Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

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

Course: Propulsion II **Semester: VI**
Program: B.Tech ASE , ASE+AVE **Time 24 hrs.**
Course Code: ASEG 322 **Max. Marks: 100**

Instructions:

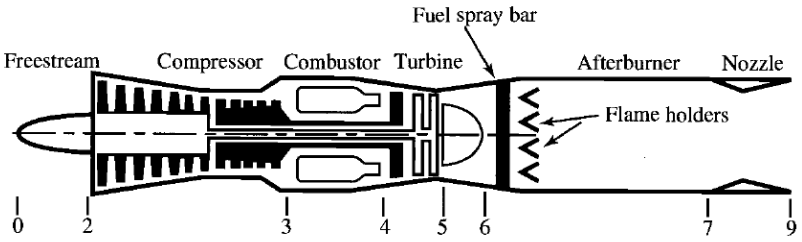
1. **Read the Instruction carefully before attempting**
2. **For Theory based : Type the Answers in word file**
3. **For Figures if any : Draw a free hand sketch and insert the same word file**
4. **For Numerical : Solve it in a paper and insert in the same word file**
5. **Upload as a single word file 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 [Case Based Study] 60 Marks

S. No.		Marks	CO
Q 1	Explain the common framework in Turbojet engine design process, consider the gross thrust of Gas turbine engine development. Discuss the effect of design parameters. Typical operating ranges for aircraft engines (sea level to15,000 m) Different Components and its operations ranges Parametric Equations such as inlet and outlets temperatures, pressures, mass flows and thermo-mechanical features of the engine Fuel chemical composition and it's Air-fuel ratios, and mass flow rates in the combustor Component Cooling Requirements.	**25**	**CO5**
Q 2	Consider a turbo jet after burner engine with losses, and calculate the performance of a turbofan engines, Specific Thrust, Specific Fuel Consumption, Exit Velocity Ratio,	**15**	**CO 4**

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

	Thermal Efficiency, Propulsive Efficiency using real cycle analysis for the following data  $M_0 = 2,\ T_0 = 390°\text{R},\ \gamma_c = 1.4,\ c_{pc} = 0.24\ \text{Btu/(lbm} \cdot °\text{R)}$ $\gamma_t = 1.33,\ c_{pt} = 0.276\ \text{Btu/(lbm} \cdot °\text{R)},\ h_{PR} = 18{,}400\ \text{Btu/lbm}$ $\gamma_{\text{AB}} = 1.30,\ c_{p\text{AB}} = 0.295\ \text{Btu/(lbm} \cdot °\text{R)},\ \pi_{d\max} = 0.98,\ \pi_b = 0.98$ $\pi_{\text{AB}} = 0.98,\ \pi_n = 0.98,\ e_c = 0.89,\ e_t = 0.91,\ \eta_b = 0.99$ $\eta_{\text{AB}} = 0.96,\ \eta_m = 0.98,\ P_0/P_9 = 1,\ T_{t4} = 3000°\text{R}$ $T_{t7}=3400^0$ R, π_c=14.		
Q 3	(a).Explain about Inlet Design and sizing for aircraft engines , (b). Explain about Nacelle and Interference (c). Drag and types of flow configurations in the diffusers: Inlet Types, inlet Design, (d). Sizing and Inlet performance.	**20**	**CO 3**
SECTION B [Numerical and Short Answers] 40 Marks			
Q 4	Consider a mean radius stage calculations by assuming isentropic flow in a axial compressor for the following data: Tt1= 514.6 0R, Pt1=12.78 psia, ω=1000 rad/sec, r=12 in, α1=α3=42, mass flow rate=54 lbm/sec, M1=M3=0.7, u2/u1=1.2, and Pt3/Pt1= 1.28, MFP (M1)= 0.4659, MFP(M2)= 0.5086 Gas properties γ= 1.4, cp= 0.24 Btu/(lbm.0R), Rgc=1716 ft2/sec2.0R, cpgc=6066 ft2/sec2.0R Calculate the following parameters Flow annulus are for rotor and stator Stage Pressure ratios Stage Loading and flow coefficient Degree of reaction Absolute and Relative Velocities	**10**	**CO 4**

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Q 5	Explain about Axial Flow Compressor parts using a schematic diagram, also explain about through flow field, cascade field, Secondary field, Two Dimensional Flow through Blade row? Describe the velocity diagram for axial compressors, flow annulus area, Stage efficiency, Degree of Reaction.	**5**	**CO 2**
Q 6	Explain the process of isentropic process. In what why does it help in the study of compressible flow explain? How does the molecular weight of a gas affect its speed of sound? Also, explain why the sonic velocity has higher values in liquids than in gases.	**5**	**CO 1**
Q 7	Hydrogen gas in a cylinder at 7 atm and 300 K is expanded isentropically through a nozzle at a final pressure of 1 atm. Assuming hydrogen to be a perfect gas with Υ=1.4, determine the velocity and Mach number corresponding to the final pressure. Also find the mass flow rate through the nozzle for an exit area of 10 cm2.	**5**	**CO 3**
Q 8	What is the main idea of degree of Reactions, Stage Loading and Flow Coefficients, and Stage Pressure Ratio for Axial Turbines.	**5**	**CO 2**
Q 9	Describe the after burner design parameters, Space heat Release rate and after Burner Burning Length.	**5**	**CO 3**
Q 10	Define:-Thrust Reversing, Thrust vectoring, nozzle coefficient, gross thrust coefficient	**5**	**CO1**

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