R5904

Scheme of Valuation/Answer Key

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

V SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: CE309

Course Name: WATER RESOURCES ENGINEERING

Max. Marks: 100 | Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Convective, orographic, cyclonic, frontal precipitation-discuss at least 3types (5)

b) i. Determination of optimum number of rain gauges for an area –explanation with formulae and terms (5)

[$N = (C_v/p)^2$

p - permissible % error in estimating average rainfall

C_v – coefficient of variance = S_x/p_{av} x100

S_x – standard deviation ; p_{av} – average rainfall of n existing rain gauge stations]

c) Total area = 10+ 11.2+ 11.6+ 9.3+ 8.4 = 50.5 sq.km (5)

average depth of rainfall = [10(25+ 30)/2 +11.2(30+ 35)/2 +11.6(35+ 40)/2 +9.3(40+ 45)/2 +8.4(45+ 50)/2]/50.5

= 1868.25/50.5 = **36.995 cms**

2 a) P_A= 110mm, P_B = 90mm and P_C = 70mm; (5)

N_X =1000mm, N_A= 1100mm, N_B = 1200mm, and N_C = 1250 mm

precipitation at X using Arithmetic mean method = $(P_A + P_B + P_C)/3$

= **90mm** - 2 marks

precipitation at X using Normal ratio method = $[P_A/N_A + P_B/N_B + P_C/N_C]Nx/3$

= 77mm- 3 marks

b) k = 2. (6)

maximum infiltration rate f_0 = 2cm/hr

minimum infiltration rate f_c = 0.5cm/hr

Infiltration rate at any time $f = f_c + (f_0 - f_c)e^{-kt} = 0.5 + 1.5e^{-2t}$- 2 marks

Substituting values for t,

Time(hr)	0	0. 5	1.0	1.5	2.0	2.5
f in cm/s	**2.0**	**1.051**	**0.703**	**0.574**	**0.527**	**0.510**

- 3 marks

Plot infiltration curve - 1 mark

c) Discuss methods of base flow separation (2 methods), with sketches (4)

3 a) (5)

φ index is 22mm/hr

duration of measurement = 30min = 0.5hr

when rate of precipitation is less than φ index , no runoff occur - 1mark

Runoff depth = [(24-22) + (36-22) + (28-22)] x 0.5= **<u>11mm</u>** - 2 marks

Area of catchment = 30km^2

runoff volume from the catchment = (30 x 10^6) x (11/1000) = **<u>33 x 10^4 m^3</u>**

- 2marks

b) (10)

S curve derivation-4marks

Lag by 9hr, difference hydrograph - 3 marks

9hr UHO =diff. hydrograph ordinates x (6/9) - 3 marks

Time (hrs)	6hr UHO m3/s	S curve addition	S curve	lagged by 9hr	difference hydrograph	9hr UHO m3/s
0	0		0		0	0.00
3	9		9		9	6.00
6	20	0	20		20	13.33
9	35	9	44	0	44	29.33
12	49	20	69	9	60	40.00
15	43	44	87	20	67	44.67
18	35	69	104	44	60	40.00
21	28	87	115	69	46	30.67
24	22	104	126	87	39	26.00
27	17	115	132	104	28	18.67
30	12	126	138	115	23	15.33
33	9	132	141	126	15	10.00
36	6	138	144	132	12	8.00
39	3	141	144	138	6	4.00
42	0	144	144	141	3	2.00
45	0	144	144	144	0	0.00

PART B

Answer any two full questions, each carries 15 marks.

4 a) (3)

Difference between perennial and inundation irrigation

b) (6)

Definition of duty and Delta -2 marks

relationship between them - Δ = 8.64B/D

Δ -delta in m;, B- base period in days ; D – duty in ha/cumec -2 marks

Derivation of relationship - 2 marks

c) (6)

gross command area = 2000 ha

Duty = 8.64B/Δ - 1 mark

intensity of irrigation for wheat = 50%

area of irrigation = 2000 x 50/100 =1000ha

kor period = 15 days kor depth = 15 cm

Duty = 8.64 x 15/0.15 =864 ha/cumec
discharge required = area/duty = 1000/864 =**1.15 cumec** - 2 marks
intensity of irrigation for gram = 30%.
area of irrigation = 2000 x 30/100 =600ha
kor period = 18 days kor depth = 12 cm
Duty = 8.64 x 18/0.12 =1296 ha/cumec
discharge required = area/duty = 600/1296 =0.**46cumec** - 2 marks
total discharge required = **1.15 cumec**- 1 mark (Both are Rabi crops)

5 a) Explanation of different flooding methods of irrigation (5)

b) Definition of (i) root zone depth (ii) permanent wilting (ii) consumptive use (iv) conveyance efficiency 4 x 1 = 4 marks (4)

c) Area of crop = 3000 ha; Field capacity of soil = 26%; Optimum moisture = 12% permanent wilting point =10%; Eff. depth of root zone =80 cm; relative density of soil = 1.4; frequency of irrigation = 10 days; overall efficiency = 23%. (6)

$d_w = \gamma_d d(FC-OMC)/\gamma_w$ = 1.4x0.8(0.26-0.12) = 15.68cm

C_u = 15.68/10 = **1.568 cm** – 3 marks

Discharge = 3000x10^4x(1.568/100)/(24x3600) =**5.45m^3/sec** – 2 marks

Discharge of canal = 5.45x100/23=**23.695 m^3/sec** – 1 mark

6 a) stage discharge curve - sketch – 2 marks (4)
- discussion – 2 marks

b) objectives of river training (at least 4) – listing only– 2 marks (5)
repelling, attracting and deflecting groynes (with sketch) – 3 marks

c) area is computed by multiplying depth of flow at vertical by width of strip which is taken halfway to adjacent verticals on either side (6)

Distance from bank	Flow depth(d) m	Meter depth m	no. of rev	time sec	N rev/s	v m/s	V_{av} m/s	area m^2	q m3/s
0	0	-	-	-	-	-	-	-	-
0.8	0.5	0.3	12	48	0.25	0.125	0.125	0.4	0.050
1.6	1	0.8	23	52	0.44	0.183	0.222	0.8	0.178
-	-	0.2	36	51	0.71	0.262			
2.4	1.6	1.28	27	54	0.50	0.200	0.228	1.12	0.255
-	-	0.32	41	60	0.68	0.255			
3	1.8	1.44	28	53	0.53	0.208	0.238	1.26	0.300
-	-	0.36	42	58	0.72	0.267			
3.8	1.2	0.96	24	50	0.48	0.194	0.227	0.96	0.218
-	-	0.24	35	50	0.70	0.260			
4.6	0.6	0.36	14	45	0.31	0.143	0.143	0.48	0.069
5.2	0	-	-	-	-	-	-	-	-

1.069

*(***Velocity using current meter is measured at 0.6 d near two banks. At other verticals ,it is***

		measured at 0.8d and 0.2 d. So the average velocity has to be calculated using the corresponding velocities at 0.8 d and 0.2d.At the banks , Average velocity at the Banks is the velocity corresponding to 0.6d.Area is computed by multiplying depth of flow at vertical by width of strip which is taken halfway to adjacent verticals on either side) ***As the given question is an above average question,full credit is to be given, if correct steps are followed by the candidate**	

PART C

Answer any two full questions,each carries 20 marks.

7	a)	Flow duration curve - fig - 2 marks - Explanation - 2 marks - Applications - 2 marks	(6)
	b)	Explanation of process of reservoir sedimentation -3 marks Control measures of reservoir sedimentation -3 marks	(6)
	c)	determining reservoir capacity fig of mass curve showing salient points-3 marks step by step procedure -5 marks	(8)
8	a)	various factors affecting selection of site for a reservoir (at least 6 factors)	(6)
	b)	initial capacity =50 million cu.m, average inflow rate = 50 million cu.m annual sediment inflow = 300,000 tons, density of sediment = 1250kg/m3 vol. of sediment inflow S = 300,000 x1000/1250 =0.24 x10^6 m^3/year sediment trapped St = S xη- 3 marks	(9)

capacity %	capacity vol (x10^6 m3)	capacity /inflow	η	av.η	St (x10_6 m3)	years to fill(10/st)
100	**50**	**1**	**0.977**	**0.9735**	**0.234**	**42.7**
80	**40**	**0.8**	**0.97**	**0.965**	**0.2316**	**43.2**
60	**30**	**0.6**	**0.96**	**0.955**	**0.2292**	**43.6**
40	**20**	**0.4**	**0.95**	**0.935**	**0.224**	**44.6**
20	**10**	**0.2**	**0.92**			

174.1years -6 marks

	c)	Definition of Porosity, specific yield ,specific retention.-3 marks relation between them [porosity = s_y + S_r] -2 marks	(5)
9	a)	Darcy's law - statement -1 marks -Formula -1 marks -Derivation -3 marks	(5)
	b)	expression for steady radial flow in a confined aquifer – fig-2 marks - Expression [$Q = 2\prod T(s_2-s_1)/\log_e(r_1/r_2)$] -2 marks - Derivation steps-4 marks	(8)
	c)	Q =CAH- 1 mark h_1 = 250-243 = 7m; h_2 = 250-245 = 5m	(7)

		t= 2hr; H = 3m; A = * $\prod(5^2)/4 = 19.64m^2$ * (***As the diameter of the well is not specified in the question , full credits may be given to those calculated with any assumed diameter)*** - 2 marks $C = 2.303(\log_{10}(h_1/h_2)/t$ - 1 mark =0.1683/hr - 2 marks Q = **<u>9.918m^3/s = 2.755litres/sec</u>**- 1 mark	
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