

9:00AM to 3.15 PM

Primary Manufacturing Processes for Composites

Open Molding, Closed Molding & Cast Polymer Molding

08

9:00AM to 3.15 PM

Secondary Manufacturing Processes for Composites

"Taped" or "Tabbed" together with wet-laid material

09

9:00AM to 3.15 PM

Mechanics of Composites

Mechanic repairs and replacing the composites components of Aircrafts

10

9:00AM to 3.15 PM

Meanfield Homogenisation for Composite Materials

RVE Analysis for calculation of effective composite properties

12

9:00AM to 3.15 PM

Structure Health Monitoring of Composites

An Acoustic Emission (AE) based Smart Composite Fastener (SCF)

Department of Aeronautical

Venue: Aero CAD Lab

AICTE SDP – “Fabrication of Heterogenous Materials” Syllabus

Course Overview

Composites have large-scale commercial applications in marine applications, aerospace, automotive, marine, sporting goods, infrastructure, energy storage, biomedical etc. In recent years, the development of new and improved composite manufacturing processes has led to limitless product development opportunities. The subject of manufacturing will be dealt within the framework of composite materials. The design portion includes an explanation of the concepts involved in the detailed design analysis of composites.

Topics

- Fundamentals of Composites
- Engineering Applications of Composite Materials.
- Primary Manufacturing Processes for Composites
- Secondary Manufacturing Processes for Composites
- Mechanics of Composite Materials
- Meanfield Homogenisation for Composite Materials (RVE Analysis for calculation of effective composite properties)
- Structure Health Monitoring of Composites

Course Outcome

Understanding of Composite Materials: Students should gain a solid understanding of what composite materials are, including the types of materials involved, their properties, and their advantages and disadvantages.

Material Selection: The ability to select appropriate materials for specific applications, taking into consideration factors like strength, weight, durability, and cost.

Understanding Manufacturing Processes: Familiarity with various manufacturing processes used in fabricating composite materials, including layup techniques, infusion, autoclave curing, and compression molding.

Composite Material Design: The capacity to design composite structures and components to meet specific performance requirements, considering factors like stress analysis, load-bearing capacity, and safety factors.

Hands-On Skills: Proficiency in the practical skills required for the fabrication of composite materials, which may include cutting, layering, curing, and post-processing techniques.

Case Studies and Applications: An understanding of real-world applications of composite materials in various industries, such as aerospace, automotive, marine, and construction.



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