CBCS SCHEME

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15AE43

Fourth Semester B.E. Degree Examination, July/August 2021
Aircraft Propulsion

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

1 a. Explain the principles of aircraft propulsion and list down the general classifications of power plants used in flight vehicles. **(08 Marks)**

 b. With neat sketch, explain the working of gas turbine engines. Draw the relevant P-V and T-S diagram. **(08 Marks)**

2 a. List out the differences between two-stroke and four stroke piston engines. **(06 Marks)**

 b. A diesel engine has a compression ratio of 14 and cut-off takes place at 6% of the stroke. Find the air standard efficiency. **(10 Marks)**

3 a. With neat sketch, explain the different types of propeller used in aircraft propulsion. **(08 Marks)**

 b. Explain turboprop, turbofan and turbojet engines with neat sketch. Mention its advantages and disadvantages. **(08 Marks)**

4 a. With the help of diagram, derive the thrust equation for a gas turbine engine. Mention the factors affecting thrust. **(08 Marks)**

 b. In a gas turbine plant working on the Brayton cycle, the air at the inlet is at 27°C, 0.1 MPa. The pressure ratio is 6.25 and the maximum temperature is 800°c. The turbine and compressor efficiencies are each 80%. Find:
  (i) The compressor work per kg of air
  (ii) The turbine work per of air
  (iii) The heat supplied per kg of air
  (iv) The cycle efficiency
  (v) The turbine exhaust temperature **(08 Marks)**

5 a. What are the major design variables for the subsonic inlets? Mention any five. **(07 Marks)**

 b. Explain with the help of diagram a supersonic inlet. List down the important characteristic features of a supersonic inlet. **(09 Marks)**

6 a. Write short notes on:
  (i) Over expanded and under expanded nozzles
  (ii) Nozzle chocking
  (iii) Thrust reversal
  (iv) Convergent-divergent nozzles **(08 Marks)**

 b. Explain Nozzle coefficients. What are the functions of an exhaust nozzle used in aircraft engine? **(08 Marks)**

7 a. With neat sketch, explain the principle of operation of centrifugal compressors. **(08 Marks)**

 b. A centrifugal compressor under test, gave the following data:
  Speed : 11500 rev/min
  Inlet total head temperature : 21°C
  Outlet and inlet total head pr: 4 bar, 1 bar
  Impeller dia: 75 cm
  If the slip factor is 0.92, what is the compressor efficiency? **(08 Marks)**

8   a. What do you mean by Degree of Reaction? With reference to Axial Flow compressor. Derive the expression of degree of reaction. **(08 Marks)**

    b. Compare Axial Flow compressor and centrifugal compressor, with respect to following mentioned parameters:
        (i)   Type of flow
        (ii)   Isentropic efficiency
        (iii)   Frontal area
        (iv)   Delivery pressure
        (v)   Applications **(08 Marks)**

9   a. With neat sketch, explain different types of combustion chamber used in aircraft engines. **(07 Marks)**

    b. Write short notes on:
        (i)   Flame tube cooling
        (ii)   Flame stabilization
        (iii)   Turbine cooling **(09 Marks)**

10 a. What do you mean by multistaging of turbine? Explain with neat sketch. **(06 Marks)**

    b. In a single stage impulse turbine, the nozzle discharges the fluid on to the blades at an angle of 65° to the axial direction and the fluid leaves the blades with an absolute velocity of 300 m/sec at an angle of 30° to the axial direction. If the blades have equal inlet and outlet angles and there is no axial thrust, estimate the blade angle, power produced per kg/sec of the fluid and the blade efficiency. **(10 Marks)**

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