USN ☐☐☐☐☐☐☐☐☐☐ **10AE55**

Fifth Semester B.E. Degree Examination, June/July 2016
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. Derive an expression for steady flow energy equation for compressible flow machines with usual notation. **(08 Marks)**
   b. Define stagnation state and stagnation enthalpy. Derive an expression for stagnation enthalpy. **(06 Marks)**
   c. Explain the advantages of gas turbines over reciprocating engines. **(06 Marks)**

2 a. Explain the operating principle of a turbofan engine with a neat schematic diagram. What are the advantages and disadvantages? **(08 Marks)**
   b. Define thrust. Derive an expression for thrust with usual notation for a gas turbine engine. **(08 Marks)**
   c. A turbojet power plant uses aviation kerosene having a calorific value of 43 MJ/kg. The fuel consumption is 0.18 kg per hour per N of thrust, when the thrust is 9 kN. The aircraft velocity is 550 m/s, the mass of air passing through the compressor is 29 kg/s. Calculate the air fuel ratio and overall efficiency. **(04 Marks)**

3 a. Explain the operation of a diffuser with relevant sketches. **(06 Marks)**
   b. Explain the process of external deceleration in a Supersonic inlet with neat sketches. **(06 Marks)**
   c. Write short notes on :
      i) Boundary layer separation
      ii) Internal flow in subsonic inlets. **(08 Marks)**

4 a. Explain the classification of combustion chambers with the help of relevant sketches. **(06 Marks)**
   b. Explain the effect of back pressure on nozzle flow. **(06 Marks)**
   c. Write short notes on :
      i) Combustion chamber geometry
      ii) Thrust reversing and thrust vectoring. **(08 Marks)**

PART – B

5 a. With the help of a neat sketch, explain the principle of operation of a centrifugal compressor. **(08 Marks)**
   b. Explain the process of surging and stall in axial flow compressor. **(06 Marks)**
   c. 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 dia - 75 cm. If the slip factor is 0.92, what is the compressor efficiency? **(06 Marks)**

6 a. Explain the working of a single stage reaction stage with a neat sketch. **(08 Marks)**
   b. What are the factors to be considered in the selection of materials? **(06 Marks)**
   c. Explain the process of internal cooling of turbine blades. **(06 Marks)**

7 a. With the help of a neat sketch, explain the operating principle of a SCRamjet engine. What are its advantages and disadvantages? **(12 Marks)**
   b. Explain the process of combustion in Ramjet engine. **(08 Marks)**

8 a. Explain the working principle of solid propellant rocket. What are its advantages and disadvantages? **(08 Marks)**
   b. Explain the rocket performance considerations. **(06 Marks)**
   c. Explain the types of liquid propellant feed system. **(06 Marks)**

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