B.E.(with Credits)-Regular-Semester 2012 - Civil Engineering Sem VI

CE603 - Fluid Mechanics-II

P. Pages : 2 **GUG/W/16/5333**

Time : Three Hours * 3 5 2 2 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. All questions are compulsory.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.

1. a) Derive the expression for shear stress distribution and velocity distribution for laminar flow in a circular pipe. **8**

b) Oil of viscosity 0.2 Pa-s and sp-gr of 0.8 flows through a 150 mm diameter pipe. If the head loss in 2000 m length pipe is 25 m , estimate. **8**
i) Shear stress along the pipe.
ii) Shear stress at a radial distance of 50 mm from the axis of the pipe.
iii) Velocity at radial distance of 25 mm from the axis of the pipe.
iv) Discharge through the pipe.
v) Check weather the flow is laminar

OR

2. a) A ship is propelled by two cylindrical rotors each of diameter 2.5 m and height 7.5 m revolving at 150 rpm about their axis which are horizontal. Estimate the force exerted upon the rotors in the direction of motion when the relative wind velocity is 40 kmph at an angle of 30º to the horizontal. **8**
Assume : $\rho_{air} = 1.22$ kg / m^3
$C_L = 4.4$ and $C_D = 1.5$.

b) A plate 600 mm length and 400 mm wide is immersed in a fluid of specific gravity 0.9 and kinematic viscosity of 10^{-4} m^2/sec. The fluid is moving with velocity of 6 m/s. Determine. **8**
i) Thickness of boundary layer at the trailing edge, and.
ii) Drag force on one side of the plate.

3. a) Two reservoirs are connected by three pipes laid in parallel their diameters are d, 2d and 3d respectively and they are of same length. Assuming f to be same for all three pipes, find the discharge through each of the larger pipes, if discharge through the smallest pipe is 2 cumec. **8**

b) A water pipeline 3200 m long and 25 cm diameter have rate of flow 10 x 10^5 lit/day. If the water line is gradually closed by operating a value in 16 seconds. Determine the water hammer pressure developed in the pipe line'. **8**

OR

4. a) Three pipes 200 m of 20 cm diameter 150 m of 15 cm diameter & 300 m of 30 cm diameter are connected in series. Determine the discharge if the difference of elevation between entry of first pipe and exit of last pipe is 10 m (f = 0.021). **8**

b) Two reservoirs are connected by a pipe line which rises above the level of the highest reservoirs what will be the highest point of the syphon above the level if the length of the pipe leading up to this point from entrance in 500 m, the dia. of the pipe is 0.35 m. The difference in level of two reservoirs in 12 m and the total length of the pipe is 900 m. The syphon must run full. Calculate the rate of flow through this siphon pipe. **8**
Assume $H_{sep} = 2.4$m of water absolute and f = 0.04. Allow for all losses.

5. a) What do you understand by a most economical section of a channel? Derive the condition of most economical section for a trapezoidal channel. **8**

b) Calculate the specific energy of 12 m^3/ sec of water flowing with a velocity of 1.5 m / s in a rectangular channel 7.5 m wide. Find the depth of water in the channel when the specific energy would be minimum. What would be the value of critical velocity as well as minimum specific energy? **8**

OR

6. a) Prove that the length of the back water curve is given by **8**

$$\ell = \frac{E_2 - E_1}{S_o - S_f}.$$

where ℓ = length of back water curve E_1 = SP. Energy at the section where water starts rising E_2 = SP. energy at the end of back water curve.
S_o = Slope of bed.
S_f = Slope of energy gradient.

b) In a rectangular channel of 0.5 m width a hydraulic jump occurs at a point where depth of water flow is 0.15 m & Froude No. is 2.5 **8**
Determine.
1) Specific energy.
2) The critical and sequent depths.
3) Loss of head.

7. a) A model of reservoir is completely drawn in 5 min by means of a sluice gate. If the model is Built to a scale of 1:400, what time will be required to drain the prototype? **8**

b An oil of specific gravity 0.90 & viscosity 0.003 Pas is required to transport through a pipe of 1 m diameter at the rate of 0.3 m^2 / sec. Tests were conducted an a 10 mm diameter pipe using water at 20ºC. The density and viscosity of water at 20ºC are 1000 kg|m^3 & 0.001 Pas. respectively. Determine the average velocity and rate of flow in the model. **8**

OR

8. a) Clearly distinguish between Francis turbine and pelten wheel turbine. **4**

b) What are the function of a draft tube. **4**

c) Under a head of 150 m at 400 rpm a turbine develops 440 kw of power. Determine its normal speed and output under a head of 100 m. **8**

9. a) A centrifugal pump having an overall efficiency of 80 % delivers 1850 liters of water Per minute to a height of 20 meters through a pipe of 100 mm diameter and 95 meters length. Taking f = 0.02 find the power required to drive the pump **8**

b) What is priming? Why is it necessary. **8**

OR

10 a) Describe the principle and working of a reciprocating pump. **8**

b) A single acting reciprocating pump runs at 60 rpm. The diameter of the plunger is 15 cm and crank radius is 15 cm. The suction pipe is 10 cm in diameter and 5 m long if suction head is 4.0 m & delivery head is 20.0 m find the coefficient of discharge, recent slip & the power required to drive the pump. **8**

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