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10AE55

Fifth Semester B.E. Degree Examination, June/July 2017
Aircraft Propulsion

Time: 3 hrs. Max. Marks:100

Note: ***Answer 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. Explain the working principle of combustion chamber with a neat sketch. Also discuss the factors affecting combustion chamber design. **(10 Marks)**

b. With neat sketches, explain thrust vectoring and thrust reversing. **(10 Marks)**

PART – B

5 a. Explain the various components of a centrifugal compressor. **(06 Marks)**

b. Define degree of reaction of an axial flow compressor and derive an expression for the same. **(08 Marks)**

c. A centrifugal compressor has an inlet eye 15 cm diameter. The impeller revolves at 2000 rpm and the inlet air has an axial velocity of 107 m/s inlet stagnation temperature 294 K and inlet pressure 1.03 kg/cm^2. Determine theoretical angle of the blade at this point and mach number of the flow at the tip of the eye. **(06 Marks)**

6 a. Classify the different types of turbines. **(04 Marks)**

b. Draw a velocity triangle of a single stage turbine and derive an expression for work output. **(10 Marks)**

c. What are the different types of losses in a turbine? **(06 Marks)**

7 a. With a neat sketch, explain the working principle of scramjet. Mention its advantages and disadvantages. **(10 Marks)**

b. Explain the sub critical, critical and super critical operation of combustion in ramjets. **(10 Marks)**

8 a. With neat sketches, explain ion rocket propulsion and arc plasma rocket propulsion. **(10 Marks)**

b. Explain the different types of nozzles used in rockets with neat sketches. **(10 Marks)**

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