Enrolment No.\_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY M. E. - SEMESTER – I • EXAMINATION – SUMMER • 2014

Sul Tin	oject ne: 02	code: 712103NDate: 19-06-2014Name: Fluid Mechanics and Gas Dynamics2:30 pm - 05:00 pmTotal Marks: 70tions:	
1113		Attempt all questions. Make suitable assumptions wherever necessary. Figures to the right indicate full marks.	
Q.1	(a)	Explain the theory of propagation of infinitesimal pressure wave in a medium and derive sonic velocity is equal to $(\partial p/\partial \rho)_s$ .	0′
	(b)	What is an aerofoil? Define with a sketch the various terms used in aerofoil geometry.	0′
Q.2	(a)	Explain velocity potential and stream function for two dimensional incompressible potential flow and hence prove Cauchy - Riemannøs equation in	0′
	(b)	Cartesian coordinates. Explain Source flow, Sink flow and Doublet with figures. <b>OR</b>	0′
	(b)	Derive the following from one dimensional steady flow energy equation $a^2/(-1) + (c^2/2) = (c^2_{max}/2) = a^2_0/(-1) = h_0$	0′
Q.3	(a)	Explain flow in constant area duct with heat transfer on (h-s) diagram and explain the different Mach number regions for heating and cooling of gas flow in duct.	0
	(b)	<ul> <li>A combustion chamber in a gas turbine plants receives air at 350 K, 0.55 bar and 75 m/s. The air-fuel ratio is 29 and the CV of fuel is 41870 KJ/kg. take = 1.4 and R = 0.287 KJ/kg K for the gas determine:</li> <li>(i) The initial and final Mach Numbers.</li> <li>(ii) Percentage stagnation pressure loss in the combustion chamber.</li> </ul>	0'
Q.3	(a)	<b>OR</b> Explain flow in constant area duct with friction on enthalpy-entropy diagram	0
	(b)	<ul> <li>Also represent graphically the variation of stagnation pressure.</li> <li>A circular duct passes 8.25 kg/s of air at an exit Mach number of 0.5. The entry pressure and temperature are 3.45 bar and 38° C respectively and the coefficient of friction 0.005. if the Mach number at the entry is 0.15, determine <ul> <li>(i) Length of the duct.</li> <li>(ii) Pressure and temperature at the exit.</li> <li>(iii) Stagnation pressure loss.</li> </ul> </li> </ul>	0′
Q.4	(a)	Explain the importance of continuity equation. Also derive the continuity equations in Cartesian coordinates system.	0′
	<b>(b)</b>	Derive Eulerøs Momentum equation in Cartesian coordinate system. OR	0
Q.4	(a)	Write down the Navier-Stocks equations of motion for three-dimensional, unsteady, compressible and viscous flow, also explain the body and pressure forces.	0
	(b)	Derive Eulerøs equation and Bernoulliøs equation for one dimensional incompressible flow.	0'
Q.5	(a)	Derive Rankine-Hugoniot equation for a normal shock wave.	0

1

<b>(b)</b>	What is similitude and model testing? Explain geometric, kinematic and	07
	dynamic similarity.	
	OR	

Q.5	<b>(a)</b>	Define following dimensionless numbers and state their significance for fluid	07	
		flow problems: Reynoldøs number, Froude number and Mach number		

(b) Explain the different types of hydraulic similarities that exist between a prototype and its model.

\*\*\*\*\*