

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), Nov 2016

B. Tech in Civil Engineering, Semester V

Roll No.....

CE522 : Ground Water Hydrology

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

- Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10
- i. Rate of flow of water through the ground strata, can be estimated by
 - (a) Manning's formula
 - (b) Striker formula
 - (c) Darcy's formula
 - (d) Dupuit's formula
 - ii. The best groundwater reservoirs have _____.?
 - (a) low permeability and low porosity
 - (b) low permeability and high porosity
 - (c) high permeability and low porosity
 - (d) high permeability and high porosity
 - iii. Property of geological formation, which represent its storage capacity, is
 - (a) permeability
 - (b) porosity
 - (c) both (a) and (b) above
 - (d) none of the above
 - iv. Capillary fringe water is also called the
 - (a) suspended water
 - (b) vadose water
 - (c) gravity water
 - (d) all of these
 - v. "specific yield" for an unconfined aquifer is
 - (a) greater than porosity
 - (b) less than porosity
 - (c) equal to porosity
 - (d) unrelated to porosity
 - VI. The porosity of sand sample is 50%. The specific yield of an aquifer containing this sand will be :
 - (a) equal to 50 %
 - (b) less than 50%
 - (c) more than 50%
 - (d) none of the above
 - vii. In one dimensional flow in a confined aquifer between two water bodies the Piezometric head line is
 - (a) a straight line
 - (b) a part of an ellipse
 - (c) a parabola
 - (d) an arc of circle
 - viii. An artesian aquifer is the one where
 - (a) water surface under the ground is at atmospheric pressure
 - (b) water is under pressure between two impervious strata
 - (c) water table serves as upper surface of zone of saturation
 - (d) none of the above

- ix. Discharge per unit drawdown of a well is known as the
 (a) specific yield (b) specific retention
 (c) specific capacity (d) specific storage
- x. A stratified unconfined aquifer has three horizontal layers as below

Layer	Coefficient of permeability (m/day)	Depth (m)
1.	6	2.0
2.	16	4.0
3.	24	3.0

The effective vertical coefficient or permeability of this aquifer, in m/day, is about

- (a) 13 (b) 15
 (c) 24 (d) 16

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

Write a short notes on :

- Electrical resistivity
- Seismic refraction
- Resistivity logging
- State and discuss assumption and limitation of Dupuit's theory.

Q.3A Write a short notes on the following : 05

- Effect of earthquake on ground-water levels.
- Connate water and meteoric water
- Secular and Seasonal variation in groundwater table
- leaky aquifer

Q.3B Derive a formula for discharge of well in a homogenous artesian aquifer, assuming equilibrium flow conditions. 05

Q.4A Explain how the porosity can influence the hydraulic conductivity and transmissivity of an aquifer. 05

Q.4B Two identical tube wells penetrating fully a 12 m thick aquifer are located at 180 m apart. The tube wells have diameter of 30 cm, radius of influence of 300 m, and the coefficient of permeability of aquifer is 10^{-3} m/sec. Compute 05
 (i) Discharge of tube well when only one is working with a drawdown of 5m.
 (ii) Percentage decrease in discharge of the well, if both are working with drawdown of 5m.

Q.5A A 30 cm diameter well penetrate 25 m below the static water table. After 24 hours of pumping @ 5400 liter/minute, the water level in a test well at 90 m is lowered by 0.53 m, and in well 30 m away the drawdown is 1.11 m 05

- What is transmissibility of the aquifer?
- Also determine the drawdown in the main well.

Q.5B Explain with a neat sketch, the sea water intrusion & shape of interface and what are the method used in abatement of seawater intrusion. 05

A From the collection and interpretation of hydrologic, geologic and geochemical data, the following information was obtained.

05

Width of aquifer	2.8 Km
Thickness of Aquifer	30 m
Porosity of aquifer material	10%
Difference of specific gravity	0.03
Permeability of the aquifer	48.9 m/day

From conductivity measurement in two observations wells located at 150 and 225 m from the shore (landward side) the 1500 ppm lines was found to be located at 15 and 22.5 m, respectively, below the top of the aquifer. Determine the fresh water- sea water interface.

Q.6B Define ground water hydrology and explain with a neat sketch, the ground water distribution with respect to Ground. 05

OR

Q.6B A horizontal confined aquifer of 10 m thickness and infinite areal extent lies with its top level 25 m below ground level. Static Piezometric surface 10 m below ground level. During steady rate of pumpage from the well at 5000 m³/day, the steady drawdown at the well is 12 m. permeability of aquifer formation is 48 m/day. Assume the radius of influences as 500 m. find the effective well diameter, in meters. 05

Q.7A What are sources of saline water intrusion into coastal and other aquifers? Explain the Ghyben -Herzberg relationship between saline water and freshwater. 05

Q.7B A well penetrate into an unconfined aquifer having a saturated depth of 15 m. the discharge is 8000 liter/hour at 6 m drawdown. Assuming equilibrium flow conditions and a homogenous aquifer, compute the discharge at 9 m drawdown. the radius of the influence may be taken as equal in both cases. Deduce the formula that you would use. 05

OR

Q.7B An R.C. network analog has to be constructed to simulate a confined aquifer of 40 × 60 km with an average thickness of 30 m, permeability of 25 m/day, and storage coefficient 4×10^{-4} . The maximum head is 40 m. the model can be represented by 40 × 60 nodes. Resistors of 3000 Ω and capacitor of 0.01 μF are available .model voltage = 8V .work out the scale factor. If the calibrating resistor of 2500 Ω is used for simulating pumping rate, determine the current pulse and excitation voltage to simulate a pumping rate of 1000 m³/day at a particular node. 05

Q.8A An aquifer of 20 m average thickness is overlain by an impermeable layer of 30 m thickness. A test well of 0.5 m diameter and two observation wells 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 m³/sec for a long time, the following drawdown are stabilized in these wells, first observation well, 4m; second observation well, 3m. (i)Show the arrangement in a diagram 2+6+2
(ii) Determine the coefficient of permeability and the drawdown in the test well.
(iii)state the validity of Darcy's law

Q.9A Give an account of the causes for fluctuation of water levels in aquifers due to pressure changes, tides, nearness to rivers and application of load. 10

Q.9B In order to determine the field permeability of a free aquifer, pumping out test was performed and the following observation were made: 10

- 1) Diameter of well = 20 cm
- 2) Discharge from the well = $240 \text{ m}^3/\text{hour}$
- 3) R.L of original water surface, before pumping started = 240.5 m
- 4) R.L of water in the well at constant pumping = 235.6 m
- 5) R.L of the impervious layer = 210 m
- 6) R.L of water in observation well = 239.8 m
- 7) Radial distance of observation well from the tube well = 50 m

Calculate

- i. K
- ii. Error in K if observation are not taken in the observation well, and radius of influence is assumed to be 300m.

Actual radius of influence based on the observation of observation well.

OR

Q.9B What do you understand by recuperation test? Derive the equation used in the test. During a Recuperation test of a 4.0 m open well a recuperation of the depression head from 2.5 m to 1.25 m was found to take place in 90 minute. 10

Determine the :

- (i) specific capacity per unit well area and
- (ii) yield of the well for a safe drawdown of 2.5 m
- (iii) What would be the yield from a well of 5.0 m diameter for a drawdown of 2.25 m?