Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	HYDRAULICS
COURSE CODE	:	BFC 21103
PROGRAMME	:	BFF
EXAMINATION DATE	:	JULY 2020
DURATION	:	6 HOURS
INSTRUCTION	:	ANSWER: (A) **ALL** QUESTIONS IN **PART A**, AND (B) ANY **TWO (2)** QUESTIONS IN **PART B**

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

PART A: ANSWER **ALL** QUESTIONS

Q1 (a) Explain briefly the application of spillway and energy dissipator.

(4 marks)

(b) Distinguish between the controlled and uncontrolled spillway.

(5 marks)

(c) Water flows at 115,000 L/s from a reservoir through a 6.0 m width of a high flow spillway. The measured head over the spillway crest is 4.0 m while the depth of water behind the reservoir is 70.5 m. The movement of flow creates a very high kinetic energy at the downstream end of the spillway and to reduce this energy an energy dissipater structure should be proposed. Design a stilling basin at the downstream of the spillway based on the Stilling Basin Type III structure.

(12 marks)

(d) Propose a suitable diagram of the Stilling Basin Type II, III & IV dimensions obtained from **Q1(c).**

(4 marks)

Q2 (a) State **TWO (2)** types of pumps and turbines.

(4 marks)

(b) With the aid of sketches, explain the concept of series and parallel pump.

(5 marks)

(c) A reaction turbine 1.64 ft. in diameter, when running at 600 rpm, developed brake power of 195 kW when the flow was 0.74 m^3/s. The pressure head at the entrance to the turbine was 28 m and the elevation of the turbine casing above tailwater level was 6.23 ft. The water enters the turbine with a velocity of 3.7 m/s. Calculate :-

(i) Effective head
(ii) Efficiency of turbine
(iii) Speed expected under a head of 70 m
(iv) Discharge under the 70 m head.

(8 marks)

(d) A centrifugal pump with 25 cm diameter operates at speed of 1450 rpm to deliver 0.3 m^3/s of discharge under a head of 12 m. Calculate the specific speed, N_s for pump. If the same pump is needed to operate at 2000 rpm, determine the discharge, Q, head, H and power required, P when the overall efficiency for pump is 75%.

(8 marks)

PART B: ANSWER **ANY TWO (2)** QUESTIONS

Q3 (a) Discuss **TWO (2)** situations of viscosity effect to flow on the following state condition:-

(i) Laminar flow
(ii) Turbulent flow

(6 marks)

(b) Three different open channel shapes have been designed to carry 4061.19 ft^3/s of water. The trapezoidal shape has bottom width of 6.0 m and side slope of 2(H):1(V). The triangular shape has side slope of 3(H):2(V). Meanwhile rectangular shape has bottom width of 4.0 m. All shapes are constructed at bottom slope of 0.005 to cater 70.87 inch depth of flow. Given that viscosity = 1.004×10^{-6} m^2/s. Determine the state of flow for all shapes based on Reynolds number.

(6 marks)

(c) According to the results from **Q3(b)**, compare the state of flow from the highest to the lowest values. Justify your opinion on these results.

(4 marks)

(d) A compound channel as shown in **FIGURE Q3(d)** is designed to convey 9.154×10^5 in^3/s of water with kinematic viscosity of water (ν) of 1.004×10^{-6} m^2/s. Determine top surface width (T), flow area (A), wetted perimeter (P), hydraulic depth (D) and state of flow based on Froude number.

(9 marks)

Q4 (a) Give **TWO (2)** differences between open channel flow and pipe flow.

(4 marks)

(b) Explain **TWO (2)** factors affecting velocity distribution in open channels.

(5 marks)

(c) Water flows at 8×10^3 mm^3/s in triangular channel with side angles of 26.57°, Manning, n of 0.013 and channel slope, S_o of 0.008. Compute the normal depth in meter.

(8 marks)

(d) Determine the best dimensions y and B in meter of a rectangular channel built from all glazed brick at all surfaces which is designed to carry 1.8×10^7 L/hr of water in uniform flow with S_o is 0.001. Compare the results with a semi-circle. You should seek the ungiven information from other sources.

(8 marks)

Q5 (a) Discuss the possible occurrence of critical flow in non-uniform flow.

(4 marks)

(b) A rectangular channel 5.5 m width has a discharge of 8.2 $m^3/s/m$. Calculate:-

(i) Critical depth
(ii) Critical velocity, and
(iii) Critical slope, if the Manning coefficient, *n* is 0.065

(5 marks)

(c) A rectangular channel of 3200 cm width with Manning's *n* 0.022, and longitudinal slope of 5/10000 is conveying flow at 7.8 m^3/s. If a constriction is made by reducing channel width to 2.8 m, calculate the max width, B_{max}.

(8 marks)

(d) Based on the results obtained from **Q5(c)**, calculate:-

(i) Depth of flow before and after constricted section
(ii) Depth of flow on constricted section, and
(iii) Sketch the flow surface profile.

(8 marks)

Q6 (a) Define gradually varied flow (GVF) and state **TWO (2)** conditions of GVF occurrence.

(4 marks)

(b) Discuss with the aid of diagrams, the regions that produce all positive and negative curve slopes in GVF profile.

(5 marks)

(c) **FIGURE Q6(c)** shows a trapezoidal channel having a bottom slope of 0.0573° and bottom width of 10 m carrying a flow of 30 m^3/s. A control structure is built at the downstream end which raises the water depth at the downstream end to 5.0 m. Compute the water surface profile and length of channel using Direct Step method if Manning, *n* for the flow surface is 0.013, N = 6 and u =1.

(8 marks)

(d) A 82.02 ft. wide spillway is discharging flow with velocity of 30 m/s at a depth of 1 m. Hydraulic jump occurs immediately downstream.

(i) Find the height of the jump and power loss due to the jump.

(5 marks)

(ii) In irrigation project such as paddy field, all area should be inundated by water for planting the crops. As an engineer, propose the suitable structure for the project.

(3 marks)

– END OF QUESTION –

FINAL EXAMINATION

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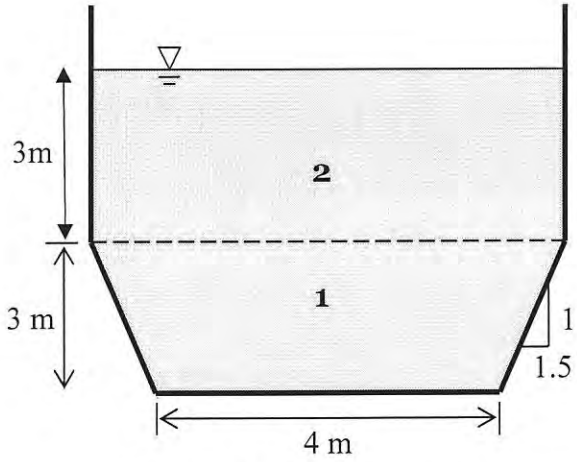

FIGURE Q3(d). Compound channel

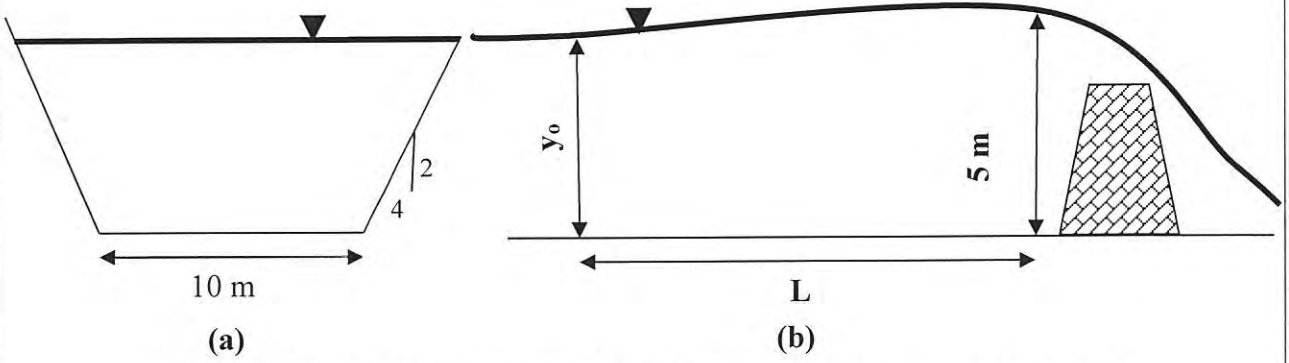

FIGURE Q6(c). Dimensions and GVF flow profile in trapezoidal channel