KATIHAR ENGINEERING COLLEGE, KATIHAR

Code: 011410

B.Tech 4th semester Mid Term Exam

Hydraulics and Open Channel Flow

Time: 2 hours **Full Marks: 20**

Instructor: Rashid Mustafa

Instructions: Answer any five question in which question number 1 is compulsory

The marks are indicated in the right- hand margin

1. Choose and write the correct option **1x4= 04**

(i) In a rectangular channel the depth of flow is 1.8 m and the specific energy is 3.0 m. The type of flow will be

(a) Sub-critical (b) Critical (c) Super-critical (d) Not feasible

(ii) Match List-I (Relative Position of Depth) with List-II (Surface Curves) and select the correct answer using the codes given below the lists:

	List-I		**List-II**
A.	$y < y_c < y_o$	**1.**	M_2
B.	$y_c < y < y_o$	**2.**	M_3
C.	$y_o < y < y_c$	**3.**	S_1
D.	$Y_o < y_c < y$	**4.**	S_2

Codes:

	A	**B**	**C**	**D**
(a)	4	3	2	1
(b)	2	1	4	3
(c)	4	1	2	3
(d)	2	3	4	1

(iii) For a turbulent boundary layer, the velocity profile is described by the one fifth power law **(** $\frac{u}{V} = (\frac{y}{\delta})^{1/5}$ **)** .What is the ratio of displacement thickness to boundary layer thickness?

(a) 1/7 (b) 1/6 (c) 1/5 (d) 1/4

(iv) The critical depth of water flowing through a rectangular channel of width 5 m when discharge is 12.5 m^3/s is (**in m**)

(a) $(2.25)^{1/2}$ (b) $(1.6)^{1/2}$ (c) $(0.46)^{1/3}$ (d) $(0.64)^{1/3}$

2. Derive the Chezy equation of resistance and also derive the relationship between Chezy coefficient C, and Manning's roughness n. **04**

3. Derive the differential equation for gradually varied flow and write its basic assumptions. **04**

4. Define displacement, momentum and energy thickness of boundary layer. For the velocity profile $\frac{u}{V} = (\frac{y}{\delta})^{1/7}$, calculate the ratio of displacement thickness and momentum thickness. **04**

5. A 3.0m wide rectangular channel is lined with rough concrete (n=0.015).The bed slope of the channel is 0.0008. If the normal depth of flow is 1.5m, calculate the (a) Conveyance (b) discharge, (c) Froude number of the flow and (d) average bed shear stress. **04**

6. For a given velocity profile, determine whether flow is attached, detached, or on the verge of separation. The velocity profile is

$$\frac{u}{V} = 2(\frac{y}{\delta})^2 + (\frac{y}{\delta})^3 - 2(\frac{y}{\delta})^4$$

Where, u= velocity at distance, V= Free stream velocity, $\boldsymbol{\delta}$ = boundary layer thickness **04**

7. Calculate width and depth of efficient trapezoidal channel to carry a discharge of 100 m^3/s at a slope of 1 in 4000. The side slope may be taken as 1:1 and the permissible velocity in the channel is limited to 2.5 m/s. The Manning's roughness coefficient is 0.014. **04**

----End of the question paper----

Note: Solution will be uploaded shortly on the college website **www.keck.ac.in**