INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

ASSIGNMENT

Course Name	:	**THERMODYNAMICS**
Course Code	:	**A30306**
Class	:	II B. Tech I Semester
Branch	:	Aeronautical
Year	:	2016 – 2017
Course Coordinator	:	Dr. D Govardhan Professor
Course Faculty	:	Dr. D Govardhan 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** **INTRODUCTION**		
1	(a) Explain Zeroth law of Thermodynamics. (b) When a stationary mass of gas was compressed without friction at constant pressure, its initial state of 0.4m3 and 0.105MPa was found to change to final state of 0.20m3 and 0.105MPa. There was a transfer of 42.5kJ of heat from the gas during the process. How much did the internal energy of the gas change?	Understand, Evaluate	1
2	(a) Define System, Surroundings and Boundary? (b) 0.44kg of air at 1800C, expands adiabatically to 3times its original volume and during the process, there is a fall in temperature to 150C. The work done during the process is 52.5kJ. Calculate Cp and Cv ?	Understand, Evaluate	1
3	(a) Distinguish between macroscopic and microscopic point of view? (b) Two thermometers one centigrade and other Fahrenheit are immersed in a fluid, after the thermometers reached equilibrium with the fluid, it is noted that both the thermometers indicate the same numerical values. Find that the identical numerical values shown by the thermometers? What would be the corresponding temperature of the fluid, expressed in degrees Kelvin and degrees Rankine?	Understand, Evaluate	1
	UNIT-II **LIMITATION OF THE FIRST LAW**		
1	(a) Describe second law of thermodynamics by Kelvin-Plank statement and Clausius statement? (b) Establish the equivalent of Kelvin-Plank and Clausius statements?	Understand, Evaluate	2
2	(a) Using Maxwell's relations, deduce the two TdS equations? (b) Heat flows from a hot reservoir at 800K to another reservoir at 250K.If the entropy change of overall process is 4.25kJ/K, make calculation for the heat flowing out of the high temperature reservoir?	Evaluate	2

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3	A gas turbine receives gases from the combustion chamber at 7.5bar and 6000C, with a velocity of 100 m/s. The gases leave the turbine at 1 bar with a velocity of 45 m/s. Calculate the work done if the expansion is isentropic.	Evaluate	2
4	Determine an expression for the work done in a closed isothermal process?	Understand	2
5	A gas from its initial pressure and volume and mass equal to 650 kN/m2, 0.6m3 and 0.65 kg respectively expands to its environment at and equal to 100kN/m2 and 295 K respectively though a reversible process. Calculate specific availability function if the system is a closed one. Take Cv = 0.82 kJ/Kg K, R = 0.31 kJ/Kg K.	Evaluate	2
	UNIT-III **PERFECT GAS LAWS**		
1	A vessel of volume 1 m3 capacity contains steam at 20 bar and 0.85 dryness fraction Steam is blown off until the pressure drops to 10 bar. The valve is then closed. Determine mass of steam blown off. Assume process as throttling.	Evaluate	3
2	A rigid vessel of volume $0.86m^3$ contains 1 kg of steam at a pressure of 2 bar. Evaluate the specific volume, temperature, dryness fraction, internal energy, enthalpy and entropy of steam.	Evaluate	3
3	Find the saturation temperature, the changes in specific volume and entropy during evaporation and the latent heat of vapourization of steam at 1MPa.	Evaluate	3
	ASSIGNMENT – II **UNIT-III** **PERFECT GAS LAWS**		
4	What do you understand by degree of superheat and degree of sub cooling?	Understand,	4
5	3 kg of steam at 18bar occupy the volume of $0.2550m^3$ during a constant volume process, the heat rejected is 1320kJ. Determine final internal energy and find initial dryness and work done.	Evaluate	4
	UNIT-IV **MIXTURES OF PERFECT GASES**		
1	A closed vessel of 1.5 m^3 capacity contains steam at 3bar and 0.8 dryness fraction. Steam at 10bar and 0.9 dryness fraction is supplied until the pressure inside the vessel reaches 5bar. Calculate the mass of steam in the vessel	Evaluate	5
2	Define mass fraction, mole fraction, volume fraction and partial pressure fraction of a constituent of a mixture of gases.	Understand	5
3	Mathematically Dalton's Law of Partial Pressures can be written as $P_{tot} = P_1 + P_2 + P_3 + \ldots$ When we apply the ideal gas law to mixtures of gases each component gas will have its own P and n, but all of the component gases will have the same T and V. Substantiate with an example.	Evaluate	5
4	Prove that Partial pressure fraction = Mole fraction = Volume fraction of a constituent of a mixture of gases with an example.	Understand,	5
	UNIT-V **THERMODYNAMIC CYCLES & REFRIGERATION CYCLES**		
1	An ideal Stirling engine using helium as the working fluid operates between temperature limits of 300 and 2000 K and pressure limits of 150 kPa and 3MPa. Assuming the mass of the helium used in the cycle is 0.12 kg, determine (*a*) the thermal efficiency of the cycle, (*b*) the amount of heat transfer in the regenerator, and (*c*) the work output per cycle.	Evaluate	6
2	Consider an ideal Ericsson cycle with air as the working fluid executed in a steady-flow system. Air is at 27°C and 120 kPa at the beginning of the isothermal compression process, during which 150 kJ/kg of heat is rejected. Heat transfer to air occurs at 1200 K. Determine (*a*) the maximum pressure in the cycle, (*b*) the net work output per unit mass of air, and (*c*) the thermal efficiency of the cycle.	Evaluate	6
3	The compression ratio of an ideal dual cycle is 14. Air is at 100 kPa and 300 K at the beginning of the compression process and at 220^0 K at the end of the heat-	Evaluate	6

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	addition process. Heat transfer to air takes place partly at constant volume and partly at constant pressure, and it amounts to 1520.4kJ/kg. Assuming variable specific heats for air, determine (*a*) the fraction of heat transferred at constant volume and (*b*) the thermal efficiency of the cycle.Drag reduction		
4	Draw the p-v and the T-s diagram of a dual combustion cycle and explain	Understand	6
5	Describe Otto gas power cycle with the help of P-V and T-S diagram. Derive an expression for its air standard efficiency.	Understand	6

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