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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 20AE5DCBPR **Max Marks: 100**
Course: Basic Propulsion

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1	a)	Briefly classify the engines used for aircraft propulsion? use simple sketches?	**10**
	b)	A turbojet power plant uses aviation kerosene having a calorific value of 43 MJ/kg. The fuel consumption is 0.18 kg per hour per N of thrust, when the thrust is 9 kN. The aircraft velocity is 500 m/s the mass of air passing through the compressor is 27 kg/s. Calculate the air-fuel ratio and overall efficiency.	**5**
	c)	With help of neat sketch, explain the working principle of ramjet engine?	**5**

OR

2	a)	Explain the various aircraft performance parameters.	**10**
	b)	Derive an expression for relation between range, Isp and mass of the aircraft considering the steady level flight condition.	**10**

UNIT - II

3	a)	Elucidate the modes of inlet operations in supersonics inlets and how shock waves are playing crucial role in it with useful sketch.	**10**
	b)	Illustrate the process of combustion and distribution of air flow through the combustor. Use necessary sketches.	**10**

UNIT – III

4	a)	An axial flow air compressor of 50 % reaction design has blades with inlet and outlet angles of 45^0 and10^0 respectively. The compressor is to produce a pressure ratio of 6:1 with an overall isentropic efficiency of 0.85 when inlet static temperature is 37^0 C. The blade speed and axial velocity are constant throughout the compressor. Assuming a value of 200 m/s for blade speed, find the number of stages required if the work done factor is unity.	**10**

b) Explicate the losses occur across the axial flow compressor and differentiate between compressor and turbine. **10**

UNIT – IV

5 a) How do you differentiate the impulse and reaction turbine? List the difference. **10**

b) A multistage gas turbine is to be designed with impulse stages, and is to operate with an inlet pressure and temperature of 6 bar and 900 K and an outlet pressure of 1 bar. The isentropic efficiency of the turbine is 85%. All the stages are to have a nozzle outlet angle of 75^0 and equal outlet and inlet blade angles. Mean blade speed of 250 m/s and equal inlet and outlet gas velocities. Estimate the maximum number of stages required. Assume Cp = 1.15 kJ/kgK, $\gamma = 1.333$ and optimum blade speed ratio. **10**

OR

6 a) Describe the turbine blade cooling techniques adopted for gas turbine engines? **10**

b) Derive an expression for degree of reaction for turbine stages? **10**

UNIT - V

7 a) With help of velocity triangle, explain the working principle of centrifugal compress and draw the flow through inducer section of the centrifugal compressor. **10**

b) A centrifugal compressor has to deliver 35 kg of air per sec. The impeller is 76 cm diameter revolving at 11,500 rpm with an adiabatic efficiency of 80%. If the pressure ratio is 4.2:1, estimate the probable axial width of the impeller at the impeller tip if the radial velocity is 120 m/s. The inlet conditions are 1 bar and 47^0 C. **10**

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