CODE NO: NR 420301 NR

2006 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

I V B.TECH I I SEMESTER SUPPLEMENTARY EXAMINATIONS
JET PROPULSION AND ROCKET ENGINEERING
(MECHANICAL ENGINEERING)

APRIL/MAY 2006

TIME 3 HOURS
MARKS: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) What are the effects on thermal efficiency and specific output of gas turbine plant due to the following factors

i. load on the plant

ii. pressure ratio

iii. turbine inlet temperature

iv. compressor inlet temperature

v. regenerator.

(b) Derive the thermal efficiency of the air standard Brayson cycle.

2. (a) Explain the energy flow in an atmospheric thermal jet engine and what are powers corresponding to brake and indicated power of i.c. engines.

(b) What is the need for thermal jet engines and discuss the applications of ther- mal jet engines.

3. A turbojet engine propels an aircraft at a mach number of 0.8 in level at an altitude of 10 km. The data for the engine is given below stagnation temperature at the turbine inlet = 1200 k stagnation temperature rise through the compressor = 175 K, Calorific value of fuel = 43

MJ/kg.Compressor efficiency = 0.75

Combustion chamber efficiency = 0.975

Turbine efficiency = 0.81

Mechanical efficiency of the power transmission between turbine and compressor = 0.98

Exhaust nozzle efficiency = 0.97

Specific impulse = 25 seconds

Assuming the same properties for air and combustion gases calculate.
(a) fuel - air ratio

(b) compressor pressure ratio

(c) Turbine pressure ratio

(d) Exhaust nozzle pressure ratio

(e) Mach number of exhaust jet.

4. (a) Draw the neat sketch of a supersonic diffuser for a ramjet engine with obliqe and normal shacks.

(b) Depict variation of the static pressure through the diffuser from its entry to exit.

5. Define and explain the terms :

(a) Thrust

(b) Thrust power

(c) Effective jet exit velocity

(d) Propulsive efficiency related to rocket engines?

6. What do you understand from monopropellant fuels? What are the merits and demerits over the bipropellant fuels used in rocket engines?

7. Describe briefly with the aid of graphs, the variation of the following quantities in rocket propulsion.

(a) Rocket thrust with altitude.

(b) Thrust coefficient Vs Exhaust nozzle pressure ration Po/Pc

(c) Thrust coefficient Vs area ratio of exhaust nozzle.

(d) Acceleration due to gravity Vs altitude.

8. (a) Give the classification of liquid propellent rocket engines.

(b) With the help of a neat diagram, explain the working of a liquid bi-propellent rocket engine.