

※ 考生請注意：本試題不可使用計算機

1. Short answers (please explain what they are):

- (a). Field capacity. (4 %)
- (b). Coefficient of transmissivity. (4 %)
- (c). Relative humidity. (4%)
- (d). One-point method of velocity measurement. (3%)

2. (a). Recently, global climate change is one of the most frequent discussions in the hydrological field. No matter it is because of the natural phenomenon or anthropogenic influence, on a globally averaged basis, precipitation over land increased by about 2% over the period (1900–1998). Please list recent trends in precipitation and streamflow in Taiwan regarding to the climate change issue. (5 %)

(b). The water that flows through river systems maintains the fisheries and habitat of aquatic ecosystems. Both the temporal and spatial variability of the abundance of water therefore significantly affects the persistence of aquatic communities. Please list the important hydrological characteristics that may affect the aquatic ecosystems and briefly explain why. (5 %)

3. Streamflow data tabulated below is from a storm event. Assume the baseflow remained the same during the recorded period.

Time (h)	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5
Streamflow (m^3/s)	10	30	110	190	240	320	380	370	270	160	100	40	10	10

(a). If the effective rainfall data is shown below, what is the watershed area? (8 %)

Time (hr)	0~1.5	1.5~3
ERH (cm)	2.0	3.0

(b). What is the 3-hour unit hydrograph $U(3, t)$? (8 %)

(c). What is the 1-hour unit hydrograph $U(1, t)$? (8 %)

(d). Assume the initial outflow is $10 m^3/s$ and $K = 0.5 h$, $X = 0.25$. Please determine the outflow of 1.5^{th} hour from this reach by using the Muskingum Method. (8 %)

(e). If rainfall runoff event tabulated below is from same area and assume the baseflow remained the same during the recorded period, please estimate the Φ -index (8 %).

Time (hr)	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
Streamflow (m^3/s)	10	10	10	16	49	103	118	88	64	43	19	10	10
Rainfall (mm)	0	3	4	7	10	8	3	1	0				

(背面仍有題目，請繼續作答)

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4. The inflow hydrograph of a reservoir is tabulated below. When $t = 0$ day, the storage (S) of the reservoir is $40 \text{ m}^3/\text{s}/\text{day}$ and the outflow (Q) is $0 \text{ m}^3/\text{s}$. Please calculate the outflow of the 3rd day when $\Delta t = 1$ day

$$Q = \begin{cases} \frac{1}{5} \left(\frac{2S}{\Delta t} + Q - 100 \right) & \text{for } \frac{2S}{\Delta t} + Q > 100 \\ 0 & \text{otherwise} \end{cases}$$

Time (days) t	0	1	2	3	4	5	6	7	8	9
Inflow (m^3/s)	0	10	25	40	50	55	45	35	20	10

(15 %)

5. Recent record flooding on the Naughty River at Sweet Village has decided to reconsider building a flood levee. A nearby rainfall gage on the river has a 60-year record. The ranked sample of annual maximum hourly rainfall and sample moments are:

- (a). The 3rd largest hourly rainfall (see table) occurred in the past year. Based on the plotting position method and Weibull formula, what's the return period of this event? (5 %)
- (b). If we only consider the mean and standard deviation of this record and assume it fits the normal distribution, please use frequency analysis to determine the designed hourly rainfall event of the same return period you got from (a). (8 %)
- (c). Following (a) & (b), if the runoff coefficient is 0.5, what is the maximum designed flow by using rational formula in a 10 Km^2 watershed? (7 %)

Rank	Rainfall (mm/hr)
1	195
2	145
3	108
..	..
..	..
..	..
59	25
60	19
Mean	48.5
Stdv	30.0

Entry is area A under the standard normal curve from $-\infty$ to $z(A)$



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936