CT Inst. of Engg.

Roll No.

Total No. of Pages: 02

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M.Tech. (ME) (Sem.-2nd)

COMPUTATIONAL FLUID DYNAMICS

Subject Code: MME-504

Paper ID: [E0429]

Time: 3 Hrs.

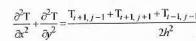
Max. Marks: 100

INSTRUCTION TO CANDIDATES :

- Attempt any FIVE questions out of EIGHT questions.
- Each question carry TWENTY marks.
- 1. a) What are different methods used for solving engineering problems? Write their relative merits and demerits. What are different steps involved in theoretical modelling of a physical problem?
 - b) What are different governing equations used for solving the fluid mechanics and heat transfer problems? Write these equations in Cartesian co-ordinates. Also write different boundary conditions used for solving these governing equations.
- 2. a) Describe Finite Difference Method, Finite Element Method and Finite Volume Method. For what type of problems these methods are most
 - b) Derive the finite difference expressions for a second order derivative with forward, backward and central difference approximations.
- 3. a) Distinguish between discretization and round-off errors. Compare them with suitable examples.
 - b) Describe briefly: Consistency, Convergence and stability of a numerical solution.
- 4. A large plate of thickness L = 2 cm with constant thermal conductivity k = 0.5 W/mK and uniform heat generation q = 1000 kW/m³. The opposite faces of the plate are maintained at uniform temperature of 100°C and 200°C. Assuming the dimensions in y and z directions to be

so large that temperature gradient is significant in the steady state temperature distribution using (FVM) and compare the results with analytical so

- 5. Explain the following methods with suitable exan and demerits:
 - Explicit method
 - Implicit method
 - III) Semi-implicit method
- 6. a) What is the purpose of defining different d control volume method? Show that central di second order of accuracy.
 - b) Verify the following difference approximation at the point (i, j). Assume $\Delta x = \Delta y = h$



Describe the SIMPLE pressure-correction m coupled mass and momentum equations.

Explain why, in practice, it is necessary t correction and not just the velocity correct mass conservation.

- Show that the QUICK advection scheme is uniform mesh).
- b) Discuss the various relaxation techniques use
- c) Describe the Tri-Diagonal Matrix Algorithm linear algebraic equations.

