**Course : Applied Thermal Engineering (UMT303)**

**Batch: B.E. Mechatronics (2nd yr.)** **Faculty: Dr. Sayan Sadhu**

**Tutorial No. 12** **Topic: Jet Propulsion**

**Q1.** Air enters a turbojet engine at 11.8 lbf/in.2, 430°R, and an inlet velocity of 620 miles/h (909.3 ft/s). The pressure ratio across the compressor is 8. The turbine inlet temperature is 2150°R and the pressure at the nozzle exit is 11.8 lbf/in.2 The work developed by the turbine equals the compressor work input. The diffuser, compressor, turbine, and nozzle processes are isentropic, and there is no pressure drop for flow through the combustor. For operation at steady state, determine the velocity at the nozzle exit and them maximum pressure. Neglect kinetic energy except at the inlet and exit of the engine, and neglect potential energy throughout.

**[Ans. 3034 ft/s, 158.3 lbf/in$^2$]**

**Q2.** A turbojet aircraft flies with a velocity of 850 ft/s at an altitude where the air is at 5 psia and 40°F. The compressor has a pressure ratio of 10, and the temperature of the gases at the turbine inlet is 2000°F. Air enters the compressor at a rate of 100 lbm/s. Utilizing the cold-air-standard assumptions, determine

(a) the temperature and pressure of the gases at the turbine exit,

(b) the velocity of the gases at the nozzle exit, and

(c) the propulsive efficiency of the cycle.

**[Ans. 201°R, 39.7psia, 3288ft/s, 22.5%]**