

CBCS SCHEME

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15AE43

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019 Aircraft Propulsion

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. Derive an expression for steady flow energy equation for compressible flow machines with usual notations. (08 Marks)
- b. Define Stagnation state and Stagnation enthalpy. Derive an expression for stagnation temperature. (08 Marks)

OR

- 2 a. With the help of PV and TS diagram, explain the cycle analysis of Jet engine. (10 Marks)
- b. Explain the advantages of gas turbine over reciprocating engine. (06 Marks)

Module-2

- 3 a. Explain the operating principle of a turbofan engine with a neat diagram. What are the advantages and disadvantages? (10 Marks)
- b. A turbojet power plant uses aviation kerosene having a calorific value of 43mJ/kg. The fuel consumption is 0.18 kg per hour per N of thrust [0.18 kg/hr. N], when the thrust is 9kN. The aircraft velocity is 500 m/s the mass of air passing through the compressor is 27kg/s. Calculate the air – fuel ratio and overall efficiency. (06 Marks)

OR

- 4 a. Briefly explain different types of propeller. (08 Marks)
- b. The diameter of the propeller of an aircraft is 2.5m. It flies at a speed of 500 kmph at an altitude of 8000m. For a flight to jet speed ratio of 0.75. Determine
i) the flow rate of air through the propeller ii) the thrust produced iii) specific thrust
iv) specific impulse v) the thrust power.
Take at $Z = 8000\text{m}$, air density $\rho = 0.525 \text{ kg/m}^3$. (08 Marks)

Module-3

- 5 a. Explain with a neat sketch, the operation of subsonic inlet under various flow speed condition. (08 Marks)
- b. Explain the concept of shock swallowing by area variation in supersonic inlets. (08 Marks)

OR

- 6 a. With the help of neat diagram, explain the different modes of inlet operations. (08 Marks)
- b. The pressure, temperature and mach number at the entry of a flow passage are 2.45 bar, 26.5°C and 1.4 respectively. If the exit mach number is 2.5, determine for adiabatic flow of a perfect gas ($\gamma = 1.3$, $R = 0.469 \text{ kJ/kg K}$).
i) Stagnation temperature ii) Temperature and velocity of gas at exit. (08 Marks)

Module-4

- 7 a. With the help of a neat sketch, explain the principle of operation of a centrifugal compressor. (08 Marks)

- b. A centrifugal compressor under test gave the following data :
Speed = 11,500 rev/min , Inlet total head temperature = 21⁰C , Outlet and inlet total head pressure = 4 bar and 1 bar impeller dia = 75cm.
If the slip factor is 0.92, what is the compressor efficiency? (08 Marks)

OR

- 8 a. Define Degree of reaction of an axial flow compressor and obtain an expression for 50% degree of reaction. (08 Marks)
b. Give the advantages and disadvantages of centrifugal and axial flow compressor. (04 Marks)
c. Derive an expression for compressor efficiency in centrifugal compressor. (04 Marks)

Module-5

- 9 a. What are the classifications of combustion chamber? Explain with neat sketches. (08 Marks)
b. Explain any two of the following :
i) Flame tube cooling ii) Use of cheaper fuels iii) Pollution. (08 Marks)

OR

- 10 a. Explain the working of a single reaction stage, with a neat sketch. (08 Marks)
b. What are the factors to be considered in the selection of materials? (08 Marks)
