INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

ASSIGNMENT QUESTIONS

Course Name	:	**AERODYNAMICS II**
Course Code	:	**A52107**
Class	:	III B. Tech I Semester
Branch	:	AERO
Year	:	2017 – 2018
Course Coordinator	:	Mr. N V Raghavendra, Associate Professor
Course Faculty	:	Mr. N V Raghavendra, Associate Professor

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

S No	Question	Blooms Taxonomy Level	Course Outcome
	ASSIGNMENT-I **UNIT-I THERMODYNAMICS IN FLUID MOTION**		
1	a. Definition of compressibility of flow. Expression for compressibility. b. Consider a rectangular room that is 5m by 10m and a 5m height ceiling, The temperature and air pressure in the room is 350c and 3atm respectively, calculate the enthalpy and internal energy of the air in the room.	Understand	1
2	a. Definition of compressibility of flow. Expression for compressibility? b. At a point in an airflow the pressure, temperature and velocity are 1atm, 320k and 1000m/s. Calculate the total temperature and pressure at this point.	Understand	1
3	a. Explain Mach number? How are flows classified based on Mach numbers. b. Consider a rectangular floor that is 5m by 7m and a 5m height ceiling, The air pressure and temperature in the room are 1atm and 25c respectively, calculate the internal energy and enthalpy of the air in the room.	Understand	2
4	a. What are variables of state? Explain first law of thermodynamics. Write equation for first law reversible process? b. Calculate the ratio of kinetic energy to internal energy in the flow where Mach number M=2 and M=20.	Understand	2

S No	Question	Blooms Taxonomy Level	Course Outcome
5	a. What is isentropic process? Derive isentropic relations? b. At a point in the flow the pressure, temperature and velocity are 5atm, 150 k, and 100m/s. Calculate the total temperature and total pressure at this point.	Understand	2
	UNIT-II **ONE DIMENSIONAL FLOWS**		
1	a. Obtain an equation for continuity? Write continuity equation for 1-D flow? b. Consider a normal shock wave in air where the upstream flow properties are 680m/s, T1 =288k, and P1= 1 atm. calculate the velocity , temperature and pressure downstream the shock	Evaluate	2
2	a. Obtain relation for area and velocity for a flow over a nozzle b. At a point in an airflow the pressure, temperature and velocity are 1atm, 320k, and 1000m/s. Calculate the total temperature and total pressure at this point?	Understand	2
3	a. Explain about the measurement of air speed in compressible subsonic and supersonic flows? b. The temperature and pressure at the stagnation point of a high -speed missile is 518.9k and 7.8atm respectively. Calculate the density at the point	Evaluate	3
4	a. Obtain the relations for normal shock? b. The temperature and pressure at the stagnation point of a high -speed missile is 518.9k and 7.8atm respectively. Calculate the density at the point. Calculate Cp, Cv, e and h for air at standard sea level conditions.	Evaluate	3
5	a. Discuss various forms of energy equation. b. Consider air at a temperature of 230K, calculate the speed of sound.	Understand	3
	ASSIGNMENT-II **UNIT-III OBLIQUE SHOCK AND EXPANSION WAVES**		
1	a. Write notes on supersonic flow over a wedge and cone with attached shock. b. A wedge with a 150 half angle in a Mach 5 flow, calculate drag co –efficient.	Evaluate	4
2	a. What is a Mach wave, Mach line, Mach angle b. A supersonic flow with M1 = 1.5 , p1= 1atm and T1= 288k is expanded around a sharp corner through a deflection angle 150.calculate T2,V2,and the angles that the forward and rearward Mach lines with respect to the upstream flow direction.	Evaluate	4
3	a. Write about shock boundary layer interactions b. Calculate the lift and drag coefficients for a flat plate at 50 angle of attack in a Mach 3 flow.	Evaluate	4
4	a. Explain supersonic flow over a flat plate at an angle of attack. b. A slender missile is flying at Mach 1.5 at low altitude. Assume the wave generated by the nose of the missile is a Mach wave. This wave intersects the ground 559ft behind nose .at what altitude is the missile flying?	Evaluate	5
5	a. Write about intersection of shocks, Mach reflection? b. Consider the flow over a 22.20 half angle wedge .If M1=2.5 P1= 1atm and T1= 300k, calculate the wave angle and P_2 T_2.	Evaluate	5
	UNIT-IV **MORE ONE DIMENSIONAL FLOWS AND SUBSONIC AND TRANSONIC AIRFOILS**		
1	Explain about wave reflection from free boundary?	Understand	6
2	Write about appearance of normal shock?	Understand	6

S No	Question	Blooms Taxonomy Level	Course Outcome
3	a. Write about super-critical airfoils? b. At a given point on the surface of an aerofoil, the pressure coefficient is -0.3 at very low speeds. If the free stream Mach number is 0.6, calculate Cp at this point.	Understand	7
4	Calculate the mass flow through the nozzle assuming that reservoirs temperature is 288K and throat area is 0.3 m2	Understand	7
5	A pitot tube at the exit of a supersonic nozzle reads, 8.92X 104 N/m2. If the reservoir pressure is 2.02 X 105 N/m2, calculate the area ratio of the nozzle (Ae/A*).	Evaluate	8
6	The nozzle of a supersonic wind tunnel has an exit to throat area ratio of 6.79 when the tunnel is running, a pitot tube mounted in the test section, measures 1.448atm, what is the reservoir pressure for the tunnel.	Evaluate	8
	UNIT-V **AIRFOIL, WING AND CONE IN SUPERSONIC FLOW**		
1	a. Explain about method of characteristics? b. Consider a flat plat at angle of attack 200 in Mach 20 free stream. Using straight Newtonian theory, calculate the lift – and wave drag coefficients	Evaluate	8
2	a. Explain about windward and leeward surface b. At a given point on the surface of an airfoil, the pressure co-efficient is -0.3 at very low speeds. If free stream Mach number is 0.6 calculate Cp at this point.	Evaluate	9
3	a. Explain comparison of pressure rise for wedge and cone of equal semi-angle? b. The theoretical lift co-efficient for a thin, symmetric airfoil in an incompressible flow is cl= $2\pi\alpha$. Calculate the lift coefficient for M free stream =0.7.	Understand	9
4	a. Explain method of characteristics for the application to supersonic nozzle design? b. Calculate the pressure at the top and bottom surfaces of the flat plate using linearized theory?	Evaluate	10
5	a. Explain principle of limited upstream influence in supersonic flow? b. Calculate L/D ratio for flight conditions of Mach 2.0 at an altitude of 11km. for these conditions the wing angle of attack is 0.035rad, assume chord length of airfoil is 2.2m.	Evaluate	10

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