Total Pages: 2

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: CE309

Course Name: WATER RESOURCES ENGINEERING (CE)

Max. Marks: 100 Duration: 3 Hours

PART A

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

1 a) What are the various methods of computing average rainfall over a basin? (7)

b) The average annual rainfall depths recorded at 5 rain gauge stations are 910,1070,1410,810 and 500mm respectively. If the average depth of rainfall over the basin is to be estimated within 10% error, determine the additional number of gauges needed. (8)

2 a) State the uses and limitations of unit hydrograph. (5)

b) Ordinates of a 4hr unit hydrograph are given below. Derive the ordinates of a 12hr unit hydrograph. (10)

Time (h)	0	4	8	12	16	20	24	28	32	36	40	44
Ordinates of 4hr UH (Cumec)	0	20	80	130	150	130	90	52	27	15	5	0

3 a) What are the factors that affect evaporation from a water body? (5)

b) What is Φ index? (2)

c) Explain the experimental method of determination of infiltration capacity using double ring infiltrometer. (8)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Explain the various methods of surface irrigation. (10)

b) What are the objectives and classification of river training works? (5)

5 a) What are the factors affecting duty? (5)

b) A water course has culturable command area of 2600 hectares out of which the intensities of irrigation for perennial sugar cane and rice crops are 20% and 40 % respectively .The duty for these crops at the head of the water course are 750 hectares per cumec and 1800 hectares per cumec respectively. Find the discharge required at the head of water course if the peak demand is 120% of the average requirement. (10)

6 a) Explain the stream flow measurement by area velocity method (10)

b) Define stage discharge curve. (2)

c) Define Flow and lift irrigation. (3)

PART C

Answer any two full questions, each carries 20 marks.

7 a) The following information is available regarding the relationship between trap efficiency and capacity inflow ratio for a river (10)

Capacity in flow ratio	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Trap efficiency	87	93	95	95.5	96	96.6	97	97.2	97.3	97.5

Find the probable life of the reservoir with an initial reservoir capacity of 30 million cubic meters if the annual flood inflow is 60 million cubic meters and the average annual sediment inflow is 3600000KN. Assume a specific weight of sediment equal to 12KN/m2. The useful life of the reservoir will terminate when 80% of initial capacity is filled with sediment

b) What is a flow duration curve? (5)

c) What are the methods for the control of river sedimentation? (5)

8 a) Derive an expression for the yield of an open well using Recuperation test. (10)

b) With a neat sketch describe the vertical distribution of ground water. (10)

9 a) Explain the method of calculating reservoir capacity for a specified yield from the mass inflow curve. (10)

b) The amounts of water flowing from a certain catchment area at the proposed dam site are given in the following table. Determine the minimum capacity of the reservoir if water is to be used to feed the turbines of the hydropower plant at a uniform rate and no water is to be spilled over. (10)

MONTH	**INFLOW (x $10^3 m^3$)**
JANUARY	2.83
FEBRUARY	4.25
MARCH	5.66
APRIL	18.40
MAY	22.64
JUNE	22.64
JULY	19.81
AUGUST	8.69
SEPTEMBER	7.10
OCTOBER	7.10
NOVEMBER	5.66
DECEMBER	5.66

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: CE309

Course Name: WATER RESOURCES ENGINEERING (CE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks

Marks

1 a) Explain the components in a hydrological cycle with a neat sketch. (5)

b) How can you obtain the optimum number of rain gauges in a catchment area? (5)

c) Differentiate mass curve and hyetograph. (5)

2 a) Explain the methods to find the average precipitation over a catchment area. (6)

b) The isohyets for annual rainfall over a catchment were drawn and areas of strips between isohyets are obtained as below. Determine the average depth of annual rainfall over the area. (5)

Isohyets(mm)	450-550	550-650	650-750	750-950	950-1150	1150-1250
Area (km^2)	1200	3000	2800	1000	900	600

c) Define infiltration indices. (4)

3 a) List and explain factors affecting runoff in a catchment area. (5)

b) What is unit hydrograph? Stating the assumptions, explain the derivation of a unit hydrograph from a storm hydrograph. (5)

c) Ordinates of 2 hourunit hydrograph are given below. Using this derive the ordinates of a 6 hour unit hydrograph using S hydrograph method. (5)

Time (hrs)	0	2	4	6	8	10	12	14	16	18	20	22
Ordinate of 2 hour unit hydrograph (cumec)	0	25	100	160	200	170	110	70	30	20	8	0

PART B

Answer any two full questions, each carries 15 marks

4 a) Write the environmental effects of irrigation. (4)

b) Differentiate between flow and lift irrigation systems. (4)

c) Gross command of a reservoir is 50,000 hectares. The CCA is 80% of GCA. Find out the capacity of the reservoir which is able to irrigate areas as given below. Reservoir and canal losses may be taken as 5% each of water required by crops. (7)

Crop	Base period (days)	Duty (hectares/cumec)	Intensity of irrigation as % of CCA
Wheat	120	2000	25
Rice	140	900	18.75
Cotton	180	1600	12.50

5 a) Define field capacity, permanent wilting point and available moisture. (4)

b) A loam soil has field capacity 27% and permanent wilting percentage 12%. The dry weight of the soil is 13.73 kN/m^3. If the depth of the rootzone is 1 m, determine the storage capacity of the soil. Irrigation water is applied when the (6)

moisture content drops to 15%. If the water application efficiency is 75%, determine the water depth require to be applied in the field.

c) Define duty and delta. Derive the relation between them. (5)

6 a) What is river training? What are the objectives of river training? What are the classifications? (8)

b) Explain Guide banks and groynes with neat sketches. (7)

PART C

Answer any two full questions, each carries 20 marks

7 a) What are the storage zones in a reservoir? (5)

b) Define trap efficiency. Explain the method to find useful life of a reservoir. (10)

c) Differentiate mass curve and demand curve. (5)

8 a) Define porosity, specific yieldand specific retention. Establish a relation between them. (5)

b) Explain and derive steady state flow to wells in a confined aquifer. (10)

c) Explain Darcy's law. (5)

9 a) Explain recuperation method to find yield from an open well. (5)

b) A well is to be constructed in a fine sandy subsoil formation. The discharge of the well is anticipated to be 0.004 m^3/sunder depression head of 4 m. Find the diameter of the well. Given (K/A) for sandy soil = 0.5 $m^3/hr/m^2$ of area under depression head of 1 m. (8)

c) Explain with sketch strainer type tube well. (7)

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Reg No.:_____ Name:_____

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

Graph sheets may be provided

PART A

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

1 a) What are the different types of precipitation? (5)

b) How will you determine optimum number of rain gauges for an area? (5)

c) The areas enclosed by the adjacent isohyets of a catchment are given in table below. Determine the average depth of rainfall. (5)

Isohyets (cms)	25 - 30	30 - 35	35 - 40	40 - 45	45 - 50
Area (sq.km)	10.0	11.2	11.6	9.3	8.4

2 a) The respective storm totals at three surrounding stations A, B and C are 110, 90 and 70 mm. If the normal annual precipitation amounts at stations X, A, B and C are respectively 1000, 1100, 1200 and 1250 mm, estimate the missing storm precipitation at station X using arithmetic mean method and normal ratio method. (5)

b) If the value of k in Horton's equation is 2 and the maximum and minimum infiltration rates observed are 2 cm/hr and 0.5 cm/hr respectively, find the infiltration rates at 30minutes interval and plot the infiltration rate curve. (6)

c) With neat sketches discuss any two methods of base flow separation. (4)

3 a) The rate of precipitation observed over a catchment of 30km^2 for successive 30 min are 16, 20, 24, 36, 28, 12 and 4mm/hr. If the φ index is 22mm/hr, find the runoff volume in m^3 from the catchment. (5)

b) A 6 hr UH ordinates for a basin are given below. Derive the 9 hr UH ordinates using S curve method (10)

Time (hrs)	0	3	6	9	12	15	18	21	24	27	30	33	36	39	42
6hr UHO m^3/s	0	9	20	35	49	43	35	28	22	17	12	9	6	3	0

PART B

Answer any two full questions, each carries 15 marks.

4 a) Differentiate between perennial and inundation irrigation. (3)

b) Define Duty and Delta and derive the relationship between them. (6)

c) The gross command area for a distributory is 2000 ha. The intensity of irrigation (6)

for wheat is 50% and that for gram is 30%. Gram has a kor period of 18 days and a kor depth of 12 cm and Wheat has a kor period of 15 days and a kor depth of 15 cm. Determine the discharge required in the distributory.

5 a) What are the different flooding methods of irrigation? (5)

b) Define the terms (i) root zone depth (ii) permanent wilting (ii) consumptive use (iv) conveyance efficiency. (4)

c) A certain crop is grown in an area of 3000 ha fed by a canal system. Field capacity of soil is 26%, Optimum moisture is 12% and permanent wilting point is 10%. Effective depth of root zone is 80 cm and relative density of soil is 1.4. If the frequency of irrigation is 10 days and overall efficiency is 23%, find (i) daily consumptive use and (ii) discharge required at the head of the canal in m^3/sec. (6)

6 a) With a neat sketch discuss stage discharge curve. (4)

b) List the objectives of river training. Discuss repelling, attracting and deflecting groynes. (5)

c) The current meter readings taken during gauging of a stream are given in the table below. The current meter rating is given as v=0.05 + 0.3N, v in m/s and N in rev/s. Compute the discharge in the stream. (6)

Distance from bank m	0.8	1.6	1.6	2.4	2.4	3	3	3.8	3.8	4.6	5.2
Flow depth m	0.5	1	1	1.6	1.6	1.8	1.8	1.2	1.2	0.6	0
Meter depth m	0.3	0.8	0.2	1.28	0.32	1.44	0.36	0.96	0.24	0.36	-
no. of revs	12	23	36	27	41	28	42	24	35	14	-
time sec	48	52	51	54	60	53	58	50	50	45	-

PART C

Answer any two full questions, each carries 20 marks.

7 a) What is Flow duration curve? What are its practical applications? (6)

b) Explain process of reservoir sedimentation and control measures for reducing it. (6)

c) Explain the step by step procedure for determining reservoir capacity from mass inflow curve. (8)

8 a) What are the various factors affecting selection of site for a reservoir. (6)

b) The data regarding trap efficiency and capacity inflow ratio of a reservoir is given in the table below. (9)

capacity/inflow	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
trap efficiency, η (%)	86	92	94	95	95.5	96	96.5	97	97.4	97.7

Derive the useful life of reservoir with an initial capacity of 50 million cu. m, if average inflow rate is 50 million cu. m and annual sediment inflow is 300,000 tons. Assume density of sediment as1250 kg/m^3. Useful life terminates when

capacity reduces to 20%.

c) Define Porosity, specific yield, specific retention. Write the relation between them. (5)

9 a) State and derive Darcy's law. (5)

b) Derive an expression for steady radial flow in a confined aquifer. (8)

c) A recuperation test in an open well yielded the following water levels: (7)
Initial water table level – 250.00m; water table level when pumping was stopped – 243.00m; water table level in well 2hr after pumping was stopped – 245.00m
Find the safe yield of the well if working head is 3m.

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

V SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

Course Code: CE309

Course Name: WATER RESOURCES ENGINEERING

Max. Marks: 100 Duration: 3 Hours

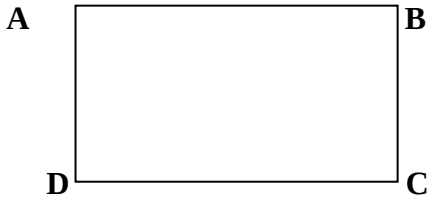
Graph sheets may be provided

PART A

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

1 a) Describe the Non recording rain gauge with a neat sketch (6)

b) Determine the mean precipitation for the rectangular area given below by Thiessen Polygon method. Precipitation recorded at rain gauge stations A, B, C and D are 15 cm, 10 cm, 12 cm and 16 cm respectively. The distance between the rain gauge stations A and B is 12 km and that between A and D is 7 km. (5)



c) The rate of rainfall for successive one hour periods of a 10 hour storm were recorded as 4.0, 6.3, 5.2, 7.5, 8.4, 2.3, 5.4, 4.5, 8.5 and 3.6 cm/hr. (4)

Taking value of φ – index as 6.0 cm/hr, compute i) Total rainfall excess

ii) W- index.

2 a) The ordinates of a 4 hour unit hydrograph of a catchment area are given below. (6)

Time in hr	0	4	8	12	16	20	24	28	32
Ordinates m^3/s	0	15	30	25	21	17	14	8	0

Find the ordinates of an 8 hour unit hydrograph for the same basin. Also sketch the hydrograph.

b) Determine the total infiltration depth for a storm lasting for 5 hours , if the initial infiltration rate is 12 mm/hr, final infiltration rate is 8 mm/hr and constant value describing the rate of decay of the difference between initial and final infiltration (5)

rate is 0.82/h.

c) What are the assumptions of Unit hydrograph theory? (4)

(6)

3 a) What is runoff? What are the factors affecting Runoff?

b) In a catchment area, the annual rainfall recorded by rain gauges A, B, C, D, E and F are 52, 63, 35, 56, 40 and 59 cm respectively. For a 10% error in estimation of mean rainfall, calculate the optimum number of rain gauges in the area. (5)

c) What are the different types of precipitation? (4)

PART B

Answer any two full questions, each carries 15 marks.

4 a) What are the factors affecting Duty of water of a canal system? (6)

b) What is Gross Commanded Area, Culturable commanded area and Unculturable commanded area? (5)

c) What are the general features of Meandering of rivers? (4)

5 a) What are River Training works? What are the classifications of River Training works? (6)

b) A stream of 120 litre/s was diverted from a canal and 100 litre/s were delivered in the field. An area of 2 hectares was irrigated in 10 hours. The runoff loss in the field was 420 m^3. Effective depth of root zone was 1.5 m. Determine Water conveyance efficiency and Water application efficiency. (5)

c) What is Consumptive use of water? List the methods by which it is determined? (4)

6 a) What is Stream Gauging? What are the factors to be considered while selecting a Stream gauging site? (6)

b) What is a Stage – Discharge curve? (5)

c) What is Field capacity and Permanent wilting point? (4)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Describe the types of Tube wells? (8)

b) What are the factors affecting selection of site for a reservoir? (6)

c) A 30 cm diameter well penetrates 20 m below the static water table. After 24 hours of pumping at the rate of 4000 litre/minute ,water level in a test well 85m away from the main well is lowered by 0.48 m, and in a test well 35 m away from (6)

the main well, the drawdown is 1m. a)What is the Transmissibility of the aquifer? b) Also determine the drawdown in the main well.

8	a)	What is a Mass Inflow curve? How is it used to calculate the reservoir capacity?	(8)
	b)	What are the methods adopted for controlling silting of a reservoir?	(6)
	c)	What is a confined aquifer? Derive an expression to obtain the discharge through a confined aquifer.	(6)
9	a)	Describe the Recuperation test used to find yield of an open well.	(8)
	b)	Explain the procedure to calculate the Life of a reservoir.	(6)
	c)	What is i) Firm yield ii) Secondary yield and iii) Average yield of a reservoir?	(6)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: CE309

Course Name: WATER RESOURCES ENGINEERING

Max. Marks: 100 Duration: 3 Hours

Graph sheets may be provided

PART A

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

1 a) A rain gauge recorded the following accumulated rainfall during a storm. Plot a Hyetograph for the given data. (6)

Time(am)	7.00	7.05	7.10	7.15	7.20	7.25	7.30
Accumulated rainfall (mm)	0	2	3	7	12	19	20

b) Describe how infiltration rate is measured using Double ring infiltrometer. (5)

c) What is Recurrence interval? How is it determined? (4)

2 a) The following are the ordinates of a 6 hour storm hydrograph of a catchment area of 426 hectares. (6)

Time	**00.00**	**6 am**	**12noon**	**6 pm**	**00.00**	**6am**	**12noon**	**6 pm**	**00.00**
Ordinates m^3/s	16	115	230	192	171	117	59	28	16

Construct a 6 hour unit hydrograph for the same basin , if constant base flow is 16 cumecs.

b) A station ‘A’ was inoperative while stations B, C, D and E registered 80 mm, 70mm, 83 mm and 79 mm of precipitation. Co-ordinates of B, C, D and E are (7, 6), (10,-8), (-11,-5) and (-5, 5) respectively with coordinates of A as (0, 0). Estimate storm precipitation by Inverse distance method. (5)

c) A 12 hour storm rainfall with following depths in cm occurs over a basin. **3, 3.4, 8.6, 4.9, 11.5, 5, 3, 11, 5.4, 5.8, 1.6, 1.3.** Surface runoff is 20.6 cm. Determine the average infiltration index. (4)

3 a) Describe how evaporation measurement is done using IMD land pan. (6)

b) What is Infiltration? What are the factors affecting Infiltration? (5)

c) What is S Hydrograph? How is it used to construct a longer or shorter period hydrograph from a longer period hydrograph? (4)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Describe the types of Irrigation. (6)

b) What is a Guide bank system? (5)

c) What is Available moisture and Readily available moisture? (4)

5 a) Describe the use of current meter in measuring velocity of a river. (6)

b) What are Irrigation efficiencies? (5)

c) What is Meandering of rivers? (4)

6 a) Determine the reservoir capacity ,if culturable commanded area is 5200 ha, canal losses are 20% and reservoir losses are 15% (6)

Crop	Base period(days)	Duty at field (ha/cumecs)	Intensity of Irrigation
Wheat	120	1700	20%
Sugarcane	320	1400	20%
Cotton	180	1200	10%
Rice	120	700	15%

b) Describe the Area Velocity method used for stream discharge measurement. (5)

c) A crop grown in an area of 5000 ha is fed by a canal system. Find daily consumptive use and discharge in m^3/s required in the area if , (4)

Field capacity of soil = 28%

Optimum moisture = 10%

Permanent wilting point = 8%

Effective depth of root zone = 70 cm

Relative density of soil = 1.3

PART C

Answer any two full questions, each carries 20 marks.

7 a) Describe the tests to determine the yield of a well. (8)

	b)	What are the zones of a storage reservoir?	(6)
	c)	Derive an expression to find the discharge through an Unconfined aquifer.	(6)
8	a)	A gravity well has a diameter of 65 cm. The depth of water in the well is 45 m before pumping has started. When pumping is done at the rate of 40 litres/s, the drawdown in a well 12 m away is 4.5 m and in another well, 24 m away, the drawdown is 3m. Determine i) Radius of zero drawdown ii) Coefficient of permeability iii) Drawdown in the well iv) Maximum rate at which water can be discharged from the well.	(8)
	b)	What are the types of Dam Reservoirs?	(6)
	c)	During a Recuperation test, water in an open well was depressed by pumping by 3 metres and it recuperated 2 metres in 75 minutes. Find i) Yield from a well of 4m diameter under a depression head of 4 metres ii) Diameter of the well to yield 600 litres/minute under a depression head of 2.5 metres.	(6)
9	a)	Describe the use of Mass Inflow curve to determine capacity of a reservoir.	(8)
	b)	Describe the divisions of Subsurface water.	(3)
	c)	Define i) Coefficient of Transmissibility ii) Storage coefficient	(3)
	d)	What is Trap efficiency? What is its significance?	(6)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth semester B.Tech degree examinations (S) September 2020

Course Code: CE309

Course Name: WATER RESOURCES ENGINEERING

Max. Marks: 100 Duration: 3 Hours

PART A

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

1 a) Explain the method of determination of optimum number of raingauges in a catchment (4)

b) Compare Thiessen polygon method and isohyetal method for determination of average precipitation over a catchment (6)

c) Explain rainfall mass curve and hyetograph. How will you construct a hyetograph from rainfall mass curve (5)

2 a) A trapezoidal channel of bed width 4 m and side slope 1 : 1 carries water at a depth of 2 m. The rate of evaporation observed was 0.35 $mm/m^2/h$. Find the daily loss due to evaporation from the canal in a length of 10 km in ha m. (5)

b) Explain the factors affecting runoff from a catchment (10)

3 a) Enlist the uses and limitations of unit hydrograph theory (5)

b) Given below are the ordinates of 4 hr UH of a basin. Derive 2 hr UH of the basin using S-curve method (10)

Time (hrs)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
UHO (m^3/sec)	0	20	36	60	80	112	120	105	92	40	24	14	9	7	0

PART B

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

4 a) Define Duty and Delta. Obtain the relation between the two (5)

b) A canal was designed to supply the irrigation needs of 1000 ha of land growing rice of 120 days base period and having a delta of 130 cm. Instead of rice if the canal water is used entirely to irrigate wheat of base period 118 days and having delta of 50 cm, determine the area that can be irrigated by the canal supplies. (10)

5 a) Explain irrigation efficiencies. (5)

b) Explain benefits and ill effects of irrigation. (4)

c) Explain (i) field capacity (ii) permanent wilting point (iii) capillary water (6)

6 a) Explain the classification of river training. (3)

b) The data pertaining to a stream gauging operation at a gauging station are given below. The rating equation of the current meter is $v = 0.51N_s + 0.03$ m/sec where N_s is the number of revolutions per second. Calculate the discharge in the stream. (12)

Distance from left water edge (m)	0	1	3	5	7	9	11	12
Depth (m)	0	1.1	2	2.5	2	1.7	1	0
Revolutions of current meter kept at 0.6 depth	0	39	58	112	90	45	30	0
Duration of observation (s)	0	100	100	150	150	100	100	0

PART C

Answer any two full questions, each carries 20 marks.

7 a) Define safe yield and average yield of reservoirs. (4)

b) Explain the method of determination of yield of reservoirs with a given capacity. (4)

c) A reservoir has a capacity of 3.6 Mha-m upto the level of the spillway crest. The average annual inflow is 1.5 Mha-m of water. If the average annual sediment inflow is $3x10^{11}$ kg, determine the useful life of the reservoir assuming that the usefulness of the reservoir is terminated when 2/3 of the total capacity is filled with sediments. Assume suitable value for specific weight of sediment. (12)

C/I Ratio	2.4	2	1.6	1.2	0.8	0.4
Trap Efficiency	98.2	98	97.5	97	96	95

8 a) Stating the assumptions underlying it, derive the Dupuit's equation for steady radial flow into unconfined aquifers. (10)

b) During a recuperation test conducted on an open well in a region, the water level in the well was depressed by 3 m and it was observed to rise by 1.75 m in 90 minutes. (a) What is the specific yield of open wells in that region (b) What will be the yield from a well of 5 m diameter under a depression head of 2.5 m? (10)

9 a) Describe the vertical distribution of ground water. (5)

b) Differentiate (i) open well and tube well (ii) flowing well and artesian well (6)

c) A 30 cm diameter well completely penetrates a confined aquifer of permeability of 45 m/day. The length of the strainer is 20 m. Under steady state of pumping, the drawdown at the well was found to be 3 m, and the radius of influence was 300 m. Calculate the discharge. If the diameter of well is increased by 50 %, what will be the percentage increase in discharge? (9)

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