sample

UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	HYDRAULICS & HYDROLOGY
COURSE CODE	:	BNP 20103
PROGRAMME	:	BNA / BNB / BNC
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS **ONLY.**

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

Q1 (a) Open channel flow conditions can be characterised with respect to space (uniform or non-uniform flow) and time criteria (steady or unsteady flows).

(i) Explain each criteria of the open channel flow conditions.

(4 marks)

(ii) Sketch each types of the flow condition.

(8 marks)

(b) A 5.0 $m^3/s/m$ of water is flowing uniformly in a very wide channel having Manning's n of 0.014 and bed slope of 0.0002. Analyze the flow depth.

(5 marks)

(c) A 8.73 m^3/s of water must flow in an open channel with hydraulically best section having Chezy's C of 68 $m^{1/2}/s$ and bed slope of 0.0012. Design the channel if the shapes are:

(i) Rectangular

(4 marks)

(ii) trapezoidal with side slope of 60°

(4 marks)

Q2 (a) Hydraulic jump occurs when supercritical flow (at upstream) changes suddenly to subcritical flow (at downstream) within a short distance. Describe **TWO (2)** applications of hydraulic jump.

(2 marks)

(b) A 22.2 m^3/s of water is flowing in a rectangular canal of 4m width. If the manning's *n* is 0.020, give the value of:

i) critical depth

(3 marks)

ii) critical velocity

(3 marks)

iii) critical bed slope.

(3 marks)

(c) A 9.8 m^3/s of water is flowing uniformly in a very long rectangular open channel of 2.6 m width having Manning's n 0.016 and bed slope 0.02. The channel is to be consticted. Analyze the water depth at:

i) the upstream,

(4 marks)

ii) the downstream,

(6 marks)

iii) the constriction, if the width of the constriction is 2.4 m.

(4 marks)

Q3 (a) List **FOUR (4)** basic data required for hydrological studies

(4 marks)

(b) Explain briefly **FIVE (5)** practical applications of hydrology

(5 marks)

(c) A reservoir level after weeks of drought is falling at a rate of 5 mm/day with a surface area of 0.5 km^2 .The average evaporation rate from the reservoir surface is 1.5 mm/day, the inlet discharge is 10,000 m^3/day, and the outlet discharge is 13,000 m^3/day. Assuming the only variables in the budget equation are inflow, groundwater, outflow, evaporation and rate change of storage. Determine the total net rate of groundwater discharge into the reservoir. Give your answer in meter.

(6 marks)

(d) A lake has an area of 25 km^2. In May 2017, total evaporation was 88 mm, average inflow to the lake was 2.2 m^3/s, the average outflow from the lake was 1.5 m^3/s, and the water level for the lake was observed to increase by 121 mm. Compute the precipitation (in mm) in May 2017.

(10 marks)

Q4 (a) List **FOUR (4)** methods in determining infiltration.

(4 marks)

(b) Describe briefly **TWO (2)** types of precipitation.

(5 marks)

(c) The infiltration rate for small area was observed to be 4.5 in/hr at the beginning of the rain and it decreased exponentially to an equilibrium of 0.5 in/hr after 10 hrs. A total of 30 inches of water infiltrated during the 10 hr interval. Determine the value of k in Horton equation.

(6 marks)

(d) The following data in **Table Q4 (d)** are obtained from the current meter gauging ($v = 0.23N_s + 0.04$) of a stream. Compute the stream discharge by using the mean section method.

(10 marks)

Q5 (a) List **FOUR (4)** factors affecting runoff.

(4 marks)

(b) Explain the characteristics of a typical hydrograph.

(5 marks)

(c) A well is pumped from a confined aquifer at a rate of 2.55 m^3/s for a certain time. In two observation wells located 60 and 10 m away from the well, the difference in elevation has been observed as 0.8 m. Estimate the transmissivity of the aquifer.

(6 marks)

(d) The daily stream flow data of a river for a drainage area of 5,810 km^2 are given in table below. Analyze the equivalent depth of the direct runoff by separating the baseflow. (Use recession curve method - $N = 0.8A^{0.2}$)

(10 marks)

FINAL EXAMINATION

SEMESTER/SESSION : SEM I / 2019/2020 PROGRAMME : BNA/BNB/BNC
COURSE NAME : HYDRAULICS&HYDROLOGY COURSE CODE : BNP 20103

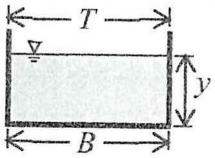
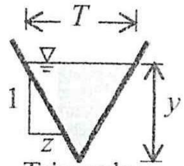
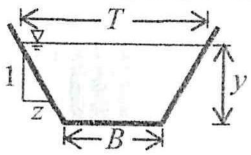
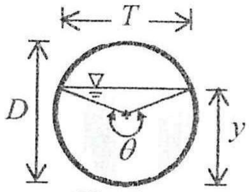
Table Q4 (d): Streamflow measurement

Distance from one end of the river (m)	Depth of water, d (m)	Current meter reading below water surface		
		depth (m)	revolution	time (sec)
0	0	-	-	-
2.00	1.00	0.60	10	40
4.50	2.20	0.44	36	48
		1.76	20	50
7.50	3.40	0.68	40	60
		2.72	30	53
9.50	4.60	0.92	46	62
		3.68	33	58
12.00	4.20	0.84	33	52
		3.36	29	48
14.00	2.50	0.50	34	52
		2.00	29	53
16.50	1.20	0.72	16	48
18.00	0.00	-	-	-

FINAL EXAMINATION

SEMESTER/SESSION : SEM I / 2019/2020 PROGRAMME : BNA/BNB/BNC
COURSE NAME : HYDRAULICS&HYDROLOGY COURSE CODE : BNP 20103

Table 1: Open channel flow section geometries

Section	Area A	Top width T	Wetted perimeter P
 Rectangular	By	B	$B+2y$
 Triangular	zy^2	$2zy$	$2y\sqrt{1+z^2}$
 Trapezoidal	$By+zy^2$	$B+2zy$	$B+2y\sqrt{1+z^2}$
 Circular	$\frac{D^2}{8}(\theta-\sin\theta)$	$D\left(\frac{\sin\theta}{2}\right)$	$\frac{\theta D}{2}$

$$R=\frac{A}{P} \qquad D=\frac{A}{T} \qquad V=\frac{1}{n}R^{\frac{2}{3}}S_o^{\frac{1}{2}} \qquad E_o=y_o+\frac{Q^2}{2gA^2}$$

$$Fr=\frac{V}{\sqrt{gD}} \qquad \frac{A_c^3}{T_c}=\frac{Q^2}{g} \qquad y_c=\sqrt[3]{\frac{q^2}{g}} \qquad S_c=\frac{n^2gA_c}{T_cR_c^{\frac{4}{3}}}$$

FINAL EXAMINATION

SEMESTER/SESSION : SEM I / 2019/2020 PROGRAMME : BNA/BNB/BNC
COURSE NAME : HYDRAULICS&HYDROLOGY COURSE CODE : BNP 20103

Table 2: Best hydraulic sections

Cross section	Side slope z	Area A	Wetted perimeter P	Hydraulic radius R	Top width T	Hydraulic depth D	Section factor Z
Trapezoid	$\frac{1}{\sqrt{3}}$	$\sqrt{3}y^2$	$2\sqrt{3}y$	$\frac{y}{2}$	$\frac{4\sqrt{3}}{3}y$	$\frac{3}{4}y$	$\frac{3}{2}y^{2.5}$
Rectangle	-	$2y^2$	$4y$	$\frac{y}{2}$	$2y$	y	$2y^{2.5}$
Triangle	1	y^2	$2\sqrt{2}y$	$\frac{\sqrt{2}y}{4}$	$2y$	$\frac{y}{2}$	$\frac{\sqrt{2}}{2}y^{2.5}$
Semicircle	-	$\frac{\pi}{2}y^2$	πy	$\frac{y}{2}$	$2y$	$\frac{\pi}{4}y$	$\frac{\pi}{4}y^{2.5}$
Parabola	-	$\frac{4\sqrt{2}}{3}y^2$	$\frac{8\sqrt{2}}{3}y$	$\frac{y}{2}$	$2\sqrt{2}y$	$\frac{2}{3}y$	$\frac{8\sqrt{3}}{9}y^{2.5}$

$$I - O = \Delta S/\Delta t \qquad P_X = 1/M \quad \Sigma(P_i)$$

$$P_X = N_X/M\ \Sigma(P_i/N_i) \qquad W_i = \frac{(1/L_i^2)}{\sum_{i=1}^{n}(1/L_i^2)} \qquad L_i^2 = X^2 + Y^2$$

$$H^2 - h^2 = \frac{Q}{\pi K}\ln\left(\frac{R}{r}\right) \qquad H - h = \frac{Q}{2\pi bK}\ln\left(\frac{R}{r}\right) \qquad Q = AV$$

$$\frac{N_1 D_1}{\sqrt{H_1}} = \frac{N_2 D_2}{\sqrt{H_2}} \qquad \frac{Q_1}{N_1 D_1^3} = \frac{Q_2}{N_2 D_2^3} \qquad \frac{P_1}{N_1^3 D_1^5} = \frac{P_2}{N_2^3 D_2^5} \qquad N_s = \frac{N\sqrt{Q}}{H^{\frac{3}{4}}}$$

$$Q = \frac{1}{n}AR^{\frac{2}{3}}S_o^{\frac{1}{2}} \qquad E = y + \frac{q^2}{2gy^2} \qquad P = \Delta S + O + E - I$$

$$f = f_c + (f_0 - f_c)\,e^{-Kt} \qquad T = bK$$