

**2005 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY**

**III B.TECH I SEMESTER SUPPLEMENTARY EXAMINATIONS  
AERO SPACE PROPULSION-I  
(AERONAUTICAL ENGINEERING)**

NOVEMBER 2005

TIME - 3 HOUR  
MARK - 80

**Answer any FIVE Questions  
All Questions carry equal marks**

- Describe the working of a direction injection system and compare it with the carburetion describing the relative merits and demerits. [16]
- What is the principal of propeller, derive the expression for the propulsive efficiency of a propeller. [16]
- What is a prewhirl, why it is needed and how can it affect the performance of a centrifugal compressor. [16]
- An aircraft flying at 250 m/s is fitted with a single sided centrifugal compressor. The inner and outer diameters of the eye of the impeller are 15 and 30 cm respectively. The impeller diameter is 50 cm and the rotational speed 300 rev/s. Estimate the stagnation pressure at the compressor when the mass flow is 4.0 kg/s. Neglect the losses in the inlet duct and fixed vanes and assume that the isentropic efficiency of the compressor is 0.85. Take the slip factor as 0.9 and the power input factor as 1.04. The intake vanes are fixed and give 30° prewhirl at all radii. [16]
- Discuss the different types of combustion chambers used in air craft engines with their relative merits and demerits. Draw neat sketches. [16]
- What is degree of reaction of a gas turbine; how it can be controlled, derive its expression with the help of velocity triangles. [16]
- A single stage free vortex turbine is designed for zero degree of reaction at root radius with equal and axial velocities at the inlet and outlet. Calculate the nozzle efflux angle and degree of reaction at the tip radius. The parameters are given below. [16]  
 Inlet temperature  $T_{01}$  1100 K  
 Pressure ratio 2.5  
 Inlet Pressure  $p_{01}$  4.0 bar  
 Turbine isentropic efficiency 0.9  
 Blade speed at root 350 m/s  
 Outlet velocity 250 m/s  
 Nozzle blade coefficient 0.05  
 Also calculate the static pressure at the inlet and outlet of the rotor blade at the root radius.
- Write short notes on the following:
  - Flame tube cooling
  - Balancing of the engine
  - Engine supercharging. [16]