Sanjay Ghodawat University, Kolhapur

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2018-19

EXM/P/09/01

Year and Program: 2018-19 B.Tech | **School of Technology** | **Department of Aeronautical Engineering (AE) S.Y**

Course Code: AET205 | **Course Title: Aero Thermodynamics** | **Semester – III**

Day and Date: Saturday 01 Dec 18 | **End Semester Examination (ESE)** | **Time: 2:30p.m - 5:30p.m** | **Max. Marks: 100**

Instructions:

1. All questions are compulsory.
2. Assume suitable data wherever necessary.
3. Figures to the right indicate full marks.
4. Use of thermodynamic data handbook and steam table is permitted.

		Marks	Bloom's Level	CO
Q.1	**Solve any Two**			
a)	State and explain Zeroth law of thermodynamics.	07	L_2	CO1
	OR			
a)	Define pure substance and explain the phase change phenomenon of a pure substance.	07	L_2	CO1
b)	State first law of thermodynamics for a cyclic process and show that internal energy is a property of a system.	08	L_3	CO2
	OR			
b)	Derive an expression for the displacement work related to: (a) Constant Pressure process and (b) Polytropic process with neat p-V diagram.	08	L_3	CO2
Q.2	**Solve any Two**			
a)	List and explain different characteristic of an ideal fuel.	07	L_2	CO3
	OR			
a)	List the advantages and disadvantages of liquid fuel over solid fuel.	07	L_1	CO3
b)	Define tonne of refrigeration (TR). List and explain the desirable properties of a good refrigerant.	08	L_2	CO6
	OR			
b)	In an air standard Diesel engine cycle with a compression ratio of 14:1, the conditions of air at the start of the compression stroke are 1 bar and 300 K. After addition of heat at constant pressure, the temperature rises to 2775 K. Determine the thermal efficiency of the cycle and net work			

		done per kg of air.	08	L_3	CO6
Q.3		**Solve any Two**			
	a)	With a neat sketch, explain state, state diagram, path, process and cycle.	08	L_2	CO1
	b)	Draw a steady flow device and derive an expression for steady flow energy equation (S.F.E.E).	08	L_2	CO2
	c)	Define and explain the following: (i) Theoretical air. (ii) Stoichiometric air-fuel ratio. (iii) Combustion. (iv) Ignition temperature.	08	L_2	CO3
	d)	Show that the efficiency of the Otto cycle depends only on the compression ratio.	08	L_4	CO6
Q.4		**Solve any Two**			
	a)	With a neat sketch, explain heat engine, refrigerator and heat pump.	09	L_2	CO4
	b)	A series combination of two Carnot engines operate between temperatures T_1 and T_2 ($T_1 > T_2$) show that (i) The intermediate temperature T is an arithmetic mean of temperatures T_1 and T_2, if the engines produce equal amounts of work and (ii) The intermediate temperature T is the geometric mean of temperatures T_1 and T_2, if the engines have equal cycle efficiencies.	09	L_4	CO4
	c)	A Carnot engine operates between two reservoirs at temperatures of T_1 and T_2 in K. the work output of the engine is 0.6 times the heat rejected. Given that the difference in temperature between the source and sink is 200 °C. Calculate- (i) The source temperature (ii) Sink temperature and (iii) Thermal efficiency of the engine.	09	L_3	CO4
Q.5		**Solve any Two**			
	a)	Define entropy and prove Clausius theorem.	09	L_2	CO5
	b)	State Clausius inequality and show that entropy as a property of the system.	09	L_3	CO5
	c)	A reversible engine takes 1200 kJ/min from a reservoir at 700K and develops 200 kJ/min when executing complete cycles. The engine			

	rejects heat to two reservoirs at 600K and 500K. Find the heat rejected to each sink.	09	L_3	CO5
Q.6	**Solve any Three**			
a)	State Kelvin-Planck and Clausius statements of second law of thermodynamics.	06	L_2	CO4
b)	With a neat sketch, explain Carnot cycle.	06	L_2	CO4
c)	Show that TdS = dH - VdP.	06	L_4	CO5
d)	Briefly explain available energy and unavailable energy.	06	L_2	CO5

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