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UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2018

Program: B.Tech ASE, ASEA | **Semester – IV**
Subject (Course): Propulsion - I | **Max. Marks : 100**
Course Code : ASEG 321 | **Duration : 3 Hrs**
No. of page/s: 02

Instructions: Make use of sketches/plots to elaborate your answer. Brief and to the point answers are expected. The Question paper has three sections: Section A, B and C. Section B and C having the internal choice. The notations have their usual meanings. Make suitable assumptions while answering the questions. Assume suitable data if missing.

SECTION A (5 x 4 = 20 Marks)			
		Marks	**CO**
Q 1	Establish the reason for the correctness of the following statements in not more than five sentences and one sketch/plot if necessary.		
	a) Propeller of an aircraft is twisted in such a way that the blade angle near the tip approaches zero degree but the blade angle at the root approaches 90 degree.	**5**	**CO1**
	b) Four Stroke Engine is preferred over Two Stroke Engine for better fuel efficiency, whereas Two Stroke Engine is preferred over Four Stroke engine for more power output.	**5**	**CO2**
	c) Liquid fuels are preferred in IC engines as compared to solid or gaseous fuels.	**5**	**CO3**
	d) Turbo-prop engine is preferred over Turbojet engine at low altitudes and low speeds.	**5**	**CO4**
SECTION B (10 x 4 = 40 Marks)			
Q 2	Why Blade element theory is superior to Froude momentum theory? Using blade element theory derive the expression for thrust grading for propeller.	**10**	**CO1**
Q 3	Explain clearly the valve timing diagram for four stroke cycle spark ignition engine with a suitable sketch. What is the effect on value timing if the engine speed is very high?	**10**	**CO2**
Q 4	A diesel engine operating on the air-standard diesel cycle has six cylinders of 100 mm bore and 120 mm stroke. The engine speed is 1800rpm. At the beginning of the compression the pressure and temperature of air are 1.03bar and 35°C. If the clearance volume is $1/8^{th}$ of the stroke volume, calculate (i) the pressure and temperature at the salient points of the cycle (ii) the compression ratio (iii) the efficiency of the cycle and (iv) the power output if the air is heated to 1500°C. Assume C_p and C_v of air to be 1.004and 0.717 kJ/kg K respectively.	**10**	**CO2**

Q 5	Explain the principle of carburation. With neat sketch explain the working of a simple carburetor. **Or** What are the functional requirements of an injection system? Explain the Air and solid injection systems.	**10**	**CO3**
SECTION-C (20 x 2 = 40 marks)			
Q 6	(A) What is an afterburner and why it is used? Draw the T-S diagram of an ideal turbojet engine with an afterburner; explain the state points in the T-S diagram. [5 Marks] (B) A turbo-prop driven airplane is flying at 600 Km/h at an altitude where the ambient conditions are 0.458 bar and -15^{o}C. The compressor pressure ratio is 9:1 and the turbine inlet temperature is 1200 K. The isentropic efficiencies of compressor and turbine are 0.89 and 0.93 respectively. Assuming that no thrust is generated by the jet exhaust from the engine; calculate the specific power input available to the propeller. [15 Marks]	**20**	**CO4**
Q 7	A simple turbojet unit operates with a maximum turbine inlet temperature of 1100K, a pressure ratio of 4:1 and a mass flow of 22kg/s under design conditions, the following components efficiencies may be assumed, Isentropic efficiency of compressor = 83%, Isentropic efficiency of turbine = 91%, Propelling nozzle efficiency = 95.5%, Transmission efficiency = 99%, Combustion chamber pressure loss = 4.5% of the compressor delivery pressure. Assume C_{pa} = 1.005kJ/kg K, and γ_a = 1.4, C_{pg} = 1.147 kJ/kg k and γ_g = 1.33.Calculate the total thrust. Also calculate the specific fuel consumptions. Assume that the unit is stationary and at sea level condition are 1 bar and 293K, f = 50. Also neglect the nozzle chocking condition. **Or** Write short notes on the following: (5 x 4 = 20 Marks) A. Axial and centrifugal compressor. B. Can and Annular combustion chamber. C. Ramjet engine. D. Pulse jet engine.	**20**	**CO4**