Faculty of Engineering at Shubra . Mechanical Engineering Department
Fluid Dynamics 2nd- Year Power March 2006. Time 2 hours

Please attempt all questions

1)Choose the most appropriate statement for each of the following statement

a) for fully turbulent pipe flow the friction coefficient f is function of 1) Reynolds Re number only. 2) both Re and relative roughness ε/D. 3) ε/D only

b) At the edge of the boundary layer 1) u/U =0.6. 2) shear stress τ is maximum.

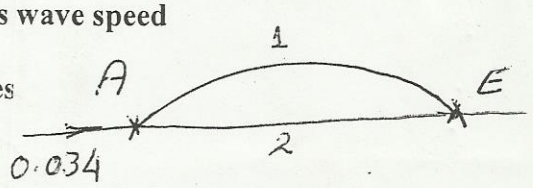
3) $\frac{\partial u}{\partial y} = 0$.

c)The pressure increase due to sudden valve closure equals 1) $\rho V^2/2$ 2)$\rho V C$ 3) $2\rho VL/t_c$

d) Valve closure is considered sudden if the closure time t_c is 1) <2L/C 2) < L/C 3) < 4L/C where L is pipe length and C is wave speed

2-a) Given below the characteristics of two pipes

Pipe	e/D	L m	D cm	∑k
1	0.001	40	10	2
2	0.001	30	10	1



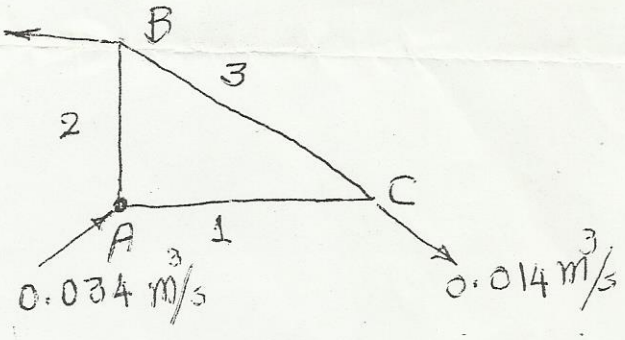
The supply flow and head at A are 0.034 m^3/s 30 m, respectively. Assume fully turbulent flow. If these pipes are connected in parallel as shown, find the discharge in each pipe and the head at E.

$$f = \frac{1.325}{[\ln(0.27\frac{\varepsilon}{D} + \frac{5.74}{Re^{0.9}})]^2}$$

, Use $R = \frac{8fL}{g\pi^2 D^5}$ and $h_L = RQ^2$

) Given below the characteristics of three pipes

Pipe	e/D	L m	D cm	∑k
1	0.001	40	10	2
2	0.001	30	10	1
3	0.001	50	10	3



2-b) If these 3 pipes make a loop as shown, use Hardy Cross method to find the discharge in each pipe and the head at B and C.

3) A pipe line of length 3 km and diameter 50 cm with water velocity 3 m/s. The pipe is made of steel with Young modulus of elasticity E= 2.2 X 10^{11} Pa. Water bulk modulus of elasticity K=2.2 G Pa Pipe wall thickness t=6 mm. The pipe is equipped with expansion joints throughout. Evaluate the speed of pressure wave C Find the amplitude of pressure increase if the valve is

1) closed in 2 s.

2) closed in 10 s.

$$C^2 = \frac{K/\rho}{1 + (K/E)(D/t)}$$

$\Delta p = \rho VC$ (sudden closure)

$\Delta p = \rho V(\frac{2L}{t_c})$ (gradual ")