

II B.Tech I Semester Supplementary Examinations, November 2005
THERMODYNAMICS & FLUID MECHANICS
(Common to Mechatronics and Production Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain the concept of continuum and under what circumstances it is invalid. [4+6]
 (b) Differentiate between Homogeneous and Heterogeneous systems. [6]
2. In a steady flow apparatus 140kJ of work is done by each kg of fluid. The specific volume of the fluid, pressure and velocity at the inlet are 0.37 m³/kg, 600 kpa and 16 m/s. The inlet is 32 m above the floor and the discharge pipe is at the floor level. The discharge conditions are 0.62 m³/kg, 100kpa and 300m/s. The total heat loss between the inlet and discharge is 9kJ per kg of fluid. Find whether specific internal energy increase or decrease. [16]
3. (a) Prove the statement “Of all engines which operate between given two thermal reservoirs the reversible engine possesses the maximum thermal efficiency”. [8]
 (b) A heat engine is used to drive a heat pump. The heat transfer from the heat engine and from the heat pump are used to heat the water circulating through the radiators of a building. The efficiency of the heat engine is 27% and C.O.P. of the heat pump is 4. Evaluate the ratio of heat transfer to the circulating water to the heat transfer to the heat engine [8]
4. (a) Using Maxwell’s relations deduce the two Tds equations. [8]
 (b) Derive the equation [8]

$$\frac{(\partial V/\partial T)_s}{(\partial V/\partial T)_p} = \frac{1}{\gamma-1}$$
5. (a) Define the mean effective pressure? What is its importance in reciprocating engines? [8]
 (b) Explain graphically the variation of the efficiency of Diesel cycle with compression ratio and cut off ratio. [8]
6. (a) The standard atmospheric pressure is 76cm of mercury. Express it in terms of column height of water and in N/m². [8]
 (b) A closed tank contains 0.5m of mercury, 2m of water, 3m of oil of specific gravity 0.6 successively and air is present on top. If the gauge pressure at the bottom of the tank is 124Kpa, what is the pressure of air at top of the tank? [8]
7. (a) What do you understand by stream tube ? Explain in detail. [8]

- (b) The stream function and velocity potential for a flow are given by $\psi = 2xy$ and $\phi = x^2 - y^2$. Show that the conditions of continuity and irrotational flow are satisfied. [8]
8. (a) How will you find the drag on a flat plate due to laminar and turbulent boundary layers. [8]
- (b) A smooth flat plate of length 5m and width 2m is moving with a velocity of 4 m/sec in stationary air of density as 1.25 kg/m^3 and kinematic viscosity $1.5 \times 10^{-5} \text{ m}^2/\text{sec}$. Determine thickness of boundary layer at the trailing edge of the smooth plate. Find the total drag on one side of the plate assuming that the boundary layer is turbulent from the very beginning. [8]
