Established by UP Govt. Act No. 07 of 2015
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Value Added Courses

Faculty of Mechanical Engineering

	J.S. University, Shikohabad Faculty of Mechanical engineering	Value Added Course
		AY: 2022-23

COMPUTATIONAL FLUID DYNAMICS

Learning Objective:

This Course will provide knowledge of computational fluid dynamics

Duration: 30 Hours. (Theory and Practical)

Course Outcomes: -

After completion of the course the student shall be able to:-

1. Students should be able to model fluid / heat transfer problems and apply fundamental conservation principles.
2. Students should be able to do discretize the governing equations by Finite Difference Methodand Finite volume Method.
3. Students should be able to develop programming skills by in-house code development forconduction, convection and fluid dynamics problems.
4. Students should be able to solve basic convection and diffusion equations and understands therole in fluid flow and heat transfer.
5. To prepare the students for research leading to higher studies.
6. To prepare the students for career in CAE industry using software tools.

	J.S. University, Shikohabad Faculty of Mechanical engineering	Value Added Course AY: 2022-23

Syllabus

Module I: Introduction to CFD

Introduction to Computational Fluid Dynamics, Derivation and physical interpretation of governing equations (conservation of mass, momentum and energy) in differential form, Concept of substantial derivative, divergence and curl of velocity, Mathematical behavior of Governing Equations and
boundary conditions.

Module 2 : Solution to Conduction Equation

Introduction to FEA, FDM and FVM, Solution of two dimensional steady and unsteady heatconduction equation using finite volume method (Implicit and Explicit) with Dirichlet, Neumann, Robbin boundary conditions, Stability Criteria.

Module 3 : Solution to Advection Equation

Solution of two dimensional steady and unsteady heat advection equation using finite volume method (Implicit and Explicit) with Dirichlet BC, Stability Criteria, Introduction to first order upwind, CD, second order upwind and QUICK convection schemes.

Module 4: Solution to Convection-Diffusion Equation

Solution of two dimensional steady and unsteady heat convection-diffusion equation for slug flow using finite volume method (Implicit and Explicit), Stability Criteria, 1-D transient convection-diffusion system, Peclet Number

Module 5: Solution to Navier – Stokes Equation

Solution of Navier-Stoke's equation for incompressible flow using SIMPLE algorithms for lid driven cavity flow problem, Introduction to external flow simulation.

References:-

1. H. Tennekes and J. L. Lumley, A First Course in Turbulence, MIT Press.
2. David C. Wilcox, Turbulence Modeling for CFD, DCW Industries
3. John D Anderson: Computational Fluid Dynamics- The Basics with Applications, McGraw-Hill
4. Atul Sharma, Introduction to Computational Fluid Dynamics: Development, Application andAnalysis, Wiley
5. Suhas V. Patankar, Numerical Heat Transfer and Fluid Flow, Hemisphere PublishingCorporation

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