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10AE55

# Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
## Aircraft Propulsion

Time: 3 hrs. Max. Marks:100

**Note:** ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***



### PART – A

1 a. Explain the principles of aircraft propulsion. Give a brief classification of aircraft power plants. **(08 Marks)**

b. Define the following with relevant expressions :
(i) Stagnation temperature
(ii) Stagnation Velocity of sound **(06 Marks)**

c. Write short notes on basics of heat transfer. **(06 Marks)**

2 a. With the help of a heat schematic diagram explain the working of a Turboprop engine. List its advantages and disadvantages. **(12 Marks)**

b. List the different methods of thrust augmentation. Explain afterburner with relevant sketches. **(08 Marks)**

3 a. List the functions of an Inlet. Explain the subroute inlet with relevant sketches. **(08 Marks)**

b. With relevant sketches describe the modes of inlet operation. **(06 Marks)**

c. 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 ($\gamma = 1.3$, $R = 0.469$ kJ/kg °K)
(i) Stagnation temperature (ii) Temperature and velocity of air at exit (iii) Flow rate per $m^2$. **(06 Marks)**

4 a. Give the classification of combustion chamber. Describe the types of combustion based on geometry with relevant sketches. **(10 Marks)**

b. Explain over-expanded and under expanded nozzles with neat schematic diagram. **(10 Marks)**

### PART – B

5 a. With the help of a neat schematic diagram describe the working of a centrifugal compressor. **(10 Marks)**

b. A 50% reaction axial flow compressor runs at a mean blade speed of 250 m/s. The pressure ratio developed by the machine is 1.3. Determine the blade and air angle if the mean flow velocity was 200 m/s. Condition at inlet are 1 bar and 300 K. **(10 Marks)**

6 a. Illustrate the working of a single stage turbine with help of pressure and velocity variation graph. **(10 Marks)**

b. With the help of relevant sketches explain the method of blade fixing in turbines. **(06 Marks)**

c. Explain external cooling of turbine blades with sketches. **(04 Marks)**

7 a. Describe the operating principle of Scramjet engine. Draw its P-V and T-S diagram and list the advantages and disadvantages. **(12 Marks)**

b. Write short notes on:
(i) Preliminary concepts in supersonic combustion
(ii) Integral ram rocket. **(08 Marks)**

8 a. Illustrate the working of a solid propellant rocket with neat sketches. **(10 Marks)**
b. With the help of heat sketches explain Rocket nozzle classification. **(10 Marks)**

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