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10AE55

Fifth Semester B.E. Degree Examination, Aug./Sept.2020

Aircraft Propulsion

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting at least TWO questions from each part.

PART – A

1　a. Classify the different types of power plants used in aircrafts. **(06 Marks)**
　　b. Briefly explain the three modes of heat transfer with suitable equations. Also explain diffusion mass transfer. **(08 Marks)**
　　c. A steam pipe of diameter 10 cm, $T_S = 500$ K, t = 0.8 passing through a large room at 300 K. The pipe loses heat by natural convection (h = 15 W/m^2K) and radiation. Find the surface emissive power of the pipe, the total radiation falling upon the pipe and the total rate of heat loss from the pipe. **(06 Marks)**

2　a. Derive a general thrust equation of a gas turbine engine and also mention the advantage and disadvantage of turbofan engine. **(08 Marks)**
　　b. What are the factors affecting thrust based on engine characteristics? **(06 Marks)**
　　c. The effective jet exit velocity from a jet engine is 3000 m/s. The forward flight velocity is 1500 m/s and the air flow rate is 90 kg/s, calculate thrust, thrust power and propulsive efficiency. **(06 Marks)**

3　a. With suitable diagram, explain subsonic and supersonic inlets. **(10 Marks)**
　　b. Formulate a relation between minimum area ratio and external deceleration ratio. **(10 Marks)**

4　a. With an appropriate sketch, explain the working of gas turbine combustion chamber and also identify the various zones in it? **(10 Marks)**
　　b. What is the use of thrust reversing? Explain the classification of thrust reverser with neat sketch. **(10 Marks)**

PART – B

5　a. A centrifugal compressor takes in gas at 0°C and 0.7 bar and delivers at 1.05bar. The efficiency of the process compared with adiabatic compression is 83%. The specific heat at constant pressure and constant volume are 1.005 and 0.717 respectively. Calculate the final temperature of gas and work done per kg of gas. If the gas were further compressed by passing through a second compressor having the same pressure ratio and efficiency and with no cooling between the two compressors. What would be the overall efficiency of the complete process? **(10 Marks)**
　　b. Define degree of reaction of an axial flow compressor and derive an expression for the degree of reaction for the compressor. And get the expression for 50% reaction. **(10 Marks)**

6　a. Explain the working of a single stage reaction stage with a neat sketch. **(08 Marks)**
　　b. What are the factors to be considered in the selection of materials? **(06 Marks)**
　　c. Explain the process of internal cooling of turbine blades. **(06 Marks)**

7 a. With the help of a neat sketch, explain the operating principle of a SCRamjet engine. What are its advantages and disadvantages?   (12 Marks)
   b. Explain the process of combustion in Ramjet engine.   (08 Marks)

8 a. Explain the working principle of solid propellant rocket. What are its advantages and disadvantages?   (08 Marks)
   b. Explain the rocket performance considerations.   (06 Marks)
   c. Explain the types of liquid propellant feed system.   (06 Marks)

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