GUJARAT TECHNOLOGICAL UNIVERSITY ME – SEMESTER-1 (OLD) EXAMINATION – WINTER 2016

Su	bject	t Code: 711103N Date:19/11/20	Date:19/11/2016	
Su Tii Ins	bject me:1 tructio 1. 2. 3. 4.	 t Name: Fluid Mechanics and Gas Dynamics 0:30 Am to 1:00 Pm Total Marks: ons: Attempt all questions. Make suitable assumptions wherever necessary. Figures to the right indicate full marks. Use gas table if require. 	70	
Q.1	(a)	Explain different dimensionless numbers.	07	
	(b)	Discuss various regions of flow with neat diagram.	07	
Q.2	(a) (b)	Explain Gas dynamics and its importance. Define: Stagnation Temperature, Stagnation pressure, Stagnation density. OR	07 07	
	(b)	The pressure, temperature and Mach number at the entry of a flow passage are 2.45 bar, 26.5 °C, and 1.4 respectively. If the exit mach number is 2.5 determine for adiabatic flow of a perfect gas. (\breve{Y} = 1.3, R= 0.469 kJ/kg-K): (1) Stagnation temperature,(2) temperature and velocity of gas at exit (3) Flow rate per square meter of inlet cross-section.	07	
Q.3	(a)	Explain aerofoil theory and discuss on Drag & lift forces.	07	
	(b)	Explain development of a shock wave theory.	07	
Q.3	(a)	Explain joukowski theory. Discuss on two dimensional flow.	07	
	(b)	Explain mach angle and mach cone of supersonic flow.	07	
Q.4	(a)	Write short note on flow in constant area ducts with friction.	07	
	(b)	Air at $P_0 = 10$ bar, To = 400 K is supplied to a 50 mm diameter pipe. The friction factor for the pipe surface is 0.002. If the mach number changes from 3 at the entry to 1 at the exit, determine: (1) Length of pipe, (2) Mass flow rate.	07	
Q.4	(a)	Explain Rayleigh line.	07	
	(b)	The condition of a gas in a combustor at entry are: $P_1 = 0.343$ bar, $T_1 = 310$ K, $C_1 = 60$ m/s. Determine the mach number, pressure, temperature and velocity at the exit if the increasing in stagnation enthalpy of the gas between entry and exit is 1172.5 kJ/kg. Tale $C_p = 1.005$ kJ/kg-K, $\breve{Y}=1.4$	07	
Q.5	(a) (b)	Explain Buckingham's Π theorem. What is undistorted models? The pressure difference ΥP in a pipe of diameter D and length L due to turbulence flow depends on the velocity V, viscosity μ , density ρ , and roughness K, Using Buckingham's Π theorem, obtain an expression for ΥP .	07 07	
Q.5	(a)	Explain Rayleigh's method. What is distorted models?	07	
	(b)	The resistance force R of a supersonic plain during flight can be considered as dependent upon the length of the aircraft L, velocity V, air viscosity μ , air density ρ and bulk modulus of air K. Express the functional relational between these variables and the resistance force.	07	
