ESCUELA SUPERIOR POLITÉCNICA DEL LITORAL (ESPOL)
FACULTAD DE ING. EN CIENCIAS DE LA TIERRA (FICT)
INGENIERÍA CIVIL, 1er. EXAMEN DE HIDRÁULICA
TÉRMINO: 2024-II - FECHA: 22/XI/2024

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 (15 PUNTOS):

1) ¿Cómo revisa Interagua la ubicación de tuberías de AAPP, AALL, y AASS? (2 puntos)

_____
_____
_____
_____

2) ¿Cuál es la diferencia entre una marea de sicigia y una de cuadratura? (2 puntos)

_____
_____
_____
_____

3) Escoja la(s) opción(es) INCORRECTA(s): (2 puntos)

☐ Si aumenta el área y el perímetro, es porque el nivel aumentó.

☐ Cuando la fuerza específica es mínima, es porque el tirante es crítico.

☐ En caso de flujo convexo, el área de presiones es mayor que el triángulo hidrostático.

☐ El flujo uniforme es dependiente del régimen en el cual esté el canal.

4) Laboratorio: Si se tiene doble ángulo (el del canal, y el de la rampa), ¿cómo se procede cuando la sección a analizar está en: 1) la rampa de subida; 2) la rampa de bajada? (2 pts)

_____
_____
_____
_____

NOMBRE:_____

MATRÍCULA: _____PARALELO:____1er. EXAMEN HIDRÁULICA, 2024-II FICT

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

☐ Las ecuaciones de Navier – Stokes pueden resolver el flujo a lo largo de un río.

☐ El número de Courant debería ser mayor a 1 si se quiere garantizar estabilidad numérica.

☐ Si se tiene una nube de puntos batimétricos, es suficiente para generar un archivo ráster y continuar a la modelación hidrodinámica.

☐ Para la evaluación hidrodinámica en 2D no se debe usar las ecuaciones de Saint-Venant.

6) Comente brevemente cada uno de los factores que Ud emplea para estimar la rugosidad en un canal y qué información específica usa para ello. (3 puntos)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

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

Tolerancia para iterar un flujo uniforme	Mejor ajuste estadístico
Método racional	Tirantes y anchos originales
Menor Δ (error) de los menores al $\Delta_{crítico}$	Lazo repetitivo “while”
Refinamiento de secciones	Para áreas menores a 100 Ha

NOMBRE:_____

MATRÍCULA: _____PARALELO:____1er. EXAMEN HIDRÁULICA, 2024-II FICT

2da. PARTE (20 PUNTOS):

El diseño del canal "El Descanso" (contratado por el municipio de La Concordia) tiene la configuración, en llanuras y cauce principal, que se muestra en la tabla 1 (lo que implica que debe estimarse los coeficientes de rugosidad de las 3 instancias). El prediseño del canal (según geotecnia) establece una pendiente lateral de 2V: 3H, caudal de 12 m^3/s, ancho de solera de 5m, una inclinación longitudinal de $5^o/_{oo}$. Los TdR (Términos de Referencia) exigen evaluar el régimen en el cual está el canal principal (y usando los métodos de Bakhmetev y Chugaev). Comente su procedimiento. Nota: n_b de arcilla = 0.025; arena, 0.032.

Tabla 1:

Llanura Izquierda:	Canal Principal	Llanura Derecha:
Vegetación media	Poca vegetación	Vegetación notable ("large")
Casas ocupando más del 60% de la sección	Rocas pequeñas que no llegan a 5% de la sección	Rocas varias ocupando un 20% de la sección
Cambios de vez en cuando		
arcilla	arena	arcilla
Considerable erosión y cambios de fondo	Casi no hay cambios	Severos cambios y erosión de fondo
Longitud real / Longitud directa = 2		

$$A = (b+s*y)*y$$

$$P = b+2*y*(1+s^2)^{0.5}$$

$$T = b + 2*s*y$$

$$\left(\frac{K_1}{K_2}\right)^2 = \left(\frac{y_1}{y_2}\right)^N \qquad K_i = \left(\frac{1}{n}\right) * A_i * R_{h_i}^{2/3}$$

$$N = \frac{2*\log\left(\frac{K_1}{K_2}\right)}{\log\left(\frac{y_1}{y_2}\right)} \qquad K_o = \frac{Q}{\sqrt{S_o}}$$

$$y_n = y_i\left(\frac{K_o}{K_i}\right)^{\frac{2}{N}}$$

Para canal principal:

Channel conditions		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.

NOMBRE:_____

MATRÍCULA: _____PARALELO:____1er. EXAMEN HIDRÁULICA, 2024-II FICT

Table 3. Adjustment values for factors that affect roughness of flood plains

[Modified from Aldridge and Garrett, 1973, table 2]

Flood-plain conditions		*n* value adjustment	Example
Degree of irregularity (n_1)	Smooth	0.000	Compares to the smoothest, flattest flood plain attainable in a given bed material.
	Minor	0.001–0.005	Is a flood plain slightly irregular in shape. A few rises and dips or sloughs may be visible on the flood plain.
	Moderate	0.006–0.010	Has more rises and dips. Sloughs and hummocks may occur.
	Severe	0.011–0.020	Flood plain very irregular in shape. Many rises and dips or sloughs are visible. Irregular ground surfaces in pastureland and furrows perpendicular to the flow are also included.
Variation of flood-plain cross section (n_2)		0.0	Not applicable.
Effect of obstructions (n_3)	Negligible	0.000–0.004	Few scattered obstructions, which include debris deposits, stumps, exposed roots, logs, or isolated boulders, occupy less than 5 percent of the cross-sectional area.
	Minor	0.005–0.019	Obstructions occupy less than 15 percent of the cross-sectional area.
	Appreciable	0.020–0.030	Obstructions occupy from 15 to 50 percent of the cross-sectional area.
Amount of vegetation (n_4)	Small	0.001–0.010	Dense growth 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, or 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	0.011–0.025	Turf grass growing where the average depth of flow is from one to two times the height of the vegetation, or 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.
	Large	0.025–0.050	Turf grass growing where the average depth of flow is about equal to the height of the vegetation, or 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, or mature row crops such as small vegetables, or mature field crops where depth of flow is at least twice the height of the vegetation.
	Very large	0.050–0.100	Turf grass growing where the average depth of flow is less than half the height of the vegetation, or moderate to dense brush, or heavy stand of timber with few down trees and little undergrowth where depth of flow is below branches, or mature field crops where depth of flow is less than the height of the vegetation.
	Extreme	0.100–0.200	Dense bushy willow, mesquite, and saltcedar (all vegetation in full foliage), or heavy stand of timber, few down trees, depth of flow reaching branches.
Degree of meander (m)		1.0	Not applicable.

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

$$Z_c = \frac{Q}{\sqrt{g}}$$

$$M = \frac{2*\log\left(\frac{Z_1}{Z_2}\right)}{\log\left(\frac{y_1}{y_2}\right)} \qquad y_c = y_i\left(\frac{Z_c}{Z_i}\right)^{\frac{2}{M}}$$

$$n=(n_b+n_1+n_2+n_3+n_4)m$$