Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2021

Course: Propulsion-I **Semester : IV**
Program: B. Tech ASE, ASEG **Time : 03 hrs.**
Course Code: ASEG 2003 **Max. Marks : 100**

SECTION A

1. **Each Question will carry 5 Marks**

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Q 1	1. Backward curved centrifugal vanes, compared to forward curved vanes, provide a) High impeller outlet flow velocity b) High outlet static pressure c) High specific energy input d) High noise. **[2.5]** 2. Contribution in thrust generation of Propeller is more due to a) Less Mass flow rate handling capacity b) More Mass flow rate handling capacity c) Less velocity change d) More velocity change **[2.5]**	**C02**
Q 2	1. A gas turbine cycle with a reheating and heat exchanger improves a) Only thermal efficiency b) Only the specific power output c) Both the thermal efficiency and specific power output d) Neither thermal efficiency and specific power output **[2.5]** 2. Which one of the following is correct a) The turbine used in gas turbine is power plant is larger than that used in steam power plant b) The turbine used in gas turbine is power plant is smaller than that used in steam power plant c) The same turbine can be used for both the plants d) None of the above **[2.5]**	**C01**
Q 3	1. Brayton cycle work ratio is less than Rankine cycle	**C02**

	a) More pump work b) Less pump work c) More compressor work d) Less compressor work **[2.5]** 2. If the degree of reaction of compressor is 85% it means a. 50 % enthalpy rise in rotor and 50% enthalpy in stator b. 15% enthalpy rise in rotor and 85 % enthalpy in stator c. 85% enthalpy rise in rotor and 15 % enthalpy in stator d. None of the above **[2.5]**	
Q 4	1. Root section of the blade mainly non airfoil section due to a) To meet the flow condition b) To meet the different angle of attack c) To meet the strength criteria d) All of the above **[2.5]** 2. Compression ratio in the diesel engine is of the order of: a) 5-7 b) 7-10 c) 10-12 d) 15-20 **[2.5]**	**C01**
Q5	1. A diesel engine is usually more efficient than a spark ignition engine because a) diesel being a heavier hydrocarbon, releases more heat per kg than gasoline b) The air standard efficiency of diesel cycle is higher than the Otto cycle, at a fixed compression ratio. c) The compression ratio of a diesel engine is higher than that of an SI engine d) Self-ignition temperature of diesel is higher than that of gasoline **[2.5]** 2. For the same maximum pressure and heat input, the most efficient cycle is (a) Otto cycle (b) Diesel cycle (c) Brayton cycle (d) Dual combustion cycle **[2.5]**	**C01**
Q6	1. The degree of reaction of a turbine is defined as the ratio of (a) Static pressure drop to total energy transfer (b) Total energy transfer to static pressure drop (c) Change of velocity energy across the turbine to the total energy transfer (d) Velocity energy to pressure energy **[2.5]** 2. Inter-cooling in gas turbines (a) Decreases net output but increases thermal efficiency (b) Increases net output but decreases thermal efficiency	**C02**

	(c) Decreases both net output and thermal efficiency (d) Increases both net output and thermal efficiency **[2.5]**	
SECTION B 1. **Each Question will carry 10 Marks** 2. **Instruction: Assume necessary data if needed**		
Q 1	Explain the types of blades used in compressor through velocity tringle and select the proper blade for high speed compressor application.	**C02**
Q2	Explain the performance curve of a axial flow compressor and their significance.	**C02**
Q3	Calculate the air standard efficiency of the cycle of an oil engine works on diesel cycle, which has maximum compression ratio is 16. At the beginning of compressor temperature is 20^{o}C and 750 KJ/Kg of air of heat is supplied at constant pressure and it reaches to 430^{0}C temperature at the end of adiabatic expansion. What would be the theoretical work-done per Kg of air. take Cv = 0.717 KJ/Kg K and specific heat ratio = 1.4.	**C03**
Q4	Explain clearly the actuator disc theory assumption and derive the equation of thrust using Rankine theory.	**C03**
Q5	A simple gas turbine takes in air at 1.0 bar and 27 °C and compresses to a pressure of 6 bar with the isentropic efficiency of compression being 85%. The air passes to the combustion chamber, and after combustion the gases enter the turbine a temperature of 560 °C and expand to 1.00 bar, the turbo efficiency being 80%. Neglecting the change of mass flow rate due to fuel, calculate the flow of air in kg per second for a net output of 1500 kW making the following assumptions: Loss of pressure in combustion chamber = 0.08 bar.	**CO4**
SECTION C 1. **Each Question will carry 20 Marks** 2. **Instruction: Assume necessary data if needed**		
Q 1	Solve a turbomachinery unit centrifugal compressor which runs at 10,000 rpm delivers 650 m3/min of air corresponding to inlet condition of 1 bar and 250C the pressure ratio is 4 with isentropic efficiency is 82% blade are radial and outlet of impeller and velocity of flow is constant throughout and it is 62 m/s , D2= 2D1, slipfactor = 0.9 and power input factor = 1.04 & K1 =0.9. draw the velocity tringle at inlet and outlet with the effect of slip and calculate . a) Final temperature of air b) Power reqired in Kw c) Impeller dia at inlet and outlet d) Width of impeller at inlet e) Impeller blade angle at inlet f) Diffuser blade angle at inlet **OR**	**CO4**

	Analyze an axial flow compressor in which Air at 1 bar and 288K enters to the compressor with an axial velocity of 150 m/s. There are no inlet guide vanes. The rotor stage has a tip diameter of 60 cm and a hub diameter of 50 cm and rotates at 100 rps. The air enters the rotor and leaves the stator in the axial direction with no change in velocity or radius. The air is turned through 30.20 as it passes through the rotor. Assume an overall pressure ratio of 6 and a stage pressure ratio of 1.2. Find a) the mass flow rate of air, b) the power required to drive the compressor, c) the degree of reaction at the mean diameter, d) the number of compressor stages required if the isentropic efficiency is 0.85	