PAPER ID-310673

Subject Code: KCH051

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM V) THEORY EXAMINATION 2023-24
COMPUTATIONAL FLUID DYNAMICS

TIME: 3 HRS **M.MARKS: 100**

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Q no.	Question	Marks	CO
a.	Define Computational Fluid Dynamics	2	1
b.	Define Newtonian Fluid ?	2	1
c.	Why is Computer Simulation necessary in fluid flow and heat transfer?	2	1
d.	How boundary conditions will be decided in such a inviscid flow?	2	1
e.	What is inviscid flow?	2	1
f.	Classify Boundry Value Problem.	2	1
g.	Name at least three grid topologies used in structure grid generation?	2	1
h.	What is the Commercial Software for CFD?	2	1
i.	Write the advantage of implicit approach	2	1
j.	Define FEM?	2	1

SECTION B

2. Attempt any *three* of the following: **10x3=30**

a.	Why is CFD a research tool? Elaborate its importance in Chemical Engineering application?	10	2
b.	Write the governing equation for one dimensional unsteady state heat conductions. Mention the initial and boundary conditions also.	10	3
c.	What is discretization error? Discuss finite difference technique to solve ordinary differential equation (ODE-BVP) with suitable example	10	3
d.	Study the stability behaviour of second order wave equation by Von-Neuman stability method	10	3
e.	Define contraction and expansion in fluid flow. How will you apply CFD to solve multiphase reactive flows? Explain with suitable examples	10	3

SECTION C

3. Attempt any *one* part of the following: **10x1=10**

a.	Describe the various type of fluid flow model with suitable sketch and bring out what type of model leads to what type of governing equation forms.	10	2
b.	Consider a cylindrical fin with uniform cross-sectional area A. the base is at a temperature of 100 ^{0}C (T_B) and the end is insulated. The fin is exposed to an ambient temperature of 20 ^{0}C. One-dimensional heat transfer in this situation is governed by $$d/dx \{kA (dT/dx)\} - h P (T-T_\infty) = 0$$ where 'h' is the convective heat transfer coefficient, 'P' the perimeter, k the thermal conductivity of the material and T_∞ the ambient temperature. Calculate the temperature distribution along the fin using five equally placed control volumes. Take hp / (kA)=25 m^2 (note: kA is constant)	10	2

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4. Attempt any *one* part of the following: 10x1=10

a.	Explain the importance of grid generation in CFD process and discuss the difference between structured grid and unstructured grid.	10	3
b.	Discuss various configurations of Body-fitted structured grids and multi-block grids with the help of sketches.	10	3

5. Attempt any *one* part of the following: 10x1=10

a.	Distinguish the elliptic, parabolic and hyperbolic System of PDE's applied to fluid flow? What are the types of boundary conditions specified for flow problems.	10	2
b.	What is the need for classification of PDE and how do you classify second order PDE?	10	2

6. Attempt any *one* part of the following: 10x1=10

a.	How do you determine the accuracy of the discretization process? What are the uses and difficulties of approximating the derivatives with higher order finite difference schemes? How do you overcome these difficulties?	10	2
b.	What are different basic rules that you need to obey to discretize any governing differential equation by finite volume method. Explain these clearly with supportive figures.	10	3

7. Attempt any *one* part of the following: 10x1=10

a.	Define the Flow and heat transfer in pipes and channels?	10	2
b.	Give the note on (i) Reactive flow (ii) Multiphase flow	10	2