Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, Dec 2021

Course: Hydraulic Engineering **Semester: V**
Program: B Tech Civil Engineering **Time: 03 Hours**
Course Code: CIVL 3019 **Max. Marks: 100**

Instructions: Attempt all the questions

SECTION A (4 x 5 = 20 marks)

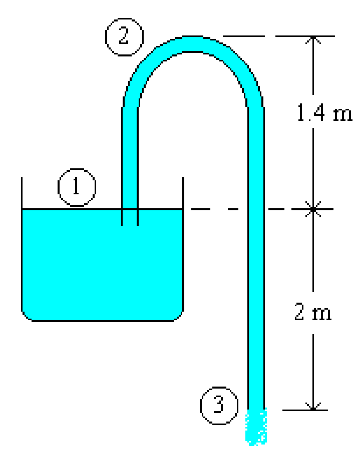
1. **Each Question carries 4 marks**

S. No.		Marks	CO
Q1	What is the discharge for laminar flow through a pipe of diameter 4 cm having centerline velocity of 1.5 m/s?	**4**	**CO1**
Q2	In fully developed turbulent pipe flow, assuming 1/7th power law, what is the ratio of time mean velocity at the centre of the pipe to that average velocity of the flow?	**4**	**CO1**
Q3	Assertion (A): In the boundary layer concept, the shear stress at the outer edge of the layer is considered zero. Reason (R): Local velocity is almost equal to velocity in potential flow. (a) Both A and R are true and R is the correct explanation of A (b) Both A and R are true but R is NOT the correct explanation of A (c) A is true but R is false (d) A is false but R is true	**4**	**CO2**
Q4	The transition Reynolds number for flow over a flat plate is 5×10^5. What is the distance from the leading edge at which transition will occur for flow of water with a uniform velocity of 1 m/s? [For water, the kinematic viscosity, $\nu = 0.858 \times 10$- 6 m^2/s	**4**	**CO2**
Q5	Calculate the critical depth and the corresponding specific energy for a discharge of 5.0 m^3/s in the triangular channel with B = 2m and m = 1.5.	**4**	**CO3**

SECTION B (10 x 4 = 40 marks)

1. **Each Question carries 10 marks**
2. **Instruction: Write Short/brief notes**

Q6	A 0.3m diameter pipe 2340m long is connected with a reservoir whose surface is 72m above the discharge end of the pipe. If for the last 1170m, a second pipe of the same diameter to be laid beside the first and connected to it, what would be the increase in discharge? Take friction factor f as 0.02.	**10**	**CO1**
	OR		
Q6	Derive the velocity distribution for smooth pipes. Also, define the ageing of pipe.	**8+2**	**CO1**
Q7	A parachutist has a mass of 90 kg and a projected frontal area of 0.30 m^2 in free fall. The drag coefficient based on frontal area is found to be 0.75. If the air density is 1.28 kg/m^3, find the terminal velocity of the parachutist.	**10**	**CO2**

Q8	Find the ratio of skin friction drag on the front half and rear half portions of a flat plate kept in a uniform stream of zero incidence. Assume the boundary layer to be turbulent over the entire plate.	**10**	**CO2**
Q9	Draw the following GVF Profiles: a) H_2 b) M_3 c) S_1 d) A_2	**10**	**CO3**
	SECTION-C (20 x 2 = 40 marks) **1. Each Question carries 20 marks** **2. Instruction: Write long answer.**		
Q10	A rectangular channel with a bottom width of 4.0 m and a bottom slope of 0.0008 has a discharge of 1.50 m^3/s. In a gradually varied flow in this channel, the depth at a certain location is found to be 0.30 m. Assuming n = 0.016, determine the type of GVF profile.	**20**	**CO3**
	OR		
Q10	A uniform flow of 12.0 m^3/s occurs in a long rectangular channel of 5.0 m width and depth of flow of 1.50 m. A flat hump is to be built at a certain section. Assuming a loss of head equal to the upstream velocity head, compute the minimum height of the hump to provide critical fl ow. What will happen (a) if the height of the hump is higher than the computed value and (b) if the energy loss is less than the assumed value?	**10+10**	**CO3**
Q11	a) A siphon has a uniform circular bore of 75 mm diameter and consists of a bent pipe with its crest 1.8 m above water level and a discharge to the atmosphere at a level 3.6 m below water level. Find the velocity of flow, the discharge and the absolute pressure at crest level if the atmospheric pressure is 98.1 kN/m^2. Neglect losses due to friction.  b) Show that the kinetic energy correction factor for laminar flow through a circular pipe is 2	**10+10**	**CO1**