Sanjay Ghodawat University, Kolhapur

2020-21

Established as State Private University under Govt. of Maharashtra. Act No XL, 2017

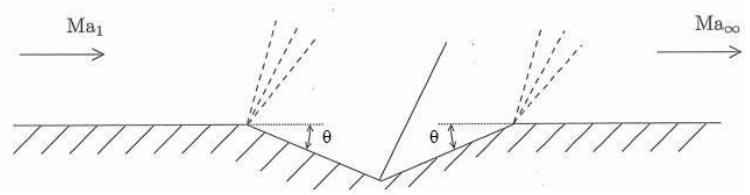
EXM/P/09/00

Year and Program: TY-B.Tech	School of Technology	Department: AERO
Course Code: AET301	Course Title: Aerodynamics-II	Semester : V
Day : Monday Date: 14.12.2020	End Semester Examination	Time:2 Hrs. Max Marks:50

Instructions: 1) All Questions are compulsory.
2) Assume data wherever necessary

		Marks	Bloom's Level	CO
Q.1	**Answer the following (Any Two)**–			
a)	Consider a high-speed missile and calculate c_p, c_v, e, and h when: i. The temperature and pressure are 1100°Rand 8.4 atm. ii. The air at standard sea levelconditions. iii. How do c_p and c_v compare for bothcases?	8	4	CO1
b)	The flow just upstream of a normal shock wave is given by $P_1 = 2$ atm, $\rho_1 = 1.035$ kg/m^3, $M_1 = 3.15$. Calculate the following properties just downstream of the shock: P_2,T_2, M_2, ρ_2, T_{02} and P_{02}. Consider $\Upsilon = 1.33$.	8	3	CO2
c)	Consider a flow with pressure and temperature of 2126 lb/ft^2 and 529°R, respectively. A Pitot tube is inserted into this flow and measures a total pressure $P_{02} = 7732.9$ lb/ft^2. i. Calculate: u_1, u_2 and T_2. ii. Consider Bernoulli's equation for Incompressible flow: $u = \sqrt{\frac{2(P_0 - P)}{\rho}}$. Calculate percent error induced by Bernoulli'sequation.	8	4	CO2

Q.2	**Answer the following (Any two) –**			
a)	A supersonic flow at $Ma_1 = 4.21$ moves parallel to a wall and encounters a geometrical disturbance as shown in figure below. The deflection angle $\theta = 19^0$.	8	3	CO3



Determine:

1. Exit Mach number, Ma_∞
2. Decrease in static pressure, $(P_1 - P_\infty) / P_1$
3. Decrease in static pressure, $(P_{01} - P_{0\infty}) / P_{01}$

b)	Derive an expression for Area-Mach number relation for a supersonic flow through nozzle.	8	3	CO3
c)	Explain in detail about the working of supersonic wind tunnel.	8	2	CO4

Q.3 Answer the following (Any two) –

a)	For a B747 aircraft what is critical Mach number? Explain M_{crit} in terms of freestream mach number and comment on the location of minimum pressure.	9	3	CO4
b)	Using linearized theory, calculate the lift and drag coefficients for an infinitely thin flat plate in a Mach 2.6 freestream at angles of attack of a) $\alpha = 5^0$ b) $\alpha = 15°$	9	4	CO5
c)	The F-104 supersonic fighter flying at Mach 2 at 11km altitude with the air density and temperature given by $\rho_\infty = 0.3648$ kg/m^3 and $T_\infty =$ 216.78K. Calculate the angle of attack of the wing assuming steady level flight with aircraft weight of 9400kgf.	9	4	CO5

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