Code No: NR211401 **NR**

II B.Tech I Semester Supplementary Examinations, May 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

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1. Discuss where the following quantities can be used as properties are not.
   (a) $\int$ P dV+$\int$V dP
   (b) $\int$P dV
   (c) $\int$V dP
2. Explain the physical significance of the various terms of the steady flow energy equation & also explain how all the terms in that expression has the same units.
3. (a) Prove that the change in entropy during a polytropic process is given by $s_2 - s_1 = C_v\ (n - \gamma\ /\ n - 1)\ \log_e\ (T_2\ /\ T_1)$ where γ is ratio of specific heats and n- index of compression or expansion.
   (b) A closed system consists of 1kg of air which is initially at 1.5 bar and 67^0C. The volume doubles as the system undergoes a process according to the law $pV^{1.2}$ = Constant. Find the work done, Heat transfer and change in entropy.
4. (a) Define : Helmholtz function and Gibbs function and hence deduce the two Maxwell's relations.
   (b) Prove that the partial molal Gibbs function is equal to the chemical potential
5. (a) Explain the four processes make up he simple ideal Rankine cycle. How do actual vapor cycles differ from the idealized ones?
   (b) Consider a simple Rankine cycle and an ideal Rankine cycle with three reheat stages. Both cycles operate between the same pressure limits. The maximum temperature is 700^0C in the simple cycle and 500^0C in the reheat cycle. Which of these cycles will have a higher thermal efficiency?
6. (a) What is the difference between saturation pressure and vapour pressure?
   (b) An open tank contains water to a depth of 2.5 m and an oil of relative density 1.25 to a depth of 1.5m, the water being above the oil. Determine the pressure at the oil and water interface and at the bottom. Draw the pressure diagram.
7. (a) Define stream line. Derive the equation of stream line.
   (b) The velocity components are given as $u = 2xy^3\ /\ 3 - x^2y$ and $v = xy^2 - 2yx^3\ /\ 3$. Indicate whether the velocity distribution is a possible flow field. Determine the velocity at a point (2, 3) and the velocity potential function.
8. (a) Differentiate between

i. Stream lines body and bulb body

ii. Friction drag and pressure drag.

(b) The air is flowing over a cylinder of diameter 10cm and of infinite length with a velocity of 15 cm/sec. Find the total drag, shear drag, pressure drag on 1m length of the cylinder if the total drag coefficient is 1.5 and shear drag coefficient is 0.25. The density of air is given as 1.25 kg/m^3.

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