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BAS-016

B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

00153

June, 2018

BAS-016 : PROPULSION – II

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any* ***seven*** *questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. Distinguish between the following : *3+4+3*

(a) Normal shock waves and oblique shock waves

(b) Subsonic nozzle and supersonic nozzle

(c) Engine inlet and exhaust nozzle

2. Differentiate between Turboprop and Turbojet engines. Explain the working of a turboprop engine with the help of neat and labelled sketches. *4+6*

3. Differentiate between axial flow compressor and centrifugal compressor. Explain the velocity diagrams of axial flow and centrifugal compressors along with their physical significance. *4+6*

4. Explain the following terms : *5×2=10*
   (a) Thrust augmentation
   (b) Bypass ratio
   (c) Stage pressure ratio
   (d) Compressor surge
   (e) Degree of reaction

5. Write short notes on the following : *5+5*
   (a) Types of combustion chambers
   (b) Lubrication system of a typical jet engine

6. (a) Explain the working principle of a ramjet engine with the help of a neat and labelled sketch.
   (b) Discuss the characteristics of a centrifugal compressor. *5+5*

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

   Mass flow (m) = 20 kg/s

   Inlet temperature (T_{01}) = 1000 K

   Inlet pressure (p_{01}) = 4 bar

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

   Blade speed, U = 360 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. *10*

8. An axial flow compressor stage has blade root, mean and tip velocities of 150 m/s, 200 m/s and 250 m/s respectively. The stage is to be designed for a stagnation temperature rise of 20 K 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. *10*

9. (a) Calculate the stage air angles for the data given in Q. No. 8 above for a stage with 50 percent reaction at all radii.

   (b) What are the factors to be considered for effective combustion in a combustion chamber ? *5+5*