(3 hours)

Note: **Max. Marks: 80**

Question no.1 is compulsory
Solve any 3 questions out of remaining
Assume data wherever necessary and clearly mention the assumptions made.
Draw neat figures as required.

Q 1 **Answer any 4 of the following.** **20**

a Write a short note on type of flow in open channel
b Explain 'S' curve in detail with neat sketches.
c Explain Momentum Thickness and Energy Thickness.
d Write a note on Boundary Layer Separation. State its control measures.
e Write a short note on Aerofoil.

Q 2 a Derive equation for Boundary Layer thickness, Local Coefficient of Drag for the given velocity profile : **10**

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

b A cylinder whose axis is perpendicular to the stream of air having a velocity of 22 m/s, rotates at 310 r.p.m. The cylinder is 2 m in diameter and 10 m long. Find : (i) the circulation, (ii) theoretical lift force per unit length, (iii) position of stagnation points, and (iv) the actual lift, drag and direction of resultant force. Take density of air 1.24 kg/m^3. For actual drag and lift take C_L = 3.4, C_D = 0.65 and uθ/U = 1.57. **10**

Q 3 a A rectangular channel 5.5 m wide and 1.25 m deep has a slope of 1 in1000 and is lined with good rubble masonry for which Manning's n = 0.017. It is desired to increase the discharge to maximum by changing the channel slope or form of section. The dimensions of the section may be changed but the channel must contain the same amount of lining. Compute the new dimensions and probable increase in discharge. **10**

b In a rectangular channel 3.5 m wide laid at a slope of 0.0036, uniform flow occurs at a depth of 2 m. find how high the hump be raised without causing afflux? If the upstream depth of flow is to raised to 2.5 m, what should be the height of the hump? take n=0.015

Q 4 a Design an irrigation channel by Lacey's theory for the following data **10**
Full supply Discharge : 14 m^3/s
Silt Factor : 1.0
Side Slope : ½ : 1 (H:V)
N = 0.0225
Bed slope 1 in 5000

b Explain the Kennedy's theory in detail and write down the drawbacks in Kennedy's theory. **10**

TURN OVER

Q5	**a**	Derive dynamic equation for gradually varied flow for a rectangular channel. Also state assumptions made for the same	**10**
	b	Show that the head loss in a hydraulic jump formed in a rectangular channel may be expressed as $\Delta E = (V_1-V_2)^3/2g(V_1+V_2)$	**10**
Q6	**a**	The normal depth of water in a rectangular channel is 1.5 m wide, is 1 m. The bed slope of the channel is 0.0006 and N = 0.012. Find critical depth. At a certain section of the same channel the depth is 0.92 m while at a second section the depth is 0.86 m. Find distance between the two sections. Also find whether the section is located downstream or upstream w. r. to the first section.	**10**
	b	Derive the equation for most economical section of circular channel.	**10**

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