Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	:	WATER RESOURCES ENGINEERING
COURSE CODE	:	BFW 40103
PROGRAMME	:	4 BFF
EXAMINATION DATE	:	JUNE 2014
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **ELEVEN (11)** PAGES

Q1 (a) State **FOUR (4)** purposes of water resources management.

(4 marks)

(b) Discuss **THREE (3)** initiatives that have been taken by government in managing water resources in Malaysia.

(6 marks)

(c) Explain briefly **TWO (2)** factors that contribute in the increasing of non-revenue water (NRW) in Malaysia.

(4 marks)

(d) Malaysia has implemented Integrated River Basin Management (IRBM) in managing river basin in Malaysia. Do you think it is the best practices? Compose your opinion with relevant example.

(6 marks)

Q2 (a) Explain **TWO (2)** meteorological factors that affecting discharge value.

(4 marks)

(b) Discuss **FOUR (4)** assumptions used in Rational Method.

(4 marks)

(c) Batu Pahat catchment with the area of 102.8 km^2 consist of 40% resident areas (C = 0.75), 30% industrial areas (C = 0.86), and 30% plantation estate and farms (C= 0.21). By referring to Figure **Q2**, estimate the peak flow rate for 5 and 50 years return period using modified rational method. Assumed that velocity is 4.5m/s.

(12 marks)

Q3 (a) Compare **FOUR (4)** differences between MASMA drainage system with concrete drainage system.

(8 marks)

(b) On-site detention (OSD) is to be constructed in UTHM campus area with an area of 0.4 ha and having a terrain slope of 1:2500. 35% of it shall be occupied by building, 25% access road and pavement, 35% garden and turf areas and 5% water body areas. By referring to Table **Q3(i),** Table **Q3(ii),** Table **Q3(iii),** Table **Q3(iv)** and Figure **Q3**, calculate the Permissible Site Discharge (PSD), Site Storage Requirement (SSR) and the inlet and outlet pipe sizes.

(12 marks)

Q4 (a) Explain briefly **FOUR (4)** most common causes of dam failures.

(8 marks)

(b) Illustrate the relationship between flood storage capacity, active storage capacity and dead storage capacity.

(4 marks)

(c) Every year, east coast states of peninsular Malaysia were hit by monsoon flood. Justify **FOUR (4)** main causes of this disaster.

(8 marks)

Q5 (a) With an aid of suitable formula and concepts, explain how the storage-outflow function has been derived

$$\left(\frac{2S_{j+1}}{\Delta t}+Q_{j+1}\right)=\left(I_j+I_{j+1}\right)+\left(\frac{2S_j}{\Delta t}-Q_j\right)$$

(8 marks)

(b) Referring to Table **Q5**, determine the Muskingum routing parameters K and X for a river reach with the following observations. The initial storage in the system is 715,000 m^3.

(12 marks)

Q6 (a) Estimate the probability that the annual maximum discharge, Q on the Semberong River will exceed 50,000 cfs at least once during the next three years. Assume that the return period T = 5.3 years.

(4 marks)

(b) Table **Q6** show an analysis of the maximum-annual floods over the past 150 years in cumulative distribution. Estimate the magnitudes of the floods with return periods of 5, 25 and 100 years.

(8 marks)

(c) Explain **FOUR (4)** benefit of development of irrigation system

(8 marks)

- END OF QUESTION –

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2013/2014 PROGRAMME : 4 BFF
COURSE NAME : WATER RESOURCES ENGINEERING COURSE CODE : BFW 40103

TABLE Q3 (i) Maximum Permissible Site Storage (PSD)and Minimum Site Storage Requirement (SSR) in accordance with the five regions in Peninsular Malaysia

Terrain/Slope Condition	PSD (l/s/ha)					SSR (m^3/ha)				
	Impervious Area (as a Percentage of Project area)									
	25%	40%	50%	75%	90%	25%	40%	50%	75%	90%
Region 1 – West Coast										
Low-lying	63.4	64.2	64.5	65.2	65.5	322.2	363.0	394.2	478.3	540.4
Mild	76.7	77.5	77.9	78.7	79.1	306.6	340.0	367.2	448.5	504.7
Steep	87.7	88.6	89.1	90.1	90.5	294.0	327.0	350.5	426.7	478.8
Region 2 – East Coast										
Low-lying	53.0	53.6	53.9	54.5	54.7	276.6	350.4	410.7	609.1	768.8
Mild	61.1	61.8	62.2	62.8	63.1	257.6	321.7	373.9	546.1	678.7
Steep	67.4	68.2	68.6	69.3	69.6	243.5	302.6	351.0	509.9	625.9
Region 3 – Northern										
Low-lying	54.8	55.4	55.7	56.3	56.5	311.1	353.3	389.7	493.3	564.4
Mild	68.0	68.8	69.2	69.9	70.2	295.5	328.3	360.3	454.0	521.6
Steep	77.3	78.2	78.6	79.5	79.8	284.8	316.2	341.8	430.3	492.6
Region 4 – Highland										
Low-lying	42.6	43.1	43.4	43.8	44.0	227.8	285.7	331.4	460.5	546.6
Mild	49.6	50.2	50.5	51.0	51.2	212.3	266.0	307.3	428.2	509.2
Steep	55.0	55.6	56.0	56.5	56.8	202.1	252.3	291.0	405.5	484.1
Region 5 – Southern										
Low-lying	61.1	61.9	62.2	62.8	63.1	315.0	362.0	398.4	501.0	572.7
Mild	74.8	75.7	76.1	76.9	77.2	298.5	340.9	372.6	465.9	532.3
Steep	83.4	84.3	84.8	85.7	86.1	288.5	323.3	352.5	442.8	505.0

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2013/2014
COURSE NAME : WATER RESOURCES ENGINEERING

PROGRAMME : 4 BFF
COURSE CODE : BFW 40103

TABLE Q3(ii) Maximum Permissible Site Storage (PSD), Minimum Site Storage Requirement (SSR), and Inlet values in accordance with the major towns in Peninsular Malaysia

Terrain/Slope Condition	PSD (l/s/ha)					SSR (m^3/ha)					Inlet (l/s/ha)				
	Impervious Area (as a Percentage of Project area)														
	25%	40%	50%	75%	90%	25%	40%	50%	75%	90%	25%	40%	50%	75%	90%
Batu Pahat															
Low-lying	45.1	45.6	45.9	46.3	46.6	249.2	293.7	331.1	437.3	502.6	107.0	125.0	137.0	166.0	184.0
Mild	55.6	56.2	56.6	57.1	57.4	234.7	273.8	304.7	403.7	468.4	127.0	146.0	158.0	189.0	208.0
Steep	62.3	63.0	63.4	64.0	64.3	225.6	261.8	291.3	383.5	447.1	140.0	159.0	172.0	204.0	224.0
Johor bharu															
Low-lying	61.1	61.9	62.2	62.8	63.1	315.0	362.0	398.4	501.0	572.7	138.0	157.0	170.0	200.0	221.0
Mild	74.8	75.7	76.1	76.9	77.2	298.5	340.9	372.6	465.9	532.3	163.0	184.0	200.0	231.0	252.0
Steep	83.4	84.3	84.8	85.7	86.1	288.5	323.3	352.5	442.8	505.0	181.0	200.0	215.0	250.0	271.0
Segamat															
Low-lying	41.4	41.9	42.1	42.5	42.7	294.3	326.6	356.0	454.9	512.2	110.0	130.0	140.0	170.0	190.0
Mild	48.6	49.1	49.4	49.9	50.1	289.2	321.1	350.0	431.6	497.4	140.0	150.0	170.0	200.0	220.0
Steep	54.2	54.8	55.1	55.7	55.9	280.2	310.5	332.9	415.1	479.1	150.0	170.0	180.0	220.0	240.0

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2013/2014
COURSE NAME : WATER RESOURCES ENGINEERING

PROGRAMME : 4 BFF
COURSE CODE : BFW 40103

TABLE Q3(iii) OSD volume, Inlet and Outlet size

Project Area (ha)	Impervious Area (as a Percentage of Project area)														
	25%			40%			50%			75%			90%		
	Volume (m3)	Inlet & overflow Dia. (mm)	Outlet dia. (mm)	Volume (m3)	Inlet & overflow Dia. (mm)	Outlet dia. (mm)	Volume (m3)	Inlet & overflow Dia. (mm)	Outlet dia. (mm)	Volume (m3)	Inlet & overflow Dia. (mm)	Outlet dia. (mm)	Volume (m3)	Inlet & overflow Dia. (mm)	Outlet dia. (mm)
TERRAIN: LOWLYING, SLOPE 1:2000 to 1:5000															
0.1	32	133	61	37	141	62	40	147	62	50	1600	62	58	168	62
0.2	63	188	86	73	200	87	80	208	87	96	226	87	115	237	87
0.4	126	265	122	146	283	124	160	294	124	192	319	124	230	336	124
0.6	189	325	149	219	346	151	240	355	151	288	391	151	345	411	151
0.8	252	375	172	292	400	175	320	416	175	384	451	175	460	475	175
1	315	419	192	365	447	195	400	465	195	500	507	195	575	531	195
2	750	443	272	880	484	276	970	510	276	1260	569	276	1460	604	276
3	1125	542	333	1320	593	339	1455	624	339	1890	697	339	2190	739	339
4	1500	626	384	1760	685	391	1940	721	391	2520	804	391	2920	854	391
5	1875	700	430	2200	765	437	2425	806	437	3150	899	437	3650	954	437
TERRAIN: MILD, SLOPE 1:875 to 1:1999															
0.1	30	144	68	35	153	68	38	158	68	47	172	69	54	179	69
0.2	60	204	96	69	217	96	75	224	96	93	243	97	107	253	97
0.4	120	288	135	138	306	135	150	317	135	186	343	137	214	358	137
0.6	180	353	166	207	375	166	225	388	166	279	420	168	321	439	168
0.8	240	408	192	276	433	192	300	448	192	372	485	194	428	507	194
1	300	456	214	345	484	214	375	501	214	465	542	217	535	567	217
2	740	482	303	850	522	303	940	546	303	1220	606	307	1420	638	307
3	1110	590	371	1275	639	371	1410	669	371	1830	742	376	2130	782	376
4	1480	681	428	1700	738	428	1880	772	428	2440	857	434	2840	903	434
5	1850	761	479	2125	826	479	2350	863	479	3050	958	485	3550	1010	485
TERRAIN: STEEP, SLOPE 1:100 to 1:874															
0.1	30	152	71	32.5	160	71	35	165	72	44.5	178	72	50.5	186	72
0.2	59	215	101	65	227	101	70	234	102	89	252	102	101	263	102
0.4	118	304	143	130	321	143	140	331	145	178	357	145	202	372	145
0.6	177	372	175	195	393	175	210	405	177	267	437	177	303	455	177
0.8	236	429	202	260	454	202	280	468	204	356	505	204	404	526	204
1	300	480	226	320	507	226	290	523	229	405	564	229	485	588	229

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2013/2014 PROGRAMME : 4 BFF
COURSE NAME : WATER RESOURCES ENGINEERING COURSE CODE : BFW 40103

TABLE Q3 (iv) Discharge and Pipe Diameter Relationship

Terrain: Low-lying		Terrain: Mild		Terrain: Steep	
Discharge (m^3/s)	Pipe Diameter (mm)	Discharge (m^3/s)	Pipe Diameter (mm)	Discharge (m^3/s)	Pipe Diameter (mm)
0.01	236	0.01	250	0.01	259
0.02	247	0.02	261	0.02	269
0.04	270	0.04	282	0.04	288
0.06	292	0.06	303	0.06	307
0.08	315	0.08	325	0.08	326
0.1	338	0.1	346	0.1	345
0.12	361	0.12	367	0.12	364
0.16	406	0.16	410	0.16	402
0.22	474	0.22	474	0.22	459
0.24	497	0.24	495	0.24	478
0.28	542	0.28	538	0.28	516
0.32	587	0.32	581	0.32	554
0.36	633	0.36	623	0.36	592
0.42	701	0.42	687	0.42	649
0.48	769	0.48	751	0.48	707
0.52	814	0.52	794	0.52	745
0.56	860	0.56	836	0.56	783
0.62	928	0.62	900	0.62	840
0.66	973	0.66	943	0.66	878
0.72	1041	0.72	1007	0.72	935
0.78	1109	0.78	1071	0.78	992
0.82	1154	0.82	1114	0.82	1030

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2013/2014 PROGRAMME : 4 BFF
COURSE NAME : WATER RESOURCES ENGINEERING COURSE CODE : BFW 40103

TABLE Q5 (b) Relationship between Time and Inflow (cfs)

Time (h)	Inflow (m^3/s)	Outflow (m^3/s)
1	93	85
2	137	91
3	208	114
4	320	159
5	442	233
6	546	324
7	630	420
8	678	509
9	691	578
10	675	623

Time (h)	Inflow (m^3/s)	Outflow (m^3/s)
11	634	642
12	571	635
13	477	603
14	390	546
15	329	479
16	247	413
17	184	341
18	134	274
19	108	215
20	90	170

TABLE Q6 Cumulative distribution for maximum-annual flood data

n	**Flow, X_n (m^3/s)**	**$P(X< x_n)$**
1	0	0
2	16	0.11
3	24	0.23
4	45	0.34
5	56	0.45
6	68	0.57
7	89	0.64
8	104	0.76
9	128	0.82
10	147	0.94
11	165	0.98
12	182	1

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2013/2014 PROGRAMME : 4 BFF
COURSE NAME : WATER RESOURCES ENGINEERING COURSE CODE : BFW 40103

FIGURE

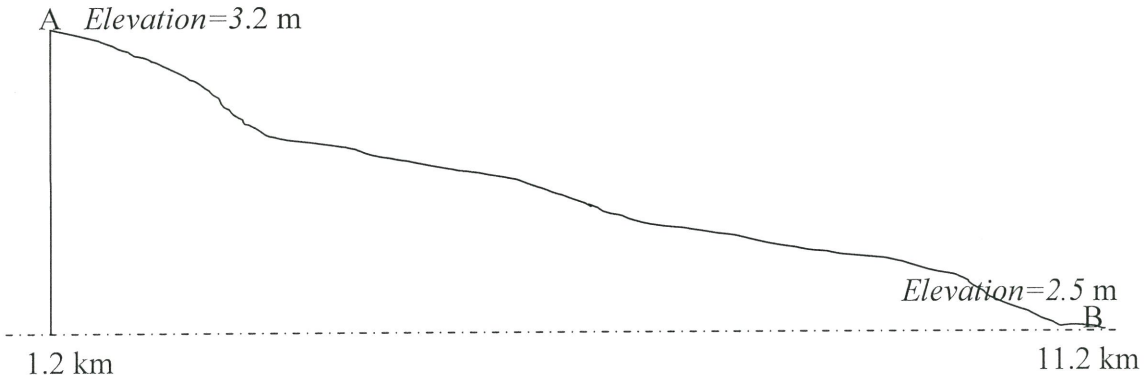

FIGURE Q2 (i) River profile

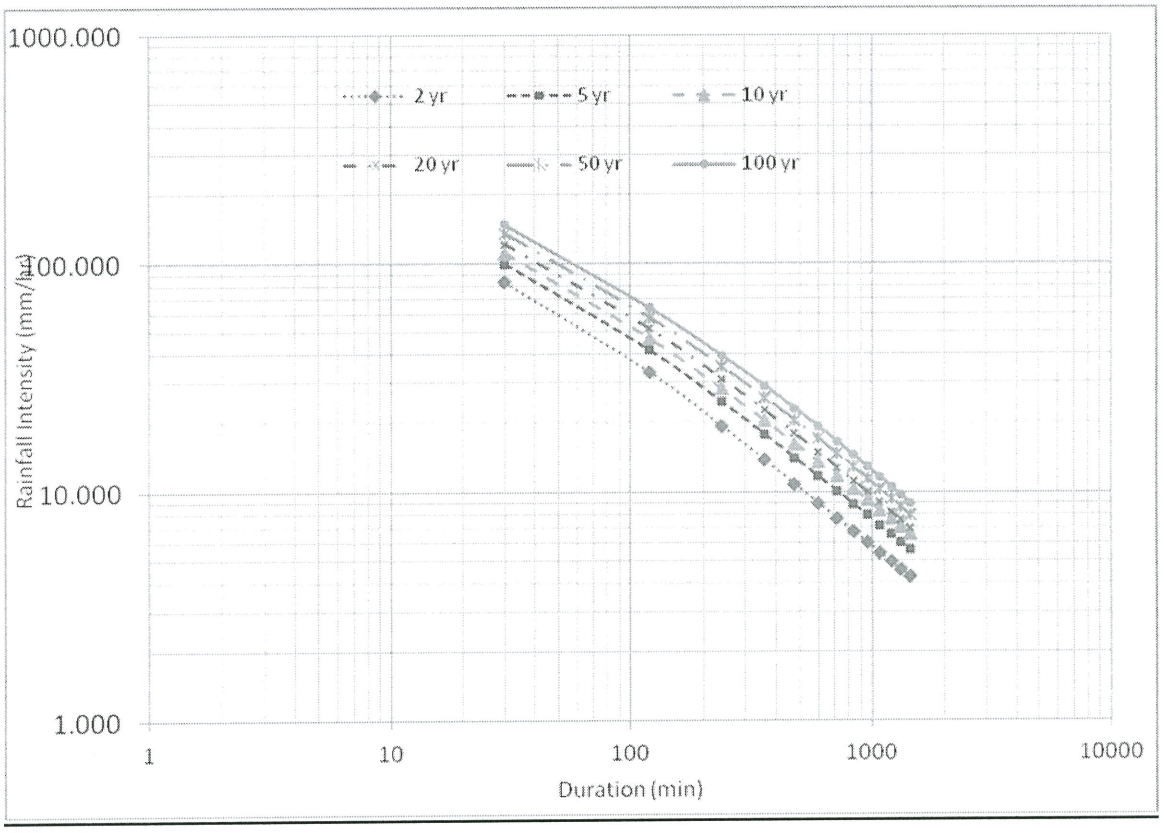

FIGURE Q2 (ii) IDF Curve for Batu Pahat Catchment

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2013/2014 PROGRAMME : 4 BFF
COURSE NAME : WATER RESOURCES ENGINEERING COURSE CODE : BFW 40103

FIGURE

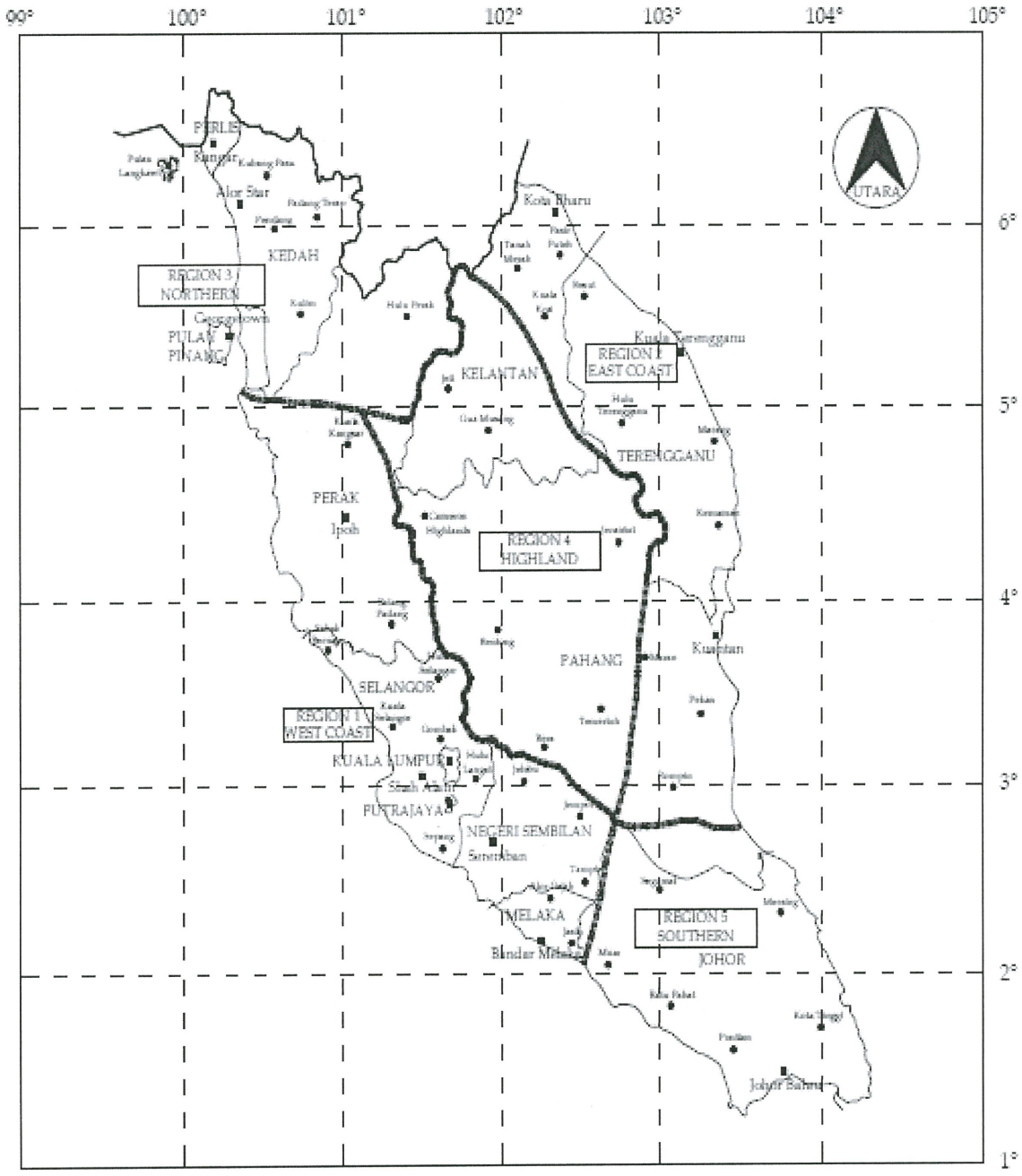

FIGURE Q3 Five (5) Design Regions

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2013/2014 PROGRAMME : 4 BFF
COURSE NAME : WATER RESOURCES ENGINEERING COURSE CODE : BFW 40103

EQUATIONS

$$A_o = \left(\frac{Q_o}{e}\right)^{3/4} \qquad y_o = \left(\frac{A_o}{5}\right)^{1/2} \qquad T_o = 10y_o \qquad V_o = \frac{Q_o}{A_o} \qquad K = \frac{L}{mV_o}$$

$$X = 0.5\left(1 - \frac{Q_o / T_o}{S_o m V_o L}\right) \qquad Q_2 = C_0 I_2 + C_1 I_1 + C_2 Q_1 \qquad t = \frac{length}{velocity}$$

$$C_0 = \frac{(\Delta t / K) - 2X}{2(1-X) + (\Delta t / K)} \qquad C_1 = \frac{(\Delta t / K) + 2X}{2(1-X) + (\Delta t / K)} \qquad C_2 = \frac{2(1-X) - (\Delta t / K)}{2(1-X) + (\Delta t / K)}$$

$$t_c = 1.24\left(\frac{L}{S}\right)^{0.36} \qquad t_d = \frac{Channel \quad length}{Average \quad velocity} \qquad C_s = \frac{2t_c}{2t_c + t_d} \qquad Q = C_s CiA$$

$$P = \sum_{n=1}^{5} p(1-p)^{n-1} \qquad P(Q > X) = \frac{1}{T}$$

$$\frac{dS}{dt} = I - Q$$

$$\Delta S = I\Delta t - Q\Delta t$$