

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
 ORGANISATION OF ISLAMIC COOPERATION (OIC)
 DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING (MPE)

Mid Semester Examination

Winter Semester : 2022-2023

Course Code: ME 4711

Time : 1 Hour 30 Minutes

Course Title: **Computational Fluid Dynamics (CFD)**

Full Marks : 75

There are **three** questions. Answer **all** of them. The symbols have their usual meanings. Marks of each question and corresponding CO and PO are written in brackets. Assume reasonable data if necessary. State all assumptions (if any) clearly. Do not write on the Question Paper.

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1. a) What is computational fluid dynamics (CFD)? Discuss how CFD has emerged as a multidisciplinary tool for solving fluid dynamics and heat transfer problem. (6) (CO1) (PO1)
- b) How is CFD being used in the power-generation industry? What kinds of data are collected and how are they useful in increasing the efficiency of power generation? (7) (CO1) (PO1)
- c) State the main elements involved in a complete CFD analysis and briefly explain their purposes. (12) (CO1) (PO1)
2. a) What are the governing equations of CFD? Which fundamental principles do they represent? Briefly explain why these equations must be conserved for CFD solution. (5) (CO2) (PO1)
- b) Derive the equation for the conservation of energy in two-dimensional form considering incompressible fluid flow in cartesian coordinate. (Derive in full form without skipping any steps. State all assumptions and definitions). (15 + 5) (CO2) (PO1) (PO2)
- Explain briefly the significance of each term in the final form of above equation.
3. a) What is the Discretization technique? Discuss different discretization methods used in CFD mentioning their differences along with their advantages/disadvantages. (10) (CO2) (PO1)
- b) What is Relaxation Factor and Convergence in CFD? Discuss its significance on numerical solution. (7) (CO1) (PO1)
- c) Why is grid generation needed in CFD? What is local mesh refinement technique and why is it important? Explain with an example and sketch. (8) (CO2) (PO2)