Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. SEMESTER I (old course)–EXAMINATION (Remedial) – WINTER 2015

Subject code: 711103N Date: 10/12/2015

Subject Name: Fluid Mechanics and Gas Dynamics

Time: 10:30 AM to 1:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Data book of gas table allowed to use.**

Q.1 **(a)** Explain types of flow with example. **07**

(b) Define the equation of continuity. Obtain an expression for continuity equation for a 3-dimensional flow. **07**

Q.2 **(a)** Derive Bernoulliôs equation for the flow of an incompressible frictional less fluid from consideration momentum. **07**

(b) A pipe of diameter 400 mm carries water at a velocity of 25 m/s. The pressures at the points A and B are given as 29.43 N/cm^2 and 22.563 N/cm^2 respectively while the datum head at A and B are 28 m and 30 m. find the loss of head between A and B. **07**

OR

(b) A metallic ball of diameter 2×10^{-3} m drops in a fluid of sp.gr 0.95 and viscosity 15 poise. The density of the metallic ball is 12000 kg/m^3. Find (I) the drag force exerted by fluid on metallic ball (II) the pressure drag and skin friction drag. (III) The terminal velocity of ball in fluid. **07**

Q.3 **(a)** Sketch and describe the flow pattern of an ideal fluid flow past a cylinder with circulation. **07**

(b) A compression shock occurs in a divergent air flow passage. On the upstream side of the shock, the velocity of air is 400 m/s and the pressure and temperature are 0.2 MPa and 35^o c respectively. Determine (i) Mach number and air velocity on the downstream side of the shock (ii) change in entropy per unit mass of air as a result of shock. **07**

OR

Q.3 **(a)** Write down the Navier ï stocks equations of motion with necessary assumptions, also explain the body and pressure force. **07**

(b) An aircraft engine employs a subsonic inlet diffuser of area ratio 4. Free stream air at a total pressure and temperature of 1×10^5 N/m^2 and 570 K approaches the diffuser with a Mach number 2.2 A shock wave stands just outside the diffuser inlet. Determine the Mack number, pressure and temperature of the air at the exit of the diffuser. Also find the loss in stagnation pressure of air. **07**

Q.4 **(a)** Derive the prandtl Meyer relationship for a normal shock. **07**

(b) Air enters a circular duct of 15 cm diameter with a Mach number 0.5, pressure 300 KN/m^2 and temperature 320 K. Average friction factor for duct is 0.005. Assuming chocked adiabatic flow with friction, determine (I) Length of duct (II) change in entropy (III) change in impulse function (IV) Loss in isentropic stagnation pressure. **07**

OR

Q.4 **(a)** What is fanno flow? What are the assumptions made in deriving equationôs for Fanno flow? **07**

(b) Air is heated in a constant area duct. The initial conditions are 0.3 MPa and 15^{0}c. The initial Mach number is 0.2. The final total temperature is 897^{0}c. What are the final total pressure and Mach number? **07**

Q.5	**(a)**	The pressure difference qpp in a pipe od diameter D and length L due to the turbulent flow depends on velocity V , viscosity µ , density ɟ and roughness K , using Buckinghamôs ´ theorem , obtain the expression for qpp.	**07**
	(b)	Define and explain (1) sub ï sonic flow (2) super-sonic flow (3) sonic flow (4) Mach cone	**07**

OR

Q.5	**(a)**	State Buckinghamôs ´ theorem. Explain about repeating variables in detail.	**07**
	(b)	Define and Explain (1) Froudeôs number (2) Mach number (3) hydraulic similarities (4) Distorted models.	**07**

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