Uva Wellassa University - Sri Lanka

B.Tech Degree Programme 2006/07

BSc in Computer Science and Technology Degree Programme 2006/07

End Semester Examination - Semester 1

January 2008

ENG 203-2 Engineering Physics

Instructions

Answer for **Four (04)** questions **only**
No. of questions: Five (05)
No. of pages: Four (04)
Time: Two hours
Clearly state any assumptions made.
You can assume any missing data.
Tables of properties will be provided

Question 01

(a) What is an open system and close system?

(20%)

(b) One-half kilogram of a gas contained within a piston-cylinder assembly undergoes a constant – pressure process at 4 bar beginning at υ_1=0.72 m^3/kg. For the gas as the system, the work is -84 kJ. Determine the final volume of the gas, in m^3.

(20%)

(c) Determine the phase or phases in a system consisting of H_2O at the following conditions and sketch *p-v* and *T-v* diagrams showing the location of each state.

I. p = 5 bar, T= 151.9 ^{0}C.
II. p = 5 bar, T = 200 ^{0}C.
III. p = 2.5 MPa, T = 200 ^{0}C.
IV. p = 4.8 bar, T = 160 ^{0}C.
V. p = 1 bar, T = -12 ^{0}C.
VI. p = 22.09 MPa, T = 374.14 ^{0}C

(30%)

(d) A two-phase liquid-vapor mixture of water is contained in a 0.1 m^3 rigid tank initially at a pressure of 30 bars. If on heating the critical point is attained, determine:
a) The quality at the initial state,
b) The volume occupied by the liquid component of the water at the initial state, in m^3.

(30%)

Question 02

(a) Define the following heat transfer situations as either conduction, convection, radiation, or a combination of the three. Clearly state, between which two objects the heat transfer occurs and the direction of heat transfer.

For example: A person with a headache holds a cold ice pack to his/her forehead.
Answer: Conduction occurs from the person's forehead to the ice pack.

a) The sun shines brightly on a car, making the black upholstery very hot.
b) A small 4" fan is installed in the back of a computer to help cool the electronics.
c) Potatoes are boiled in water.
d) A turkey is being roasted in the oven.
e) An ice cube placed on a metal tray is left out of the freezer

(20%)

(b) For heat transfer purposes, a standing man can be modelled as a 30cm diameter, 170cm long vertical cylinder with both top and bottom surfaces insulated and with the side surface at an average temperature of 34^0C. For a convection heat transfer coefficient of 15 W/m^2 ^{0}C determine the rate of heat loss from this man by convection in an environment at 20^0C.

(40%)

(c) A power cycle operates between a reservoir at temperature T and lower temperature reservoir at 280 K. At steady state, the cycle develops 40 kW of power while rejecting 1000 kJ/min of energy by heat transfer to the cold reservoir. Determine the minimum theoretical value for T, in degrees Kelvin. [Hint: Use Carnot Principle]

(40%)

Question 03

(a) A U-tube manometer contains oil (SG = 0.9), mercury (SG = 13.6) and water as shown in Fig Q3 (a). For the column heights indicated what is the pressure difference between pipes A and B.

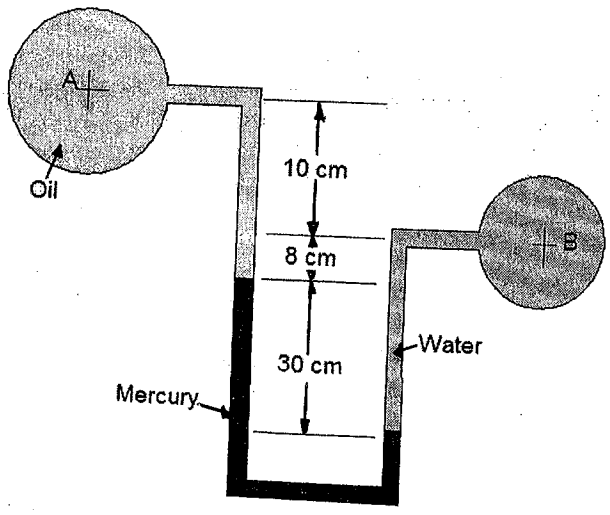


Fig Q3 (a)

(50%)

(b) A 3 m wide, 8 m high rectangular gate is located at the end of a rectangular passage that is connected to a large open tank filled with water as shown in Fig Q3(b). The gate is hinged at its bottom and held closed by a horizontal force, F_H, located at the center of the gate. The maximum value for F_H is 3500 kN. Determine the maximum water depth, h, above the center of the gate that can exist without the gate opening.

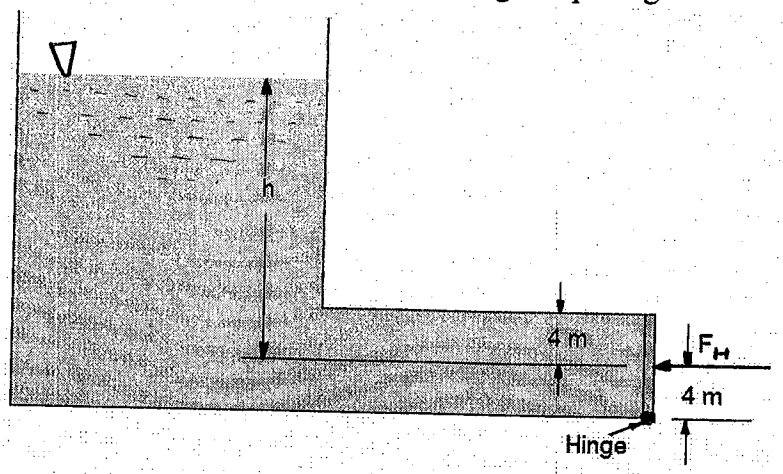


Fig Q3 (b)

(50%)

Question 04

(a) Briefly discuss about the characteristics of the conventional stress – strain curve of commonly used engineering materials.

(40%)

(b) The hoist in Fig Q4 (b) consists of the beam AB and attached pulleys, the cable, and the motor. Determine the resultant internal loadings acting on the cross section at C if the motor is lifting the 500 lb load W with constant velocity. Neglect the weight of the pulleys and beam.

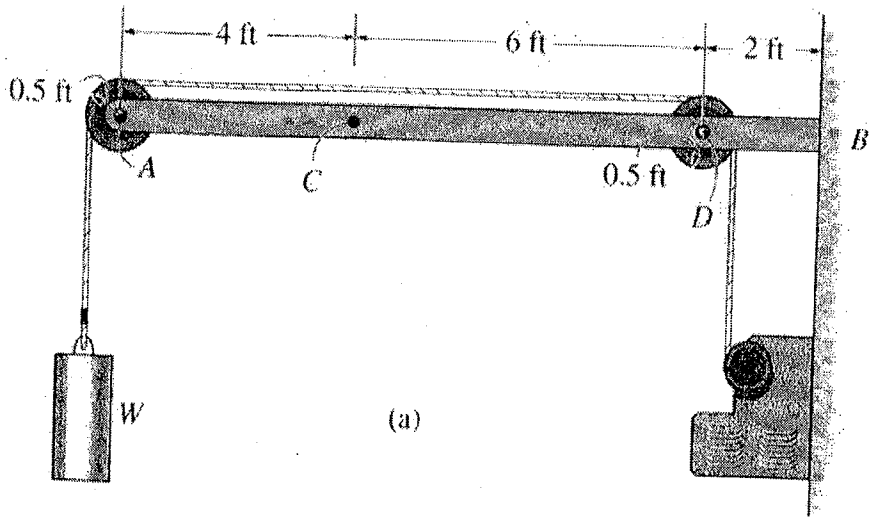


Fig Q4 (b)

(60%)

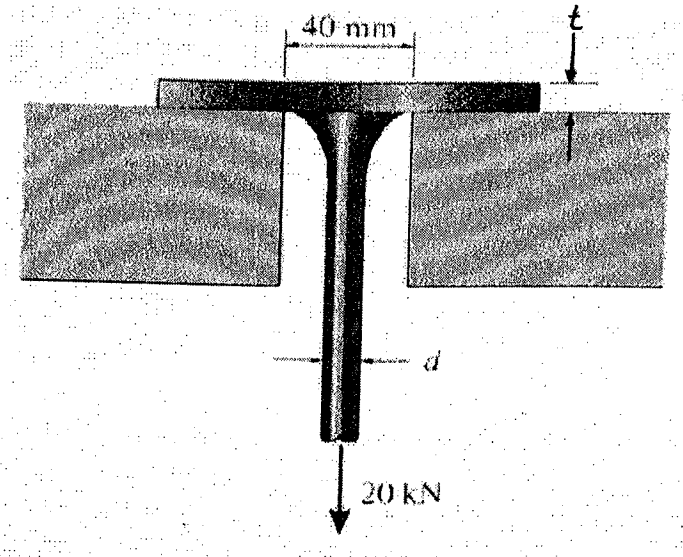
Question 05

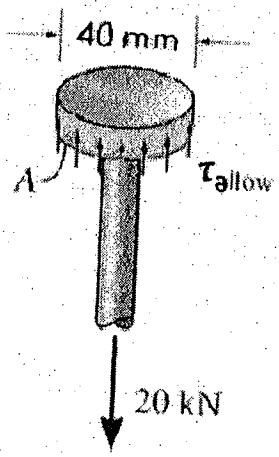
(a) Write short notes on the following topics.

I. Manometers
II. Bernoulli equation
III. Pressure prism
IV. Hooke's law
V. Factor of Safety

(50%)

(b) The suspender rod is supported at its end by a fixed – connected circular disk as shown in Fig Q5 (b). If the rod passes through a 40 mm diameter hole, determine the minimum required diameter of the rod and the minimum thickness of the disk needed to support the 20 kN load. The allowable normal stress for the rod is σ_{allow} = 60 MPa, and the allowable shear stress for the disk is τ_{allow} = 35 MPa.





(50%)

Fig Q5 (b)