**CBCS SCHEME**

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# Fourth Semester B.E. Degree Examination, July/August 2022
## Aircraft Propulsion

Time: 3 hrs.                     Max. Marks: 100

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

### Module-1

1   a.   With the help of a neat schematic and P-V diagram, explain the working principle of a four stroke diesel engine. **(10 Marks)**

   b.   Explain the principle of aircraft propulsion and the types of fluid suitable for aircraft propulsion. **(10 Marks)**

### OR

2   a.   With the help of a neat schematic and P-V diagram, explain the working principle of a four stroke petrol engine. **(10 Marks)**

   b.   List the advantages of gas turbine engine over reciprocating engines and explain. **(10 Marks)**

### Module-2

3   a.   With the help of a neat schematic diagram, explain the working of a Turbo-prop engine. Write the thrust equations, its advantages and disadvantages. **(12 Marks)**

   b.   List the theories used in the design of propellers and describe Blade Momentum theory. **(08 Marks)**

### OR

4   a.   An aircraft flies at 960 kmph. One of its turbojet engines takes in 40 kg/s of air and expand the gases to the ambient pressure. The air fuel ratio is 50 and the lower calorific value of the fuel is 43 MJ/kg. For maximum thrust power, determine (i) Jet velocity (ii) Thrust (iii) Specific thrust (iv) thrust power (v) Propulsive, thermal and overall efficiencies (vi) TSFC. **(12 Marks)**

   b.   List the methods of thrust augmentation and describe the after burner with relevant sketches. **(08 Marks)**

### Module-3

5   a.   List the purpose of inlets in gas turbine engines. Briefly explain supersonic inlets. **(10 Marks)**

   b.   With the help of relevant sketches, describe the process of shock swallowing by area variation. **(10 Marks)**

### OR

6   a.   With the help of neat sketches, explain under-expanded and over-expanded nozzles. **(10 Marks)**

   b.   Air flowing in a duct has a velocity of 300 m/s, pressure 1.0 bar and temperature 290 K. Taking $\gamma = 1.4$ and R = 287 J/kgK. Determine (i) Stagnation pressure and temperature (ii) Velocity of found in the dynamic and stagnation conditions. (iii) Stagnation pressure assuming constant density. **(10 Marks)**

### Module-4

7   a.   Describe the essential parts of a centrifugal compressor with a neat sketch. Explain the principle of operation. **(10 Marks)**

   b.   Define degree of reaction of an axial flow compressor and obtain an expression for 50% degree of reaction. **(10 Marks)**

**OR**

8 a. Describe the following with relevant sketches:
- (i) Surging and stall of axial flow compressor.
- (ii) Vaneless and Vaned Diffuser. **(10 Marks)**

b. A centrifugal compressor under test gave the following data :
Speed – 11,500 rpm, Inlet total head temperature - 21°C,
Outlet and inlet total head pressure – 4 bar and 1 bar,
Impeller diameter – 75 cm
If the stip factor is 0.92. What is the compressor efficiency? **(10 Marks)**

## Module-5

9 a. With suitable sketches, explain the difference between impulse and reaction turbine.
**(10 Marks)**

b. Describe external and internal cooling of turbine blades, with relevant sketches. **(10 Marks)**

**OR**

10 a. Explain different types of combustion chambers used in gas turbine engines. List their advantages and disadvantages. **(10 Marks)**

b. Explain the factors affecting combustion chamber performance with relevant sketches.
**(10 Marks)**

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