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## IES MASTER Civil Engineering Toppers Handwritten Notes Open Channel Flow

- Theory BY- KANCHAN SIR
- Explanation
- Derivation
- Example
- Shortcuts
- Previous Years Question With Solution

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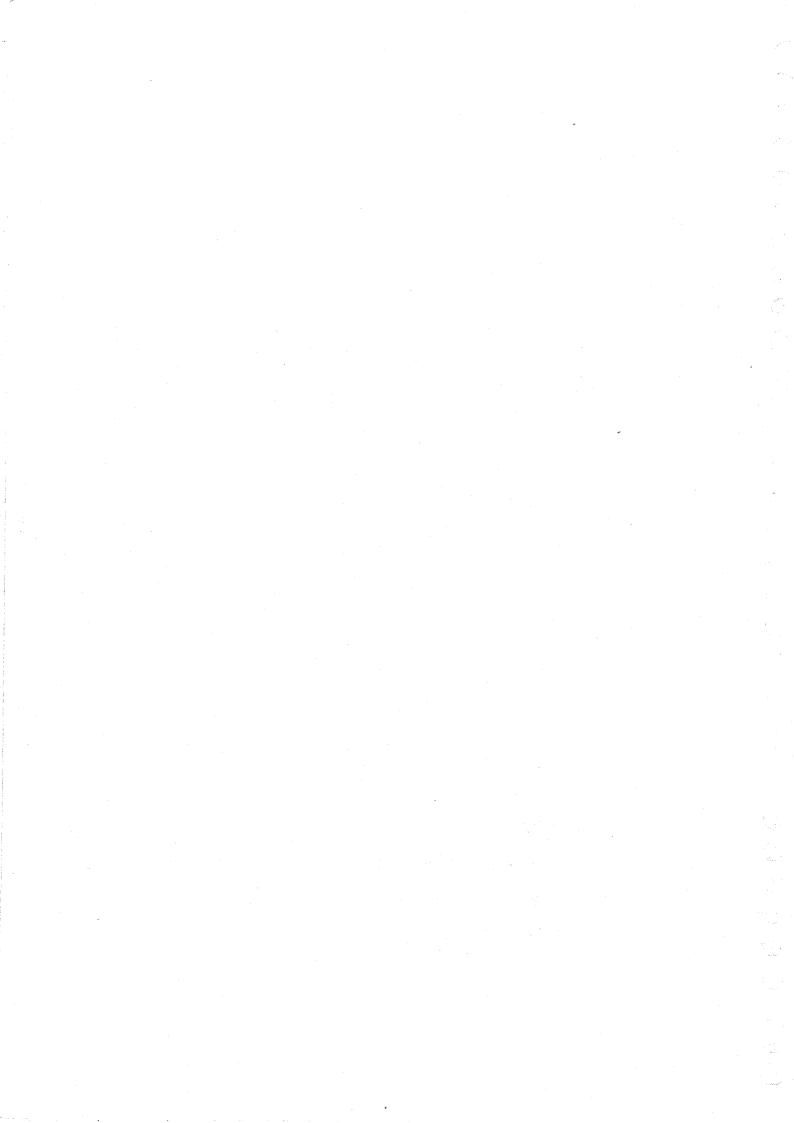
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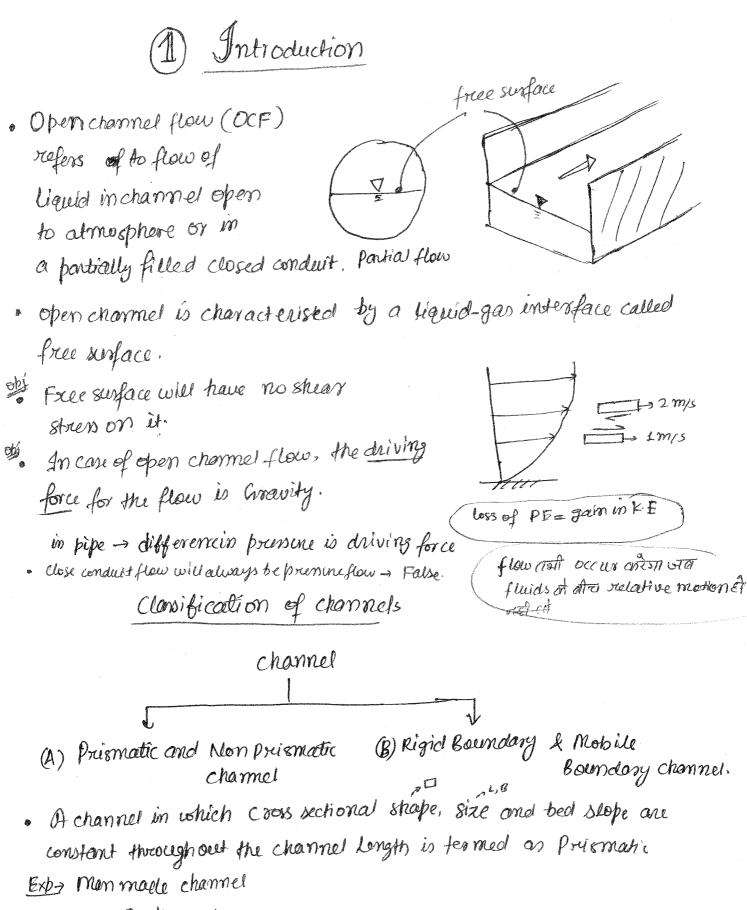
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Open channel flow

(1) Introduction
obj + (1) Uniform flow
(2) Energy depth relationship → obj + čonv
(3) Energy depth relationship → obj + čonv
(4) Caradually Varied flow → \* obj + conv
(5) Rapidly Varied flow (Hydraulic flow) → obj + conv
(6) Surges → \* obj + conv





· Natural channelsone non preismatic.



tomo = so = bed slope

. If the boundary of channel one non deformable like lined conal or non crudible unlined canal than the channel is called rigid boundary channel. In this case the scoughness and geometry is constant wir to time and does not very with tim discharge. or In suigiel boundary channel only depth of flow varies with discharge hence it is said to have single degree of freedom. In case of mobile boundary channel, depth, width, slope (side slope, bedslope) and layout can change ?[ 4 DOF]. ß · In our course will study only Prismatic Rigid boundary channel lay out Type of Flow Prismatic and G-s constant (ansume always Type of Floer in our course (B) unsteady flow (A) Steady Flow -, unsteady uniform X. not possible (2) (madually voried (4) spatially Rapidly miform practically (3) varied flow (1) flow floer (GVF) varied → GVUF (RVF) flow \* RVUF (SVF) Steady - location fixed str 31005 2 time varied flow > SVUF uniform - st fixed time (instant time) R= curvatin IR R WEITER # small curvatine Losse 1 1 curvature EVF →G uniform 2 Rm Bnonuniform RVF flow SVF

(i) <u>Skeady flaw</u> occurs when the flow parameter such as clupth & discharge do not change with time. $\frac{dEE}{DE} = 0$ , $Fp = f(x, t)$ $\frac{dEE}{Dt} = 0$ , $Fp = f(x, t)$ $\frac{dEE}{Dt} = 0$ , $Fp = f(x, t)$ $\frac{dEE}{Dt} = 0$ ; flow interaction $\frac{dEE}{Dt} = 0$ ; flow interaction d	n en
do not change with time $\frac{\partial F_{E}}{\partial t} = 0$ $\frac{\partial F_{E}}{\partial t} =$	(A) steady and Unsteady Flow ??? . Steady flow occurs when the flow parameter such as depth & discharge
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depth and adversary remained the channel length of the value of the channel length of the value	uniform & Non uniform flow: > . If the flow parameter such as
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$\begin{array}{c} \text{Understandy} \text{ testing of the form flow} \\ \text{flow practically means steady uniform flow} \\ \text{for steady} \\ for ste$	Length of Unobstructed flow. Die brachcally not possible hence uniform
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Example of flow under uniform flow condition Ff Wisso	Drobesties of uniform (5 5 steady-uniform) (57 Jx and for 1)
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Ff = WSind STOTE every instant 4 minute add flow defin change eton o depth of flow under uniform flow condition is called Normal depth of flow is called Normal depth of flow	balanced by frictional force. (Bedsløpe = watersorgaline sløpe) mars
STOR every instant & TRININ unsteady flow depth of flow under uniform flow condition Ff W Sino is called Normal depth of flow Triallead a H= energy (power) W(50	$F_{i} = wsind$
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The latter of a H = browny Control	e depth of flow and depth of flow
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Varied flow - depth of flow, Velocity of flow is not some along the length of channel. Gradually Varied flow : = . Flow in mobile boundary, non poursmatte channel and in flow with Varying discharge / velocity will be a varied flow. · Varied flow is called non uniform flow. non prismatic · steady non uniform flow can be GVF., RVF and SVF. channel · If depth of flow changes gradually over long distance along the charmed length such that the curvatine of force surface is small then the flow is called gradually varied flow (C,VF). , shuice gake Exp-of GVE -> Flow upstream of a weir or stuice gate · In GVF, loss of energy is mainly due to boundary friction [ generally eddy loss is regrected ] GVF \*\* In case of GVF, poursure distoution 8 mai Large curvatine across the depth" hydrostatic. unvatione · Af the depth of flow varies rapidly along the channel length then the flow is uniform called RVF i.e. GVF Pressine = Zwy = Jwg.y rapidly varied flow. · In this case PB= Swgy. ( to marely &) Hydro static stress free susface will have large curs vature ( for RVF). Exp of RVF >. It generally occurs at the chownstruam of weir or geff = 9+a Spillinger or she ic e gate. [ie Hydrawithe \*\* . Since the RVF stretch is small, four chional €a 8eff = 8-9 rusistance one insignificant. The flow is also assume no flow is externally added to or takenout of channel. [in GVF also]

· If some flow is added or extracted from the system along the channel longth the floer is called spatially varied flow (SVF). · SVF can be steady or unsteady. · Uniform extraction of flow along the channel length like flow over 20 mB/sec siele weir can be called SVF. Flow over the bottom rack is SVF. 12 15 m3/se Qi-Qz = constant -> SVP surface run off due to rainfall is SVUF ₹5 16,17,10 1 6.7, OSVUF (spatially varied unsteady flow) Rumoff SUUP GNUF -> parrage of flood way in GNUF enfilmation rate a river when the river Varrying with time. bank one not breached is GVUF surging If river breached then SVUF. final depth RVUF RVUF -> Suszes are example of RUUF (Barealso) mi hal depth GNUF - gradually varied unsteady flow RVUF > Rapidly varied unsteady flow unsteady SVUE -> spatially voried unsteady flow.) non-uniform og Breaking of wave on the sea shore Lominor and Turbulent Flow · When flow is occurring in such a way that one layer of flouid slightspassed the other layer with out their being any intermixing blue different layers, the flow is said to be laminar. · If how ever their is intermining blue diff lagen, flow is  $Re = \frac{F_L}{F_V} = \frac{\int U^2 L^2}{\dots}$ said to be turbul ent.  $Re = Reynold number = \frac{VR}{2!} = \frac{JVR}{!}$ viscous force V= aug velocity of flow R = ty drawlic radius = area of floor wetted permeter ß 11 = dynamic viscosity B·y Hydrallic = B+24 v = kinematic viscosity radius (R)