

GUJARAT TECHNOLOGICAL UNIVERSITY
ME SEMESTER – I (OLD) EXAMINATION – SUMMER 2017

Subject Code: 711103N**Date: 10/05/2017****Subject Name: Fluid Mechanics and Gas Dynamics****Time: 02:30 P.M. to 05:00 P.M.****Total Marks: 70**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Define the continuity equation. Obtain the expression for continuity equation for a three dimensional flow. **07**
 (b) Write a brief note on: Eulerian and Lagrangian methods for representing fluid flow. **07**
- Q.2** (a) Derive the Navier-Stokes equation for viscous compressible fluid with constant viscosity. **07**
 (b) Obtain the generalized Bernoulli's equation from fundamentals. **07**
- OR**
- (b) Differentiate between: (i) stream function and velocity potential function (ii) stream line and streak line. **07**
- Q.3** (a) Write in details about : (i) sources and sinks (ii) doublets and vortices **07**
 (b) Explain the Joukowski hypothesis. **07**
- OR**
- Q.3** (a) Discuss about circulation and vorticity and find out their relation with each other. **07**
 (b) Prove that Laplace's equation $\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = 0$ is satisfied for irrotational flow. **07**
- Q.4** (a) Explain the different types of hydraulic similarities that must exist between a prototype and its model. **07**
 (b) What are the methods of dimensional analysis? Describe the Buckingham's method for dimensional analysis. **07**
- OR**
- Q.4** (a) Prove that stagnation temperature and stagnation density are given as **07**
- $$T_s = T_1 \left[1 + \frac{k-1}{2} M_1^2 \right] \text{ and } \rho_s = \rho_1 \left[1 + \frac{k-1}{2} M_1^2 \right]^{\frac{1}{k-1}}$$
- Q.4** (b) Define: (i) Mach number (ii) Sub-sonic flow (iii) supersonic flow (iv) sonic flow (v) Mach angle (vi) Mach cone (vii) compressibility factor **07**
- Q.5** (a) Obtain expression for the critical pressure ratio for a compressible flow through a nozzle. **07**
 (b) Explain about supersonic pitot tube. **07**
- OR**
- Q.5** (a) Flow through a convergent divergent nozzle depends on the downstream ambient pressure; explain which five possible cases of flow conditions are? **07**
 (b) What do you understand by the terms: stagnation point, stagnation pressure and stagnation temperature? **07**
