Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY ME - SEMESTER- I (OLD course)• EXAMINATION – SUMMER 2015

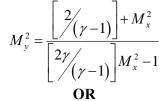
		ME SEMESTER I (OLD COUSC) EXHIMATION SOMMER 2013	
Su	bject	Code: 712103 Date: 13/05/20	15
Ti	me: tructio	Attempt all questions. Make suitable assumptions wherever necessary.	70
Q.1	(a)	What is an aerofoil? Define with a neat sketch the various terms used in aerofoil	07
	(b)	geometry. Explain stream function for two dimensional fluid flows and give its properties.	07
Q.2	(a) (b)	Derive Eulerøs Momentum equations in Cartesian co-ordinates system. Write down the Navier-stocks equations of motion with necessary assumptions, also explain the body and pressure forces.	07 07
	(b)	OR Derive the continuity equation in Cartesian co-ordinates for multidimensional fluid flow with usual notations.	07
Q.3	(a) (b)	Derive Rankine-Hugoniot equation for a normal shock wave. Air flows through a convergent divergent nozzle. At some section in the nozzle, pressure = 2 bar, velocity = 170 m/s, temperature = 200 °C and cross sectional area = 1000 mm ² assuming isentropic flow conditions determine: (a) stagnation temperature and stagnation pressure, (b) sonic velocity and Mach number at this section and (c) Velocity and Mach number at outlet section where pressure is 1.1 bar. Take, R = 287 J/kg K, C _p = 1000 J/kg K and = 1.4.	07 07
Q.3	(a)	Draw Fanno line on h-s diagram and discuss the effect of friction in subsonic	07
	(b)	and supersonic flows. A normal shock wave occurs in air flowing at a Mach number of 1.5. The static pressure and temperature of the air upstream of a shock wave are 1 bar and 300K. Determine the Mach number, pressure and temperature downstream of the shock wave. Also estimate the shock strength.	07
Q.4	(a)	The resisting force F of a supersonic plane during flight can be considered as dependent upon the length of aircraft l , velocity V, air viscosity μ , air density, and bulk modulus of air K. Express the functional relationship between these variables and the resisting force using Buckinghamøs -theorem.	07
	(b)	Explain the objective, importance and applications of prototype model studies. OR	07

Q.4 (a) The pressure drop $\hat{e} P$ in a pipe of diameter D and length *l*, depends on the density , and viscosity μ of the fluid flowing, mean velocity V of flow and the average height of protuberance t. Show that the pressure drop can be expressed in the form:

$$\Delta P = \rho V^2 f\left(\frac{l}{D}, \frac{\mu}{VD\rho}, \frac{t}{D}\right)$$

- (b) What is similitude and model testing? Explain geometric, kinematic and 07 dynamic similarity.
- Q.5 (a) What is lift and Drag coefficient of an aerofoil? Write expression for lift and 07 drag. Show by graph how lifts and drag coefficient vary with angle of attack.

(b) Derive the downstream Mach number relation for flow through a normal shock: 07



- (a) Explain clearly velocity potential and stream function Q.5 and hence prove 07 Cauchy-Riemannøs equation in Cartesian coordinates system. 07
 - (b) Define following model laws and give their fields of applications.
 - 1. Mach Number
 - 2. Weber Number
 - 3. Reynolds Number
 - 4. Euler Number
