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**Question Paper Code : 60675**

M.E./M.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Second Semester

Automobile Engineering

IC 4291 – COMPUTATIONAL FLUID DYNAMICS

(Common to: M.E. Computer Aided Design / M.E. Engineering Design / M.E. Internal Combustion Engineering / M.E. Product Design and Development / M.E. Thermal Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the types of boundary conditions in CFD?

2. What is grid independent test?

3. What is the difference between diffusion and advection process?

4. What is stability analysis?

5. Describe the merits of finite volume method.

6. What is QUICK scheme?

7. Describe the merits of stream function vorticity method.

8. Mention the applications of creeping flow.

9. What are different turbulence models?

10. List out the standard CFD code that are commercially available in industry.

PART B — (5 × 13 = 65 marks)

11. (a) By using Tayler series expansion derive second order forward and backward difference.

Or

(b) Explain the classification of partial differential equation respect to Computational fluid dynamics.

12. (a) What is Thomas algorithm? Explain in detail.

Or

(b) Explain discretization of unsteady diffusion process.

13. (a) What is central difference scheme? Explain.

Or

(b) Describe hybrid and power law discretization scheme.

14. (a) Describe SIMPLE (Semi Implicit Method for Pressure Linked Equations) procedure of Patankar and Spalding.

Or

(b) What do you meant by pressure based algorithms? Explain PISO algorithms.

15. (a) What is Large Eddy Simulation method? Explain.

Or

(b) Explain Direct Numerical simulation methods.

PART C — (1 × 15 = 15 marks)

16. (a) From the I law of thermodynamics derive conservation of energy equation.

Or

(b) Explain two equation standard $k - \omega$ and $k - \varepsilon$ models.

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