UNIT II- FLOW THROUGH CIRCULAR CONDUITS

PART – A ( 2 Marks )

01. Write down the Hagen- Poiseuille Equation for laminar flow? (APR-05)

02. What is boundary layer? Give a sketch of boundary-layer region over a flat plate. (APR-03)

03. Define displacement thickness? (NOV-04)

04. Define the terms: Drag and lift. (DEC-07)

05. What are energy lines and hydraulic gradient lines? (APR-03)

06. Write down four examples of laminar flow? (DEC-06)

07. What is the physical significance of Reynolds number? (DEC-07)

08. Diff between laminar and turbulent flow. (DEC-05)

09. What is syphon? What is its application? (NOV-03)

10. What are the losses experienced by a fluid while passing through a pipe? (APR-05)

11. What is equivalent pipe? (DEC-06)

12. What do you mean by a flow through parallel pipes? (NOV-04)

PART-B ( 16 Marks )

01. The diameter of a water pipe is suddenly enlarged from 350mm to 700mm. The rate of flow through it is 0.25 m^3/s. Calculate the loss of head in enlargement. (NOV'02)

02. Compare the rate of growth of the laminar boundary layer over a smooth flat plate in the following cases.
   a. Flat plate placed in a water stream flowing at 2m/s
   b. Flat plate placed in an air stream flowing at 2m/s

03. Flat plate placed in an air stream flowing at 8m/s
   i. Given that the densities of water and air are 1000 and 1.2 kg/m^3 respectively and the viscosities of water and air are 0.001 and 0.000019 ns/m^2 respectively. (NOV'02)
   ii. Viscosities of water and air are 0.001 and 0.000019 ns/m^2 respectively. (NOV'02)

04. Determine the length of an equivalent pipe of dia 20cm and friction factor 0.02 for a given pipe system discharging 0.1 m^3/s. The pipe system consisting of the following (NOV'02)
   a) A 10m line of 20cm dia with f=0.03
   b) Three 90° bend k=0.5 for each
   c) Two sudden expansion of dia 20 to 30cm.
   d) A 15m line of 30cm dia with f= 0.025
e) A global valve fully open k=10

05. A 20cm dia pipe 3km long transports oil from a tanker to the shore at 0.01 m^3/s. Find the Reynolds number to classify the flow. Take viscosity μ=0.1 Nm/s² and density(ρ)=900 kg/m^3 for oil. \(\text{(Apr 03)}\)

06. A 30cm dia pipe of length 30cm is connected in series to a 20cm dia pipe of length 20cm to convey discharge. Determine the equivalent length of pipe of diameter 25cm, assuming that the friction factor remains the same and the minor losses are negligible. \(\text{(Apr'03)}\)

07. A pipe line carrying oil of specific gravity 0.85 changes in dia from 350mm at position 1 to 550mm dia to a piston 2 which is at 6m at a higher level. If the pressure at position 1 and 2 are taken as 20N/cm² and 15N/cm² respectively and the discharge through the pipe is 0.2 m³/s. Determine the loss of head and determine the flow. \(\text{(Apr'03)}\)

08. The rate of flow of water through a horizontal pipe is 0.3 m³/s. The dia of the pipe is suddenly enlarged from 25cm to 50cm. The pressure intensity in the smaller pipe is 14N/m². Determine the i) loss of head due to sudden enlargement ii) Pressure intensity in the large pipe iii) Power lost due to enlargement. \(\text{(Nov'03)}\)

09. Water is flowing through a tapering pipe of length 200m having dia 500mm at the upper end and 250mm at the lower end the pipe has a slope of 1 in 40. The rate of flow through the pipe is 250lit/s. The pressure at the lower end and the upper end are 20N/cm² and 10N/cm². Find the loss of head and direction of flow. \(\text{(Nov'04)}\)

10. A horizontal pipe of 400mm dia is suddenly contracted to a dia of 20mm. The pressure intensity in the large and small pipe are given as 15N/cm² and 10N/cm². Find the loss of head due to contraction if Cc=0.62. Determine also the rate of flow of water. \(\text{(Nov'04)}\)

11. A pipe line 10km long delivers a power of 50kw at its outlet end. The pressure at inlet is 5000KN/M² and pressure drop per km of pipe line is 50KN/M². Find the size of the pipe and the efficiency of transmission (Take 4F=0.02). \(\text{(Dec'05)}\)

12. The velocity of water in a pipe 200mm diameter is 5m/s the length of the pipe is 500m. Find the loss of head due to friction if f=0.008. \(\text{(Dec'05)}\)
13. A compound piping system consists of 1800m of 0.5m, 1200m of 0.40m and 600m of 0.3m new cast iron pipes connected in series convert the system to i) An equivalent length of 0.4m dia pipe and ii) equivalent size of pipe of 3600m length.  (DEC’07)

14. A 2500m long pipe line is used for transmission of power 120KW power is to transmitted through the pipe in which water having a pressure of 4000KN/m^2 at inlet in flowing. If the pressure drop over the length of pipe is 800KN/m^2 and f=0.006 find diameter of the pipe and efficiency of the transmission.  (DEC’06)

15. A flat plate 1.5m x 1.5m moves at 50Km/h in a stationary air of density 1.15Kg/m^3. If the coefficient of drag and lift are 0.15 and 0.75. Determine 1) The lift force 2) The drag force 3) the resultant force 4) The power required  (DEC 07)

16. A power transmission pipe 10cm dia and 500m long is fitted with a nozzle at the exit, The inlet is from a river with water level 60m above the discharge nozzle Assume f=0.02. Calculate the maximum power which can transmitted and the diameter of nozzle required.