Uva Wellassa University, Sri Lanka
End Semester Examination – February/March 2012
SCT 262-2 Engineering Physics

Time: Two (02) Hours

~~Total 05 Questions~~
Answer **04** questions

1)

A piston–cylinder device initially contains 0.07 m^3 of nitrogen gas at 130 kPa and 120°C. The nitrogen is now expanded to a pressure of 100 kPa polytropically with a polytropic exponent whose value is equal to the specific heat ratio (called *isentropic expansion*). The properties of nitrogen are $R = 0.2968$ kJ/kg.K and $k = 1.4$

a) Determine the final temperature. (15 marks)
b) Define the polytropic process. (20 marks)
c) Calculate the boundary work done during this process. (65 marks)

2)

In a gas turbine installation air is heated inside heat exchanger upto 750°C from ambient temperature 27°C. Hot air then enters into gas turbine with a velocity of 50 ms^{-1} and leaves at 600°C. Air leaving turbine enters a nozzle at 60 ms^{-1} velocity and leaves nozzle at temperature of 500°C. For unit mass flow rate of air determine the following assuming adiabatic expansion in turbine and nozzle,

(a) heat transfer to air in heat exchanger (30 marks)
(b) power output from turbine (30 marks)
(c) velocity at exit of nozzle (40 marks)
Cp for air as 1.005 kJ/kg°K.

3)

I. Water flows from A to D and E through the series pipeline shown in Fig. 3.1 Given the pipe diameters, velocities and flow rates below, complete the tabular data for this system.

(50 marks)

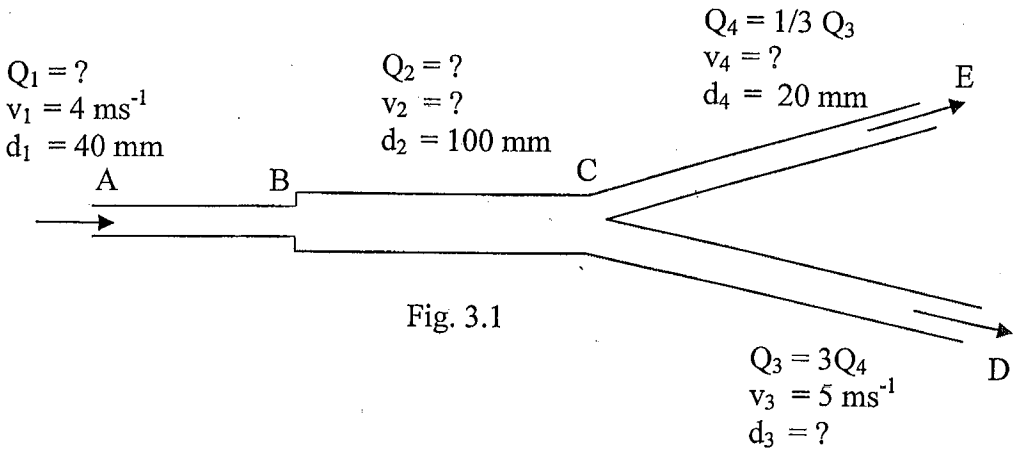

Fig. 3.1

Pipe	Diameter (mm)	Flow Rate ($m^3 s^{-1}$)	Velocity (ms^{-1})
AB			
BC			
CD			
DE			

II. The inverted U tube manometer contains oil (SG = 0.9) and water as shown in Fig.3.2. The pressure differential between pipes A and B, $P_A - P_B = -5$ kPa. Determine the differential reading, h. Density of water is 1000 kg m^{-3}

(50 marks)

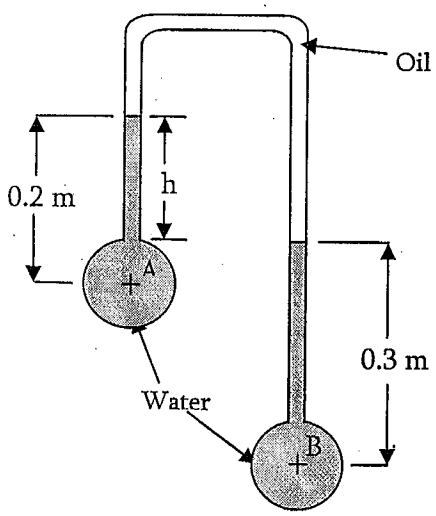

Fig. 3.2

4)

I. Draw the stress – strain diagram and mark the regions

(10 marks)

II. Explain the failure of brittle material and ductile material using suitable sketches.

(20 marks)

III. Two solid cylindrical rods are joined at B and loaded as shown. Rod AB is made of steel (E = 200 GPa). And rod BC of brass (E = 105 GPa). Determine

a. The total deformation of composite rod ABC

b. The deflection of point B

(70 marks)

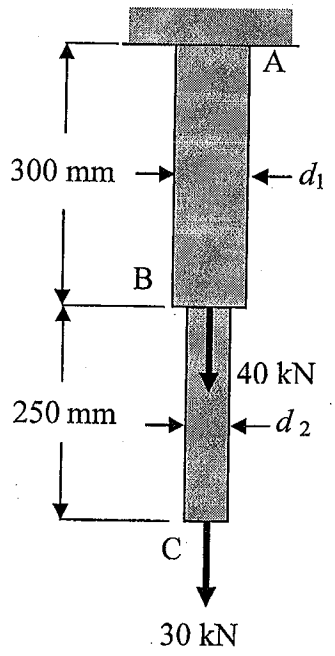

Fig. 5.1

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