Code No: NR312106 **NR**

III B.Tech I Semester Supplementary Examinations, November 2006
AERO SPACE PROPULSION-I
(Aeronautical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain the working of a two stroke petrol engine with the help of a neat sketch. What are the advantages and disadvantages of the two stroke engine as compared to a four stroke engine. Draw P-V diagrams also. Calculate the efficiency of a four stroke cycle gas engine, assumed to be working on the constant volume cycle, of stroke 50 cm, piston diameter 30 cm and a clearance volume of 10.8 litres. [16]

2. (a) Explain how balancing of a piston engine having six cylinder is carried out.
   (b) Explain the principle of a propeller. Show the effect of geometric pitch on propeller performance with the help of neat sketches. [7+9]

3. How do you classify centrifugal compressors? Explain how physically the pressure rise is achieved in practice. Derive the relationship for pressure rise also. What are the limitations of a centrifugal compressor? [16]

4. An axial flow compressor stage has blade root, mean and tip velocities of 150m/s, 200m/s and 250m/s respectively. The stage is to be designed for a stagnation temperature rise of 20K and an axial velocity of 150 m/s, both constant from root to tip. The work done factor is 0.93. Assuming 50 percent reaction at mean radius calculate the stage air angles at root, mean and tip and degree of reaction at root and tip for a free vortex design. [16]

5. (a) What are the factors affecting the design of a combustion chamber? Explain the process of combustion for combustion chamber having swirl vanes.
   (b) What are the various types of fuel injectors used in gas turbine engines. Explain with the help of sketches. [8+8]

6. (a) Explain the performance characteristics of Axial flow compressor with the help of sketches.
   (b) Obtain the expression for blade loading coefficient in case of axial flow turbine. [7+9]

7. A mean diameter design of a turbine stage having equal inlet and outlet velocities lead to the following data

   Mass flow m =20kg/s

   Inlet temperature T_{01}=1000K

   Inlet pressure P_{01}=4bar

   Blade speed U=360m/s

Axial velocity (constant through stage) Ca=260 m/s

Nozzle efflux angle α_2=65 degrees

Stage exit swirl α_3= 10 degrees

Determine the rotor blade gas angles, degree of reaction, temperature drop coefficient and power output.

Assuming a nozzle loss coefficient λ_N of 0.05, calculate the nozzle throat area required (ignoring the effect of friction on the critical conditions). [16]

Blade speed U=360m/s

8. Write short notes on the following:

   (a) Supercharging

   (b) Methods of Blade cooling

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