ESCUELA SUPERIOR POLITÉCNICA DEL LITORAL (ESPOL)
FACULTAD DE ING. EN CIENCIAS DE LA TIERRA (FICT)
INGENIERÍA CIVIL, 1er. EXAMEN DE HIDRÁULICA
TÉRMINO: 2022-II - FECHA: 25/XI/2022

COMPROMISO DE HONOR

Yo, ……
al firmar este compromiso, reconozco que la presente actividad está diseñada para ser resuelta de manera individual; que puedo hacer uso de calculadora para cálculos aritméticos, un lápiz o esferográfico. Que sólo puedo comunicarme con la persona responsable de la recepción de la misma; y que cualquier instrumento de comunicación que hubiese traído, debo apagarlo y guardarlo hasta finalizado el examen. Para esta actividad no consultaré libros, notas, ni apuntes adicionales a los que se entreguen junto con estas hojas, y los temas debo desarrollarlos de manera ordenada.
Firmo al pie del presente compromiso, como constancia de haber leído y aceptado la declaración anterior.

FIRMA:

MATRICULA: **PARALELO:**

1ra. PARTE (10 PUNTOS):

1) Describa las propiedades de los esquemas numéricos (3 puntos)

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2) Escoja la(s) opción(es) CORRECTA(s): (2 puntos)

☐ Si aumenta el perímetro mojado, es porque ha aumentado el nivel del agua.

☐ A niveles bajos, el perímetro es más influyente que el área.

☐ El radio hidráulico aumenta a tasa variable si se incrementa el nivel del agua.

☐ En una sección irregular hay un solo tirante, y varias profundidades hidráulicas.

3) Laboratorio: ¿Cuál es la implicación de poner "totalmente vertical" el tubo Pitot, al medir velocidades en la rampa de entrada, y qué ángulo se utiliza? (3 puntos)

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4) Una con líneas, según sea procedente: (2 puntos)

Subcrítico	$Sc<S_0$
Froude	$Q/(A^* (g^*D)^{0.5})$
Supercrítico	2 condiciones de borde, en 1D
Crítico	Fuerza específica máxima

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2da. PARTE (25 PUNTOS):

En el marco de un concurso internacional de estudiantes de Ingeniería Civil, se tiene la siguiente información para dimensionamiento de canal trapezoidal simétrico, bajo flujo uniforme. El caudal es de 7 m^3/s, existe un ancho de 3m, la pendiente es de 0.9 º/oo, y un colega geotécnico recomendó 3H:2V. Se conoce también que el canal será excavado en grava. Luego de una inspección en campo, se nota márgenes ligeramente erosionados, cambios de ancho de vez en cuando, ausencia de obstrucciones (tal vez unas cuantas raíces y escombros que no son notables en lo absoluto). Se espera falta de mantenimiento durante la operación del canal, por lo que es posible que haya cubierta de vegetación arbustiva, cuya altura puede asemejarse a la profundidad del agua. Se conoce también que la longitud real del tramo es 2.5 Km, mientras que la longitud directa es de 2Km. ¿En qué régimen está este flujo uniforme? (Justifique). Comente su proceso, especialmente la selección del coeficiente de rugosidad. Dibuje las dimensiones refinadas finales de la sección de excavación. Resuelva usando los métodos de Bakhmetev y Chugaev.

$A = b*y+s*y^2$; $T = b+2*s*y$; $P = b + 2*y*(1+s^2)^{0.5}$ $K_i = \left(\frac{1}{n}\right) * A_i * R_{h_i}^{2/3}$ $K_o = \frac{Q}{\sqrt{S_o}}$

Table 1. Base values of Manning's *n*

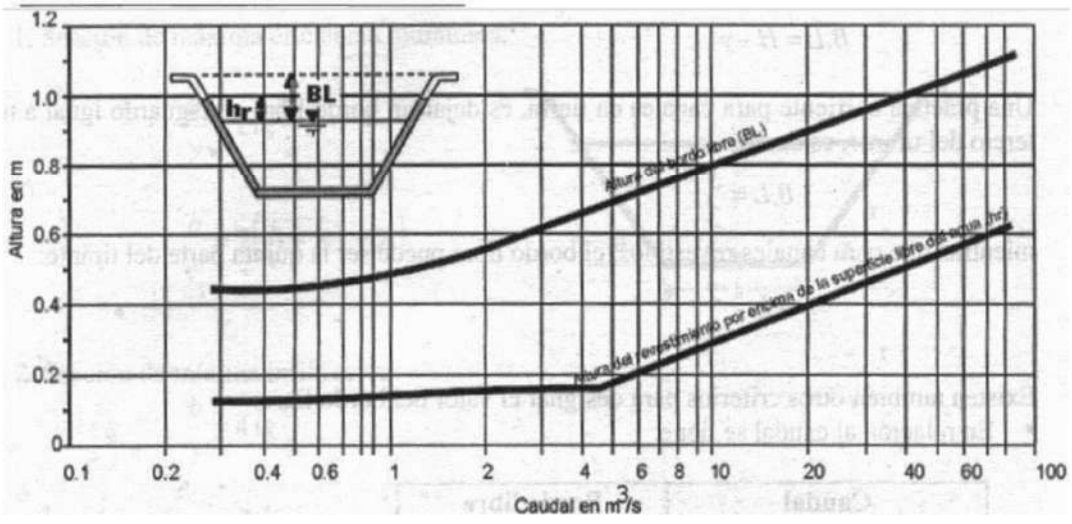
[Modified from Aldridge and Garrett, 1973, table 1; —, no data]

Bed material	Median size of bed material (in millimeters)	Base *n* value: Straight uniform channel[1]	Base *n* value: Smooth channel[2]
Sand channels			
Sand[3]	0.2	0.012	—
	.3	.017	—
	.4	.020	—
	.5	.022	—
	.6	.023	—
	.8	.025	—
	1.0	.026	—
Stable channels and flood plains			
Concrete	—	0.012–0.018	0.011
Rock cut	—	—	.025
Firm soil	—	0.025–0.032	.020
Coarse sand	1–2	0.026–0.035	—
Fine gravel	—	—	.024
Gravel	2–64	0.028–0.035	
Coarse gravel	—	—	.026
Cobble	64–256	0.030–0.050	—
Boulder	>256	0.040–0.070	—

$$N = \frac{2*\log\left(\frac{K_1}{K_2}\right)}{\log\left(\frac{y_1}{y_2}\right)} \qquad y_n = y_i\left(\frac{K_o}{K_i}\right)^{\frac{2}{N}}$$

$$Z_i = A_i * \sqrt{D_i} \qquad M = \frac{2*\log\left(\frac{Z_1}{Z_2}\right)}{\log\left(\frac{y_1}{y_2}\right)}$$

$$Z_c = \frac{Q}{\sqrt{g}} \qquad y_c = y_i\left(\frac{Z_c}{Z_i}\right)^{\frac{2}{M}}$$



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Channel conditions		*n* value adjustment[1]	Example
Degree of irregularity (n_1)	Smooth	0.000	Compares to the smoothest channel attainable in a given bed material.
	Minor	0.001–0.005	Compares to carefully dredged channels in good condition but having slightly eroded or scoured side slopes.
	Moderate	0.006–0.010	Compares to dredged channels having moderate to considerable bed roughness and moderately sloughed or eroded side slopes.
	Severe	0.011–0.020	Badly sloughed or scalloped banks of natural streams; badly eroded or sloughed sides of canals or drainage channels; unshaped, jagged, and irregular surfaces of channels in rock.
Variation in channel cross section (n_2)	Gradual	0.000	Size and shape of channel cross sections change gradually.
	Alternating occasionally	0.001–0.005	Large and small cross sections alternate occasionally, or the main flow occasionally shifts from side to side owing to changes in cross-sectional shape.
	Alternating frequently	0.010–0.015	Large and small cross sections alternate frequently, or the main flow frequently shifts from side to side owing to changes in cross-sectional shape.
Effect of obstruction (n_3)	Negligible	0.000–0.004	A few scattered obstructions, which include debris deposits, stumps, exposed roots, logs, piers, or isolated boulders, that occupy less than 5 percent of the cross-sectional area.
	Minor	0.005–0.015	Obstructions occupy less than 15 percent of the cross-sectional area, and the spacing between obstructions is such that the sphere of influence around one obstruction does not extend to the sphere of influence around another obstruction. Smaller adjustments are used for curved smooth-surfaced objects than are used for sharp-edged angular objects.
	Appreciable	0.020–0.030	Obstructions occupy from 15 to 50 percent of the cross-sectional area, or the space between obstructions is small enough to cause the effects of several obstructions to be additive, thereby blocking an equivalent part of a cross section.
	Severe	0.040–0.050	Obstructions occupy more than 50 percent of the cross-sectional area, or the space between obstructions is small enough to cause turbulence across most of the cross section.
Amount of vegetation (n_4)	Small	0.002–0.010	Dense growths of flexible turf grass, such as Bermuda, or weeds growing where the average depth of flow is at least two times the height of the vegetation; supple tree seedlings such as willow, cottonwood, arrowweed, or saltcedar growing where the average depth of flow is at least three times the height of the vegetation.
	Medium	0.010–0.025	Turf grass growing where the average depth of flow is from one to two times the height of the vegetation; moderately dense stemmy grass, weeds, or tree seedlings growing where the average depth of flow is from two to three times the height of the vegetation; brushy, moderately dense vegetation, similar to 1- to 2-year-old willow trees in the dormant season, growing along the banks, and no significant vegetation is evident along the channel bottoms where the hydraulic radius exceeds 2 ft.
	Large	0.025–0.050	Turf grass growing where the average depth of flow is about equal to the height of the vegetation; 8- to 10-year-old willow or cottonwood trees intergrown with some weeds and brush (none of the vegetation in foliage) where the hydraulic radius exceeds 2 ft; bushy willows about 1 year old intergrown with some weeds along side slopes (all vegetation in full foliage), and no significant vegetation exists along channel bottoms where the hydraulic radius is greater than 2 ft.
	Very large	0.050–0.100	Turf grass growing where the average depth of flow is less than half the height of the vegetation; bushy willow trees about 1 year old intergrown with weeds along side slopes (all vegetation in full foliage), or dense cattails growing along channel bottom; trees intergrown with weeds and brush (all vegetation in full foliage).
Degree of meandering[2] (m)	Minor	1.00	Ratio of the channel length to valley length is 1.0 to 1.2.
	Appreciable	1.15	Ratio of the channel length to valley length is 1.2 to 1.5.
	Severe	1.30	Ratio of the channel length to valley length is greater than 1.5.

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