B.E. Power Engineering - Fourth Year - Second Semester Examination 2025

SUBJECT: ***Computational Fluid Dynamic (Hons.)***

Time: Four Hours **Full Marks 100**

		Group A (CO1) (25 Marks)	Marks
1	a	The region of interest for analysis in CFD is called a) Cell; b) domain c) range d) node	1
	b	Movement of an object through a medium with a velocity having Mach number greater than one can be treated as a) Elliptic Problem, b) Parabolic problem c) Hyperbolic Problem, d) any one a, b and c depending on the medium	1
	c	The solution in CFD is obtained at different points within the zone of interest. These points are known as a) Grids; b) elements; c) nodes; d) cells;	1
	d	The following method can provide the information of a particular property over whole region. (a Experimental ; b) Numerical c) Analytical; d) all of a, b and c	1
	e	The force on the fluid element due to gravity is taken care of in which of the following equations? a) energy equation; b) momentum equation; c) continuity equation; d) flux conservation	1
	f	What is Numerical Method? What are the advantages and disadvantages of numerical methods over other methods of solving a fluid flow problem?	2 +8
	g	Explain how classification of linear 2^{nd} order differential equation is carried out into hyperbolic parabolic and elliptic types? Give example in each case..	10
		Group B (CO2) (20 Marks)	
2	a	Heat flows through an iron rod (radially insulated). One end is open to a heat source, where heat flux is a function of ambient temperature. This kind of boundary condition is known as a) Dirichlet bc; b) Neumann bc; c) mixed bc; b) none of these	1
	b	Property over the whole computational domain need to be defined for a) Boundary value problem; b) marching problems; c) Steady state problems; d) none of these;	1
	c	A nonlinear partial differential equation (related to fluid flow) can be solved using CFD by following method. (a) Direct; b) iterative; c) analytical d) none of these	1

Ref. No. Ex/PE/PE/H/T/422C/2025

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	d	Which of these methods can solve a set of linear algebraic equations line by line? a) Matrix inversion b) Thomas algorith c) Gauss-Seidel method d) Spectral element method	1
	e	Discretization of the governing equations result in _____ a) Integral equations b) Quasi-linear partial differential equations c) Partial differential equations d) Algebraic equations	1
	f	Explain why discretization of PDEs are is required in CFD? Name three types of discretization techniques?	**6**
	g	Explain how a 1D second order ODE can be discretized by Finite Difference Method	**9**
		Group C (CO3) (45 Marks)	
3	**a**	Discuss how equations $a_i T_i = b_i T_{i+1} + c_i T_{i-1} + d_i$ $(N \geq i \geq 1)$ can be solved by TDMA, when T_1 and T_N are known. (a, b, c and d are constants).	**10**
	b	How a set of algebraic equations can be solved by direct method and Gauss-Siedel method? Discuss why these methods are discouraged to solve a fluid flow problem. In this context describe the Scarborough criterion	**15**
	c	Discuss the role of continuity equation in solving momentum equations related to fluid flow. Discuss SIMPLE algorithms in detail to solve momentum equation.	**5** **15**
		Group D (CO4) (10 Marks)	
4	**a**	Which of these will not come under the three main elements of CFD packages? a) Pre-processor; b) Post-processor; c) Code creator; d) Solver	1
	b	Which of these will fall into the post-processing category? a) Definition of boundary conditions; b) Grid generation; c) Flow visualization; d) Discretization;	1
	c	Name three commercial software available in the market. Why these software are costly?	1+3
	d	What are the main activities required to be done before execute solver of a commercial CFD software.	4