

JAYA GROUP OF INSTITUTION-THIRUNINRAVUR
4th SEM – B.E. / B.Tech
INTERNAL ASSESSMENT-III(MODEL EXAM-III)

Sub. Name: Propulsion-I
Sub. Code: AE 6404
Duration: 180 minutes

Date: 10-4-15
Branch: Aeronautical
Max.Marks: 100

PART-A (10 x 2 = 20)

1. Mention relative merits of jet engines over piston engines.
2. Water injection at inlet increases thrust true/false-justify your answers?
3. Explain the concept of boundary layer separation in a flow cascade.
4. Define pressure recovery factor for the intake?
5. What is meant by the phenomenon buzz in a supersonic inlet?
6. What do you mean by nozzle chocking?
7. What are the reasons for stalling in a compressor?
8. Name the sources of losses in a axial flow compressor .
9. What is meant by Flame stabilization ?
10. What is variable area nozzle ?

PART-B (5 x 16 = 80)

- 11.a)i) Illustrate the operation of a gas turbine engine and Explain its operation in detail. Plot the variation of pressure ,temperature and velocity along the engine (8)
- ii) Mention the various method of thrust augmentation .Explain them . (8)

Or

b) Consider an air standard brayton cycle ,where the air enters the compressor at 0.11 Mpa ,15°C.It leaves the compressor at 0.55Mpa Turbine inlet Temperature is 970°C .Determine the pressure and temperature at each point in the cycle. work out the efficiency of its compressor, turbine and the overall engine. (16)

12.a)i) Derive the relation between minimum area ratio and external deceleration ratio for subsonic inlets. (10)

ii) Performancewise highlight the requirements of a good inlet. Draw the streamline patterns for a subsonic inlet under varying speed operations. (6)

Or

- b) i) With a neat sketch explain the working of a combustor chamber and its types (8)
 ii) With the aid of a simplified picture Explain the operation of a flame holder. (8)
- 13.a) i) Briefly explain the working of the centrifugal flow compressor and draw the velocity triangles (8)

ii) A centrifugal compressor has an impeller tip speed of 366m/s. determine the absolute Mach number of the flow leaving the radial vanes of the impeller when the radial component of velocity at impeller exit is 30.5m/s and slip factor is 0.90. given that the flow area at impeller exit is 0.1m^2 and the efficiency of the impeller is 90%, determine the mass flow rate. Assume that stagnation pressure and temperature at compressor entry are 101.3Kpa and 288K respectively. (8)

Or

13 b) Explain the following

- i) surging in compressor (5)
 ii) Rotating Stall (5)
 iii) Euler equation of turbo machines (6)

14.a) Write Short notes on

- i) losses in nozzle (4)
 ii) under and over expanded nozzle (4)
 iii) types of nozzle (4)
 iv) Thrust reversal (4)

Or

b) i) Explain the reason for a ramjet propulsion system as a suitable systems for missile propulsion. Why it is not suitable for aircraft propulsion? (8)

ii) A ramjet is propel an aircraft at mach 3 at high altitude where the ambient pressure is 8.5Kpa and ambient temperature is 220 k turbine inlet temperature is 2540 k if all components of the engine are ideal ie frictionless Determine

- i) Thermal efficiency
 ii) Propulsive efficiency
 iii) overall efficiency (8)

15.a) i) Draw the velocity triangle of axial flow turbine and explain how the torque is developed and derive work done. (8)

ii) With a neat sketch explain the working principle of axial flow turbine? (8)

Or

b) At the mean diameter of the gas turbine the blade velocity is 350m/s the blade angle at inlet and exit are 20° and 54° respectively and the blades at this sections are designed to have a degree of reaction of 50% the mean radius of the blades is 0.126m and the blade mean height is 0.7m. assuming that blades are designed according to vortex theory calculate

- i) flow velocity
 ii) the angles of blades at root and tip (16)