

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Backlog), November 2017

B. Tech in Chemical Engineering, Semester VI

Roll No.....

ME625 : Computational Fluid Dynamics

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A	Objective type multiple choice questions (10 questions @ 1 mark)	10
i.	Following are the FEM based software package: a) ABAQUS b) NASTRAN c) ANSYS d) All of them	
ii.	Number of rotations for a beam is a) 1 b) 2 c) 3 d) 0	
iii.	The small elements of a domain connected by joints are called as: a) Nodes b) Sub domain c) Mesh d) None of the above	
iv.	Integration formulas used for approximations are a) Midpoint rule b) Trapezoidal rule c) Simpson rule d) All of them	
v.	Discretization of convective flux using step function are done in: a) Upwind differencing scheme b) Flux-bending technique c) Central technique d) Galerkin method	
vi.	$\phi = \phi_b$ represents a) Dirichlet condition b) Neumann condition c) Cauchy condition d) None of them	
vii.	Most common techniques for the generation of unstructured grid is a) Delaunay triangulation b) Quadtree methods c) Advancing front methods d) All of them	
viii.	Following is the element type a) Subintervals b) Triangular c) Tetrahedras d) Hexahedras	
ix.	In beam problem following elements are used a) Conforming b) Non-conformin c) Converging d) Diverging	
x.	Finite volume method also known as : (a) Triangle method (b) Box method (c) Zone method (d) Variable method	

Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
i	Discuss structured grid and unstructured grids with examples.	
ii	Discuss various types of grid generation methods.	
iii	Highlight the background of finite element analysis.	
iv	Explain concept of nodes in solving a domain based problem.	
Q.3A	Explain various numerical methods used to solve solid and fluid mechanic problems.	05
Q.3B	Write a short note on finite volume method considering heat transfer through a fixed rectangular domain.	05
Q.4A	Discuss general methodology used in finite volume method.	05
Q.4B	Discuss the concept of control volume using general transport equation.	05
Q.5A	Explain the strong and weak form of a boundary value problem	05
Q.5B	Develop the weak form for the 1D diffusion equations: $\frac{d}{dx} \left(AE \frac{du}{dx} \right) + 10AX = 0$ for $0 < x < 1$.	05
Q.6A	Discuss the Galerkin method for a 2D elasticity problem.	10
Q.6B	Why Galerkin method is different from other methods for finite element formulation?	05
Q.7A	Derive the relation for mass, momentum and energy equations.	10
Q.7B	Explain difference between Jacobi method and Gauss-Seidel method	05
OR		
Q.7B	Solve the simultaneous equation using matrix inversion $x + 2y = 4$ $3x - 5y = 1$	05
Q.8A	Derive the strong form of $-\frac{dy}{dx} \left(p(x) \frac{dy}{dx} \right) + q(x)y = f(x)$, $0 < x < 1$ using Raleigh-Ritz method and discuss its significance over other methods.	10
Q.9A	Discuss different types of boundary problems.	5
Q.9B	Explain central difference technique.	5
OR		
Q.9B	Explain Upwind technique for interpolation.	5