Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, July 2020

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

Instructions:

1. **Read the Instruction carefully before attempting**
2. **For Theory based : Type the Answers in word file**
3. **For Figures if any : Draw a free hand sketch and insert the same word file**
4. **For Numerical : Solve it in a paper and insert in the same word file**
5. **Upload as a single word file for all the Question in Blackboard.**

Note : Please upload the word document only, Do not upload PDF and or other format. The answer scripts will be considered for evaluation only through Blackboard. No other mode of submission is acceptable.

SECTION A [60 Marks]

S. No.		Marks	CO
Q 1	Analyze a Gas turbine engine at a design speed under the following data employing a separate power turbine, heat exchanger, reheater and intercooler between two-stage compression. Efficiency of compression in each stage: 85% Isentropic efficiency of compressor turbine: 90% Isentropic efficiency of power turbine: 85% Transmission efficiency: 98% Pressure ratio in each stage of compression: 2:1 Pressure loss in intercooler: 0.07 bar Temperature after intercooling: 300 K Thermal ratio of heat exchanger: 0.75 Pressure loss in combustion chamber: 0.15bar Combustion efficiency of reheater: 98% Maximum cycle temperature: 1000 K Temperature after reheating: 1000 K Air mass flow: 25 kg/s Ambient air temperature: 15 °C Ambient air pressure: 1 bar	**25**	**CO4**

NOTE : The submission time of the Question Paper Answer Sheet is 24 Hhrs from the scheduled time (*exceptional provision due to extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas*).
No Submission will be entertained after 24 Hrs

	Take the calorific value of fuel as 42 MJ/kg and pressure loss in each side of heat exchanger as 0.1 bar. Find the net power output overall thermal efficiency, specific fuel consumption. Neglect the kinetic energy of the gases leaving the system		
Q 2	In a gas turbine the compressor taken in air at a temperature of 27, and compresses it to five times the initial pressure with an isentropic efficiency of 85%. The air is then passed through a regenerator heated by the turbine exhaust before reaching the combustion chamber. The effectiveness of the regeneration is 80%. The maximum temperature after constant pressure combustion is 677 °C and the efficiency of the turbine is 80%. Neglecting all losses except mentioned, and assuming the working fluid throughout the cycle to have the characteristics of air a. Sketch the cycle on the T-s diagram. Calculate the efficiency of the cycle	**15**	**CO3**
Q 3	Analyze the radial blade centrifugal compressor performance under the following assumption Inlet flow velocity is equal to exit flow velocity, there is no whirl component at the inlet of compressor and isentropic efficiency of compressor is 75% . Running speed vary from 5000 to 8000 RPM with Jump of 1000 RPM volume flow rate at max RPM is about 700 M^3 /min of air. The pressure rise very from 4 to 6 and the inlet condition are atmospheric condition. Flow velocity is limited to 55 m/s and exit impeller diameter is thrice of inlet diameter of impeller. Consider the slip factor due to finite blade = 0.85 and power factor due to friction = 1.08 and blade are coefficient is about 0.85. Calculate the power required to drive the compressor in KW, impeller dia at inlet and outlet, impeller blade angle at inlet	**20**	**CO4**
SECTION B [40 Marks]			
Q 4	Discuss the effect of blade outlet angle, Prewhirl and slip on the performance of centrifugal compressor through velocity triangle.	**10**	**CO2**
Q5	Explain clearly, why back-work ratio of Brayton cycle is more compare to the Rankine cycle.	**5**	**CO1**
Q 6	Explain the design complexity in axial flow turbine and compressor and their solution in brief.	**5**	**CO1**
Q 7	A small aircraft is propelled by a 3.05 m diameter propeller, which produces 4.45 kN of thrust. The aircraft is flying at 160 km/hr at an altitude where the atmospheric conditions are such that the density of air is 1.003 kg/m3. Using momentum theory compute a. the induced velocity through the disk, b. the final velocity of the flow in the far wake	**5**	**CO3**
Q 8	A four stroke petrol engine delivers a brake power of 40 kW with a mechanical efficiency of 85%. The air fuel ratio is 15:1 and the fuel consumption is 0.4608kg/kWh. The heating value of the fuel is 41000 kJ/kg. Calculate 1) indicated	**5**	**CO3**

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	power 2) frictional power 3)brake thermal efficiency 4)indicated thermal efficiency 5) total fuel consumption and.		
Q 9	Discuss the complete design procedure of the turbomachinery component.	**5**	**CO2**
Q 10	Discuss the different optimization of method in Bryton cycle and their benefits.	**5**	**CO1**

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