

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VI (New) EXAMINATION – WINTER 2019

Subject Code: 2160102
Date: 06/12/2019
Subject Name: Fundamentals of Jet Propulsion
Time: 02:30 PM TO 05:00 PM
Total Marks: 70
Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1**
- (a) Classify jet engines. **03**
 - (b) Define: thrust, propulsive efficiency, thermal efficiency, and specific impulse **04**
 - (c) Explain the need of thrust augmentation and the methods of thrust **07**

- Q.2**
- (a) The exit velocity from a jet unit is 700 m/s for an air flow of 45 kg/s through the unit. The aircraft is flying at 300 km/h. calculate the thrust developed, the thrust power and the propulsion efficiency. Neglect mass of fuel. **03**
 - (b) With neat sketches explain the effect of compressor pressure ratio and temperature ratio on the performance of turbojet engine. **04**
 - (c) In a gas turbine engine the compressor is driven by high pressure stage of a two stage turbine and compresses 5 kg of air per second from 1 bar to 5 bar with an efficiency of 80%. High pressure turbine stage has an efficiency of 89% and its inlet temperature is 980K. the low pressure turbine stage is having efficiency of 82% and both the turbines has different pressure ratios. Exhaust from low pressure turbine is preheated in heat exchanger having an effectiveness of 70%. Neglect the mass of fuel and pressure losses. Estimate the intermediate pressures and temperatures for the cycle. Also calculate the power output of the cycle and overall efficiency. Ambient temperature and pressure 288K and 1 bar. **07**

OR

- (c) In a turbojet engine with forward facing ram intake, the jet velocity relative to the propelling nozzle at exit is twice the flight velocity. Determine the rate of fuel consumption in kg/s, when developing a thrust of 25000N under the following conditions. Ambient pressure and temperature 0.7 bar and 274K, compression pressure ratio 4:1, flight 810Km/h, turbine pressure ratio 2.23, efficiency of compressor, turbine and nozzle are 85%, 90% and 95%, **07**
- Q.3**
- (a) Draw h-s diagram representing nozzle operation and diffuser operation separately. **03**
 - (b) Explain zones of combustion chamber. **04**
 - (c) Derive Area Velocity relation for nozzles. **07**

OR

- Q.3**
- (a) What is the primary function of the inlet of an aircraft engine? **03**

- (b) Explain inlets for ramjet engine diffuser operations 04
(c) Write a note on factors affecting the performance of combustion chamber. 07
- Q.4** (a) Write in brief about rocket engines. 03
(b) Differentiate between turbojet, turboprop & turbofan engine with diagram. 04
(c) Write a short note on effect of back pressure for flow through C-D nozzle. 07
- OR**
- Q.4** (a) Why jet engine with afterburner is used for military airplanes..? 03
(b) Discuss Supersonic Inlets. 04
(c) Differentiate between critical, subcritical and supercritical operations of ramjet diffuser. 07
- Q.5** (a) What is choking ? 03
(b) Explain with sketch : Can Type combustion chamber with advantages and disadvantages 04
(c) Write a short note on solid propellant rocket engines with neat sketch. 07
- OR**
- Q.5** (a) Explain pulse jet engine with neat sketch. 03
(b) What is effect of total pressure loss on combustion ? 04
(c) Write a short note on liquid propellant rocket engines with neat sketch. 07

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