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B.Tech.(CE) (2012 to 2017) (Sem.–4)

FLUID MECHANICS-II

Subject Code : BTCE-404

M.Code : 56086

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q1. Answer briefly :

a) Define Critical Velocity and critical Reynolds number.

b) What do you understand by a smooth pipe and rough pipe flow?

c) What are hydraulic and energy gradient lines?

d) What are the factors which result in gradually varied flow?

e) What are the elements of hydraulic jump?

f) What are backwater curves?

g) What is the momentum principle?

h) What are drawdown curves?

i) Comment on the arbitrariness of boundary layer thickness.

j) Define Surge.

SECTION-B

Q2. Show that the discharge per unit width between two parallel plates distance b apart, when one plate is moving at velocity V while the other one is held stationary, for the condition of zero shear stress at the fixed plate is : $q=bV/3$.

Q3. A pipeline 12 cm in diameter and 100m long conveys water at the rate of 0.075 m^3/s. The average height of the surface protrusions is 0.012 cm and the coefficient of friction is 0.005. Calculate the loss of head, wall shearing stress, centre line velocity and nominal thickness of laminar sub layer. For water ρ = 1000 kg/m^3, v = 0.01 stokes.

Q4. A stream-lined train is 250 m long with atypical cross section having a perimeter of 8m above the wheels. Evaluate the approximate surface drag of the train when running at 80 km/hr. The kinematic viscosity of air at the prevailing temperature is 1.5×10^{-5} m^2/s and the density is 1.24 kg/m^3. Make allowance for the fact that boundary layer changes from laminar to turbulent on the train surface.

Q5. What are the characteristics of back water curve surface profiles in sustaining slope channels?

Q6. Water flows at a rate of 1×10^6 cm^3/s along a channel of rectangular section 1.75m in width. Calculate the critical depth. If a hydraulic jump formed at a point where the upstream depth is 25 cm, what would be the rise in water level and power lost in the jump?

SECTION-C

Q7. Determine the maximum wall shear stress for laminar flow in a tube of diameter D with fluid properties μ and ϕ given.

Q8. a) Derive the Chezy equation $V = C(y_m s)^{1/2}$. State clearly the assumptions made and explain the significance of the constant C and its evaluation.

b) A rectangular channel 8m wide and 1.5m deep, has a slope of 0.001 in 1 and is lined with smooth concrete plaster. It is desired to enhance the discharge to a maximum by changing the dimensions of the channel but keeping the same amount of lining. Workout the new dimensions and the percentage increase in discharge. For the smooth concrete plaster, take Manning constant N=0.015.

Q9. Find in terms of specific energy E, an expression for the critical depth in a trapezoidal channel with bottom width b and side slope 1 vertical to n horizontal.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.