SRM VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF AGRICULTURE ENGINEERING

QUESTION BANK

VI SEMESTER

1902601- GROUNDWATER AND WELL ENGINEERING

B.E. AGRICULTURE ENGINEERING

Regulation – 2019

Academic Year: 2021– 2022

Mr. S. Karthick
Assistant Professor
Department of Agriculture Engineering

Question Bank

SEMESTER: 06   REGULATION-2019   YEAR: B.E /III

UNIT I HYDROGEOLOGIC PARAMETERS

Water Balance – Distribution of subsurface water – Water bearing properties of Rocks –Types of Aquifers – Aquifer properties Estimation – Pumping test :– Permeability, Specific yield, transmissivity and Storage coefficient – Methods of Estimation – Ground water table fluctuation method – GEC Norms – Ground water development and potential in India -Groundwater prospective - Geophysical techniques – Electrical resistivity survey.

PART-A (2MARKS)

Q. No	Questions	BT Level	Competence
1.	Define aquifer.	BT-1	Remember
2.	Differentiate between confined and unconfined aquifer?	BT-1	Remember
3.	What are the types of aquifers?	BT-1	Remember
4.	Tell about the aquifer properties.	BT-1	Remember
5.	Define aquiclude.	BT-1	Remember
6.	Define aquifuge.	BT-1	Remember
7.	What do you mean by permeability?	BT-2	Understand
8.	Write factors affecting permeability?	BT-2	Understand
9.	Explain about specific yield?	BT-2	Understand
10.	Define storage coefficient.	BT-2	Understand
11.	Explain the reason behind Groundwater fluctuations.	BT-2	Understand
12.	How will you identify the anisotropic aquifer?	BT-3	Application
13.	Discuss about porosity.	BT-3	Application
14.	Interpret the relation between porosity, specific yield and specific retention.	BT-3	Application
15.	Write about specific retention.	BT-3	Application
16.	Write about safe yield	BT-4	Analyse
17.	Write about Groundwater development in India.	BT-4	Analyse
18.	Write about the Groundwater potential.	BT-4	Analyse

		BT-4	Analyse
19.	Give advantages of geophysical method	BT-4	Analyse
20.	Write the salient features of GEC Norms.	BT-5	Evaluate
21.	Define Darcy's law	BT-5	Evaluate
22.	Enumerate the importance of electrical resistivity survey	BT-5	Evaluate
23.	State hydrogeological parameter.	BT-6	Create
24.	What is the name of method used for groundwater recharge?	BT-6	Create
25.	Define transmissivity.	BT-6	Create

PART-B (13 MARKS)

Q.No	Questions	BT Level	Competence
1.	Explain the following terms: (i) Soil water (ii) Soil available water (iii) Water holding capacity (iv) Soil-water-plant relationship	BT-1	Remember
2.	Explain about water bearing properties of rock.	BT-1	Remember
3.	Explain about Groundwater Investigation.	BT-1	Remember
4.	Write the groundwater balance equation and explain the components in detail	BT-2	Understand
5.	During Hydro geological investigation two potential aquifers 32 km apart , were located ,one being 5000 years and the other 25000years old. They were found to be connected by a water bearing stratum of 30m thickness running inclined at 20m/km. From a few observation wells, the hydraulic gradient was found to be 0.2m/km. Determine the transmissibility of the water bearing stratum.	BT-2	Understand
6.	Analyze the Factors affecting the Groundwater.	BT-2	Understand
7.	Illustrate the methods of estimation of groundwater potential based on GEC methodology	BT-2	Understand
8.	Write in detail about Groundwater fluctuations and interpretation.	BT-3	Application
9.	Explain about Groundwater development potential in India.	BT-3	Application
10.	Describe about GEC Norms and its Recommendations.	BT-4	Analyse
11.	Explain about Electrical resistivity method	BT-4	Analyse
12.	Explain about seismic refraction method	BT-4	Analyse
13.	Outline about water table fluctuation in detail.	BT-5	Evaluate

14.	The fallowing observations are made on a 300 mm diameter well penetrating on unconfined aquifer i. Rate of pumping = 1800 lit/min ii. Drawdown in a well 30 m away = 1.8 m iii. Drawdown in a well 60 m away = 0.6 m iv. Depth of water in a well before pumping = 50 m Determine (a) The radius of circle of influence and (b) The coefficient of transmissibility of aquifer	BT-6	Create

PART-C (15 MARKS)

Q.No	Questions	BT Level	Competence
1.	Explain the water resources in India	BT-1	Remember
2.	Elaborate the hydrologic cycle with neat sketch	BT-2	Understand
3.	Explain the various types water bearing stratum	BT-4	Analyse
4.	Prepare a case study on Neyveli artesian aquifer	BT-5	Evaluate

UNIT II -WELL HYDRAULICS

. Darcy's law – Groundwater Flow Equation – Steady state flow – Dupuit Forcheimer Assumption – Theim's Equation - unsteady flow – Theis method and Jacob method – Image well theory – Partial penetration of wells.

PART-A (2MARKS)

Q.No	Questions	BT Level	Competence
1.	What is groundwater recharge zone?	BT-1	Remember
2.	What is well hydraulics?	BT-1	Remember
3.	State any two assumptions of dupits theory	BT-1	Remember
4.	What is Darcy's law of permeability?	BT-1	Remember
5.	In a laboratory permeability test on a clayey soil, the diameter of the stand pipe is 2 cm and the diameter of the permeameter is 120 cm. The height of the mould is 130 cm. Determine the time taken for the head of water in the stand pipe to drop from 190 cm to 150 cm.	BT-1	Remember
6.	Write the different types of flow condition.	BT-1	Remember
7.	What is meant by Drawdown?	BT-2	Understand
8.	Define cone of depression.	BT-2	Understand

9.	List the objectives of Groundwater hydraulics.	BT-2	Understand
10.	State Darcy's law and its application.	BT-2	Understand
11.	Write the assumptions of Thiem's Equation.	BT-2	Understand
12.	Tell about the water table aquifer.	BT-3	Application
13.	Write the Thiem Equation for Confined Aquifers	BT-3	Application
14.	Explain the Principle of Law of Times	BT-3	Application
15.	Explain about Theis recovery	BT-3	Application
16.	Define specific capacity of a well.	BT-4	Analyse
17.	What are the merits and demerits of partial penetration of wells?	BT-4	Analyse
18.	State Dupuit Forchheimer assumptions.	BT-4	Analyse
19.	How do you calculate groundwater flow?	BT-4	Analyse
20.	What is the rate of groundwater flow?	BT-5	Evaluate
21.	What is the water balance equation?	BT-5	Evaluate
22.	What is field water balance?	BT-5	Evaluate
23.	What is image well?	BT-6	Create
24.	What is partially penetrating well?	BT-6	Create
25.	What is steady state groundwater flow?	BT-6	Create

PART-B (13 MARKS)

Q.No	Questions	BT Level	Competence
1.	A soil sample of height 60 mm, area of cross section 10,000mm2 subjected to falling head permeability test. Determine coefficient of permeability of sample in a time interval of 5 minutes. Head is dropped from 600mm to 200mm .If the cross sectional area of the stand pipe 0f 200mm2 and if the soil sample is subjected to constant head of 180mm, calculate the total quantity of water collected in 1 hr after flowing through the soil sample	BT-1	Remember
2.	Write in detail about partial penetration of wells.	BT-1	Remember
3.	A tube well of 30 cm diameter penetrates fully in an artesian aquifer. The strainer length is 15 m. Calculate the yield from the well under a drawdown of 3 m .The aquifer consists of sand of effective size of 0.2 mm having coefficient of permeability equal to 50 m/day. Assume radius of drawdown equal to 150 meters	BT-1	Remember
4.	A 30 cm diameter well penetrates 25 m below the static water table. After 24 hours of pumping @ 5400 liters/minute, the water level in a test well at 90 m is lowered by 0.53 m , and in a well 30 m away the drawdown is 1.11 m. (a) what is the transmissibility of the aquifer ? (b) Also determine the drawdown in the main well	BT-2	Understand

5.	A 30 cm well completely penetrates an unconfined aquifer of depth 40 m. After a long period of pumping at a steady rate of 1500 lpm, the drawdown in two observation wells 25 m and 75 m from the pumping well were found to be 3.5 m and 2.0 m respectively .Determine the transmissibility of the aquifer .What is the drawdown at the pumping well ?	BT-2	Understand
6.	An aquifer of 20 m average thickness is overlain by an an impermeable layer of 30 m thickness .A test well of 0.5 m diameter and two observation well at a distance of 10 m and 60 m from the test well are drilled through the aquifer .After pumping at a rate of 0.1 m^3/sec for a long time ,the following drawdown are stabilized in these wells: First observation well,4m; second observation well,3 m. Show the arrangements in a diagram .Determine the coefficient of permeability and drawdown in the test well	BT-2	Understand
7.	A 30cm well fully penetrate a confined aquifer 30m deep. After a long period of pumping at a rate of 1200 lpm , the drawdown in the well at 20 and 45m from the pumping well are found to be 2.2 and 1.8 m respectively. Determine transmissibility of the aquifer. What is the draw down?	BT-2	Understand
8.	A 30cm well penetrates 50m below static water table. After a long period of pumping at a rate of 1800lpm , the drawdown in the well at 15m and 45 m from the pumped well where 1.7 and 0.8m respectively. Determine transmissibility of the aquifer. What is the draw down?	BT-3	Application

The following data were collected during the pumping test of a confined aquifer to determine the aquifer parameters. The test well was pumped at the rate of 31.5 Ips.The observation well is located at 15.2 m from the main pumping well. Determine T and S of an aquifer by Jacob's technique.

Time (hrs)	0.5	1.0	2.0	4.0	6.0	12.0	24.0	48.0
Drawdown (m)	0.15	0.30	0.46	0.76	0.98	1.31	1.65	1.95

(9. — BT-3 — Application)

10.	A well fully penetrating a confined aquifer is pumped at a uniform rate of 2500 litres per minute .The drawdown in an observation well situated at 60 m away are given in table .Using Theis method ,determine the formation constants of the aquifer	BT-4	Analyse

t(min)	DD in (m)	t(min)	DD in (m)
0	0.00	18	0.66
1.0	0.20	24	0.71
1.5	0.26	30	0.75
2.0	0.30	40	0.80
2.5	0.33	50	0.83
3	0.36	60	0.86
4	0.41	80	0.91
5	0.45	100	0.95
6	0.48	120	0.98
8	0.53	150	1.03
10	0.56	180	1.05
12	0.59	210	1.08

14	0.62	240	1.10		

11.	Write in detail about Jacob method, Slug test, Theis method.	BT-4	Analyse
12.	State Dupuit - Forcheimer assumptions and its uses in groundwater hydrology.	BT-4	Analyse
13.	Explain about the Image well theory	BT-4	Analyse
14.	.Using Jacob method ,determine the formation constants of the aquifer A well fully penetrating a confined aquifer is pumped at a uniform rate of 2500 litres per minute .The drawdown in an observation well situated at 60 m away are given in table	BT-5	Evaluate

T (min)	DD in (m)	T (min)	DD in (m)
0	0.00	18	0.66
1.0	0.20	24	0.71
1.5	0.26	30	0.75
2.0	0.30	40	0.80
2.5	0.33	50	0.83
3	0.36	60	0.86
4	0.41	80	0.91
5	0.45	100	0.95
6	0.48	120	0.98
8	0.53	150	1.03
10	0.56	180	1.05
12	0.59	210	1.08
14	0.62	240	1.10

PART-C (15 MARKS)

Q.No	Questions	BT Level	Competence
1.	Explain the various factors affecting the permeability.	BT-1	Remember
2.	A constant head permeability test was conducted on a sandy soil of 160mm in length, cross sectional area is 6000mm2 and porosity is 40%under a constant head of 300mm. Discharge was found out to be 45x103mm3 in 18 seconds. Calculate the coefficient of permeability, discharge velocity and seepage velocity.	BT-2	Understand
3.	Evaluate the discharge computation of partial penetrations of wells.	BT-4	Analyse
4.	Drawdown was measured during a pumping test at frequent intervals in an observation well 200 feet from a well that was pumped at a constant rate of 500 ppm. The data for this pump test is listed in table. These measurements shows that the water level is still dropping after 4000 minutes of pumping, therefore analysis of the test data requires use of the Thesis non equilibrium procedure. Determine S and T for this aquifer	BT-5	Evaluate

Pump test data	
Time (min)	Drawdown (feet)
1	0.05
2	0.22
3	0.4
4	0.56
5	0.7
7	0.94
10	1.2
20	1.8
40	2.5
100	3.4
300	4.5
1000	5.6
4000	7

UNIT III - WELL DESIGN

Design characteristics – Design of wells - Well diameter, depth and Well screen design

– Materials for well screens – Well casing – Design of collector wells and Infiltration

gallery – Dug wells versus tube wells.

PART-A (2MARKS)

Q.No	Questions	BT Level	Competence
1.	What are the objectives of well design?	BT-1	Remember
2.	How is a water well constructed ?	BT-1	Remember
3.	Can you build a well anywhere?	BT-1	Remember
4.	What material is used for well casing?	BT-1	Remember
5.	What is well screen?	BT-1	Remember
6.	Can PVC be used for well casing?	BT-1	Remember

7.	What is difference between wells and tube wells?	BT-2	Understand
8.	What are the different types of wells?	BT-2	Understand
9.	Show the specification of well diameter	BT-2	Understand
10.	What is a cased well?	BT-2	Understand
11.	Explain well depth	BT-2	Understand
12.	What is the function of well screen in tube wells?	BT-3	Application
13.	How deep is a dug well?	BT-3	Application
14.	What is the need of collector well?	BT-3	Application
15.	What are dug wells?	BT-3	Application
16.	How Can groundwater be drawn out through tube wells?	BT-4	Analyse
17.	Discuss about basin	BT-4	Analyse
18.	What is Ranny well?	BT-4	Analyse
19.	What is river intake?	BT-4	Analyse
20.	What are the advantages of infiltration gallery?	BT-5	Evaluate
21.	What is Jack well?	BT-5	Evaluate
22.	How do infiltration galleries work?	BT-5	Evaluate
23.	Is an artesian well? Justify your comments	BT-6	Create
24.	How the well was dug?	BT-6	Create
25.	What is meant by infiltration gallery?	BT-6	Create

PART-B (13 MARKS)

Q.No	Questions	BT Level	Competence
1.	Draw the cross section of well and explain its components	BT-1	Remember
2.	Explain the design principle of well	BT-1	Remember
3.	A 30 cm tube well was drilled in an area for which the bore log is given below . The GWT varies between 10 m in monsoon to 15 m in summer, bgl. A preliminary test showed that the well can yield 2500 lpm with a drawdown of 5 m . The average permeability of the sandy strata may be taken as 30m/day. Determine the length of the strainer required and its location. Assume a radius of influences of 300 m. 	Depth (m)	Strata	 	0-5	Clay with shingle	 	5-20	Very fine sand		BT-1	Remember

	20-35	Clay with kankar		
	35-50	Coarse sand		
	50-60	clay		
	60-80	Medium sand		
	>80	clay		

	If the water have to be lifted to a height of 30 m agl what is the power of the pump required .Assume total losses of 5 m and pump efficiency of 60%. What is the month electricity bill at Rs.2 per kW hr (kwh) assuming a motor efficiency of 85 % and 12 hr of pumping per day ?		
4.	Explain about infiltration wells.	BT-1	Remember
5.	Outline the design principle of well screen	BT-2	Understand
6.	Design an open well in fine sand to give a discharge of 0.003 cumec when worked under depression head of 2.5 metres.	BT-2	Understand
7.	Design a tube well to yield a quantity of 0.09 cumec with a drawdown of 6 m.. Assume a relevant data if needed.	BT-2	Understand

8.	Describe the following
	   (i) Well diameter
	   (ii) Well depth
		BT-2	Understand

9.	Design a tube well for the following data Yield required = 0.08 cumec Thickness of confined aquifer = 30 m Radius of circle of influence = 300 m Permeability coefficient = 60 m/ day Drawdown = 5 m	BT-3	Application
10.	Describe in detail about advantages and disadvantages of Tube well	BT-3	Application
11.	Enumerate the test to calculate the yield of an open well	BT-4	Analyse
12.	Explain about infiltration galleries.	BT-4	Analyse
13.	Show the different types of wells.	BT-5	Evaluate
14.	A radial water collector is to be designed for extraction of 15000 m^3/day from the ground water stored in the Palar river bed which has an aquifer extending up to 13 m below the bed ,with the width limited to the actual river bed itself, which is 600 m wide. A long duration pump test indicates a transmissibility of 3.6 x 10^6 lpd/m for a saturated thickness of 12 m when the water table is 1m below the river bed and a storage coefficient of 33 % for the aquifer as confirmed by the laboratory tests. The water table goes drawdown by 4.2 m over a period of 8 months (250 days) during which period of the summer rainfall amounts to 40 cm.	BT-6	Create

PART-C (15 MARKS)

Q.No	Questions	BT Level	Competence
1.	**Describe in detail about advantages and disadvantages of bore well**	BT-1	Remember

		BT-4	Analyse
2.	Explain the advantages and disadvantages of well irrigation over canal irrigation	BT-4	Analyse
3.	Outline the construction of dug well and collector well.	BT-5	Evaluate
4.	Show the site selection for construction of well in detail.	BT-6	Create

UNIT IV - WELL CONSTRUCTION AND MAINTENANCE

Types of wells – Well drilling - Boring, Jetting – Rotary drilling, Hammer drilling - Construction– Installation of pipes and screens - Well development, Completion and disinfection – Well maintenance – Well performance test – Well effectiveness – Well loss – Pumping equipment – Rehabilitation of wells and borewells

PART-A (2MARKS)

Q.No	Questions	BT Level	Competence
1.	What are the types of auger?	BT-1	Remember
2.	Write the need of casing	BT-1	Remember
3.	How do you maintain a well?	BT-1	Remember
4.	State bore hole.	BT-1	Remember
5.	How do you rehabilitate a water well?	BT-1	Remember
6.	State the uses of well seal.	BT-1	Remember
7.	Identify the methods of drilling.	BT-2	Understand
8.	Compare PVC casing and steel casing	BT-2	Understand
9.	Mention the reason for well disinfection.	BT-2	Understand
10.	Compare over pumping with backwashing	BT-2	Understand
11.	Show the methods of well development.	BT-2	Understand
12.	Examine the well completion operations	BT-3	Application
13.	What is well rehabilitation?	BT-3	Application
14.	Outline about well development.	BT-3	Application
15.	Classify the types of bore well.	BT-3	Application
16.	Sketch the cross section of water well.	BT-4	Analyse
17.	Classify the types of pumps.	BT-4	Analyse
18.	Explain the sequence procedure for construction well.	BT-4	Analyse
19.	How do you backflush a well?	BT-4	Analyse
20.	Where large diameter low yield wells?	BT-5	Evaluate
21.	Mention the need of filter pack.	BT-5	Evaluate
22.	Do wells need to be cleaned?	BT-5	Evaluate

23.	Draw the sketch of drillers.	BT-6	Create
24.	Design the need of dispersing agents in well development.	BT-6	Create
25.	What will you infer from disturbed sample?	BT-6	Create

PART-B (13 MARKS)

Q.No	Questions	BT Level	Competence
1.	Explain the difference between drilled well and driven well	BT-1	Remember
2.	Describe in detail about process of rotary drilling.	BT-1	Remember
3.	Enumerate about well disinfection.	BT-1	Remember
4.	Outline the need of filter pack and its benefits	BT-1	Remember
5.	List the advantages and disadvantages of different types of pump.	BT-2	Understand
6.	What are the different components of well? Explain in detail with neat sketch	BT-2	Understand
7.	Explain the following (i) Hammer Drilling (ii) Jetting	BT-2	Understand
8.	How will you develop wells?	BT-2	Understand
9.	Outline the processes of Auger boring with typical sketch	BT-3	Application
10.	Sketch the well completion operation.	BT-3	Application
11.	Explain the different types of pumps.	BT-4	Analyse
12.	Illustrate the modes of water in detail.	BT-4	Analyse
13.	How will you construct water well?	BT-5	Evaluate
14.	Formulate a procedure for well maintenance.	BT-6	Create

PART-C (15 MARKS)

Q.No	Questions	BT Level	Competence
1.	Prepare a case study on quality of ground water on your native district.	BT-1	Remember
2.	State the occurrence of water in earth.	BT-1	Remember
3.	How will you measure precipitation?	BT-4	Analyse
4.	Enumerate the facts about rehabilitation of wells.	BT-4	Analyse

UNIT V - SPECIAL TOPICS

Artificial Recharge Techniques – Sea water Intrusion – Introduction to Ground water modeling Techniques – Ground water pollution and legislation - Groundwater quality – Dose response assessment – Risk analysis.

PART-A (2MARKS)

Q.No	Questions	BT Level	Competence
1.	Why artificial recharge required?	BT-1	Remember
2.	State the objectives of artificial recharge	BT-1	Remember
3.	Outline the advantages of artificial recharge.	BT-1	Remember
4.	Compare natural recharge and artificial recharge.	BT-1	Remember
5.	What is recharge structure?	BT-1	Remember
6.	What is dose response assessment?	BT-1	Remember
7.	What causes seawater intrusion?	BT-2	Understand
8.	What is an example of saltwater intrusion?	BT-2	Understand
9.	Why is seawater intrusion bad?	BT-2	Understand
10.	How does saltwater intrusion affect humans?	BT-2	Understand
11.	Why ground water Modeling is needed?	BT-2	Understand
12.	What is numerical groundwater Modeling?	BT-3	Application
13.	State groundwater contamination.	BT-3	Application
14.	What is MODFLOW used for?	BT-3	Application
15.	Define saltwater intrusion.	BT-3	Application
16.	Discuss the Impacts of saltwater intrusion?	BT-4	Analyse
17.	List the remedies to be taken to reduce saltwater intrusion?	BT-4	Analyse
18.	What pollutants are in groundwater?	BT-4	Analyse
19.	What are the sources of groundwater Pollution ?	BT-4	Analyse
20.	What is the difference between groundwater and surface water pollution?	BT-5	Evaluate
21.	How do you recognize protection zone delineation?	BT-5	Evaluate
22.	Why groundwater legislation is needed in India?	BT-5	Evaluate
23.	What do you mean by MAR?	BT-6	Create
24.	Why groundwater quality is important?	BT-6	Create
25.	What are groundwater quality parameters?	BT-6	Create

PART-B (13 MARKS)

Q.No	Questions	BT Level	Competence

1.	Describe in detail about Surface spreading method of Artificial recharge	BT-1	Remember
2.	Show the	BT-1	Remember
3.	Explain about Sub Surface method of artificial recharge	BT-1	Remember
4.	Identify Remediation schemes of contaminant present in ground water	BT-1	Remember
5.	Explain the Recent Progress on Groundwater Legislation	BT-2	Understand
6.	Enumerate the potential sources of groundwater contamination	BT-2	Understand
7.	How can you stop groundwater pollution?	BT-2	Understand
8.	Why is pollution of groundwater a greater environmental hazard than pollution of surface water? Explain in detail.	BT-3	Application
9.	Show the remedial measures of saline intrusion	BT-3	Application
10.	Outline the groundwater quality parameters in detail.	BT-4	Analyse
11.	Write the preventive measures of groundwater pollution	BT-4	Analyse
12.	Describe in detail about causes of ground water pollution	BT-5	Evaluate
13.	Show the ground water quality features of the country	BT-5	Evaluate
14.	Summarize the facts about risk analysis in groundwater pollution.	BT-6	Create

PART-C (15 MARKS)

Q.No	Questions	BT Level	Competence
1.	Outline the methods to remediate saline intrusion.	BT-4	Analyse
2.	Prepare a case study on quality of groundwater on your native district	BT-4	Analyse
3.	Enumerate the roles and responsibilities of Central water commission on groundwater quality.	BT-2	Understand
4.	Elaborate the Water quality standards for irrigation water.	BT-2	Understand