



# CBCS SCHEME

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15AE43

## Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020 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. With neat diagrams, explain the working principle of four stroke spark ignition engine. (10 Marks)  
b. Explain kinematic viscosity, Reynold's number and stagnation density with equations. (06 Marks)

OR

- 2 a. List the advantages of gas turbine engine over reciprocating engines. (08 Marks)  
b. Explain Brayton cycle with PV and TS diagram. (08 Marks)

### Module-2

- 3 a. With a neat sketch, describe working principle of turbofan engine. (09 Marks)  
b. Discuss momentum theory of propeller with suitable sketch. (07 Marks)

OR

- 4 a. Describe different types of pitch settling arrangements in propeller. (06 Marks)  
b. A turboprop aircraft is flying at 600km/hr at an altitude where the ambient conditions are 0.458 bar and  $-15^{\circ}\text{C}$ . Compressor pressure ratio 9:1. Maximum gas temperature 1200K. The intake duct efficiency is 0.9 and the total isentropic efficiency of compressor and turbine is 0.89 and 0.93 respectively. Calculate the specific power output in kJ/kg, thermal efficiency of the unit taking mechanical efficiency of transmission as 98% and neglecting the losses other than specified. Take exhaust jet velocity 600 km/hr. (10 Marks)

### Module-3

- 5 a. Derive a relation for minimum area ratio in term of external deceleration and coefficient of pressure. (12 Marks)  
b. Explain over expanded and under expanded nozzles. (04 Marks)

OR

- 6 a. Briefly explain starting problem in supersonic inlets. (07 Marks)  
b. Discuss various types of thrust reverser systems. (09 Marks)

### Module-4

- 7 a. Find out work done by an axial compressor with a velocity triangle. (10 Marks)  
b. A centrifugal compressor has an inlet eye of 15cm diameter. The impeller revolves at 20,000 rpm and the inlet air has an axial velocity of 107m/s, inlet stagnation temperature 294K and inlet pressure is  $1.03\text{kg/cm}^2$ . Determine:  
i) Theoretical angle of the blade at this point and  
ii) Mach number of the flow at the tip of the eye. (06 Marks)

1 of 2

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg.  $42+8=50$ , will be treated as malpractice.

OR

- 8 a. With a neat schematic diagram, explain working of a centrifugal compressor. (10 Marks)  
b. Differentiate axial flow compressor and centrifugal compressor. (06 Marks)

**Module-5**

- 9 a. Explain important factors affecting combustion chamber design. (08 Marks)  
b. Define various losses in the turbine. (08 Marks)

OR

- 10 a. Discuss various cooling techniques in a turbine blade with neat sketches. (10 Marks)  
b. Mention the advantages and limitations of annular and canannular type combustion chamber. (06 Marks)

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