Sanjay Ghodawat University, Kolhapur 2019-20

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Year and Program: 2019-20 S Y B. Tech. | **School of Technology** | **Department: Aeronautical Engineering**

Course Code: AET205 | **Course Title: Aerothermodynamics** | **Semester – III**

Day and Date: Wednesday 27/11/19 | **End Semester Examination (ESE)** | **Time: 3hr Max Marks: 100** 10.30am to 1.30pm

Instructions:
1) All questions are compulsory.
2) Assume suitable data wherever necessary.
3) Figures to the right indicate full marks.

			Marks	Bloom's Level	CO
Q.1	a)	Define thermodynamics, state, system, process, equilibrium, pure substance.	06	L_2	CO1
		OR			
	a)	State zeroth law of thermodynamics and explain how it becomes a basis for measurement of temperature.	06	L_2	CO2
	b)	Differentiate the following: i) Open system and closed system. ii) Heat and work. iii) Intensive property and extensive property.	06	L_2	CO1
		OR			
	b)	Discuss Microscopic and Microscopic approaches of study of thermodynamics.	06	L_2	CO1
Q.2	a)	Prove that violation of Kelvin Planck's statement violates Clausius statement of second law of thermodynamics.	06	L_2	CO2
		OR			
	a)	Explain orsat apparatus method of analyzing the flue gases.	06	L_2	CO3
	b)	Define fuel. Explain different types of fuels.	06	L_2	CO3
		OR			
	b)	State and Prove internal energy is a property of a system.	06	L_2	CO1
Q.3		**Solve any Two**			
	a)	A solid fuel contains 72% of Carbon by weight. During combustion 0.7 kg of carbon in 1 kg of fuel is burnt to CO_2 and remainder to CO. Determine i) The minimum quantity of air required for combustion of one kg of fuel ii) If the actual air supplied is 1.5 times the minimum air, estimate percentage volumetric analysis of dry products.	08	L_3	CO3
	b)	A heat engine is used to drive a heat pump. The heat transfers from the heat engine and the heat pump are used to heat water circulating	08	L_3	CO2

through the radiators of a building. The efficiency of a heat engine is 27% and the coefficient of performance of heat pump is 4. Evaluate the ratio of the heat transfer to the water circulating through the radiator to the heat transfer to the heat engine.

c)	A system contains 0.15 m^3 of air at a pressure of 3.8 bar and 150°C. It is expanded adiabatically till the pressure falls to 1 bar. The gas is then heated at constant pressure till its enthalpy increases by 70 kJ. Determine the total work done.	08	L_3	CO2
d)	Derive an equation to determine work done during polytropic process (PV^n =Constant).	08	L_2	CO1
Q.4	**Solve any Two**			
a)	State and prove Clausius inequality.	09	L_2	CO1
b)	A 5 kg copper block at a temperature of 200°C is dropped into an insulated tank containing 100 kg of oil at a temperature of 30°C. Find the increase in entropy of the universe due to this process when copper block and oil reach thermal equilibrium. Assume that specific heats of copper and oil are respectively 0.4 kJ/kg-K and 2.1 kJ/kg-K.	09	L_3	CO1
c)	A reversible heat engine operates with constant temperature reservoirs, A, B and C at 600K, 400K and 300K respectively. Heat engine receives 2500 kJ of energy as heat from the reservoir at 600K and produces 1000 kJ of work. Determine the magnitude and direction of heat interactions with reservoir B and C.	09	L_3	CO1
Q.5	**Solve any Two**			
a)	Derive an equation to determine the Efficiency of otto cycle with usual notations. Also define mean effective pressure.	09	L_2	CO5
b)	Explain simple Rankine cycle with PV and TS diagrams.	09	L_2	CO4
c)	Explain Vapour compression refrigeration system with neat sketch.	09	L_2	CO4
Q.6	**Solve any Three**			
a)	Define entropy. Explain principle of increase of Entropy.	08	L_2	CO1
b)	An inventor claims that his engine absorbs 300 kJ of heat from a source at 325K and produces 75kJ of work. The inventor also states that his engine has two heat rejections: 125 kJ to a reservoir at 300K and 100 kJ to a reservoir at 275K. Check the validity of his	08	L_3	CO2
c)	Derive an equation to determine the efficiency of dual combustion cycle with usual notations.	08	L_3	CO5
d)	Explain vapour absorption refrigeration system with neat sketch.	08	L_3	CO4

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