WMA 302: GROUNDWATER HYDROLOGY II

TIME: 2Hrs

INSTRUCTIONS: Answer ALL Question in Section A and other ANY Other 2 from Section B

SECTION A: Answer ALL Questions

1. .... occurs when at any point in a flow field the magnitude or direction of the flow velocity changes with time.
2. One important difference between steady and transient lies in the relation between their ... **and**... .
3. When water is pumped from an unconfined aquifer, the hydraulic gradients that are reduced by the pumpage create a drawdown cone in the water table itself and the .... of flow.
4. The delineation of transient ..... has obvious importance in a study of groundwater contamination.
5. Multi-......... wells shall not connect aquifers or zones which have differences in water quality which would result in contamination of any aquifer or zone.
6. For the special case of horizontal confined aquifer of thickness b, S = Ssb and T =Kb, and the two-dimensional form of equation becomes...........

7. In a Transient Unsaturated Flow, the degree of saturation θ^1 and $\frac{\theta}{n}$ is this, θ and n represent....

8. When water is pumped from a confined aquifer, the pumpage induce hydraulic gradients towards the well that create the drawdown in the ....
9. .... flow occurs when at any point in a flow field the magnitude and direction of the flow velocity are constant with time.
10. .... means two or more cross-connected wells.
11. In the solution h(x,y,z,t) that describe the value of the hydraulic head at any point in a flow field at any time. Its will solution requires knowledge of three basic hydrogeological parameter ..., .. and ...... and
12. The fluid parameter .... **and** ....
13. .... is an opening in the well casing or well head installed for the primary purpose of determining the position of the water level in the well.
14. .... indicate the instantaneous direction of flow throughout a system (at all times in a steady system, or at a given instant in time in a transient system).
15. .... define as any well constructed for the primary purpose of obtaining samples of groundwater or other liquids for examination or testing,
16. In the 3 approaches that can be used to predict the growth of unconfined drawdown cones in time and space. What is the equation to the Second approach equation? ....
17. One of the Advantage of Pumping Test is that it Provide .... parameter values,
18. State the Richard Equation of transient flow through an unsaturated porous medium ....
19. .... means the yield of the well expressed in gallons per minute per foot of draw-down of the water level (gpm/ft.-dd) per unit of time.
20. One scientific limitation of pumping test relates to the non uniqueness of pumping test........
21. .... Define how fast the water is moving in the discharge pipe
22. The drawdown in the hydraulic head at any point in a confined aquifer in which more than ... is pumping is equal to the sum of the drawdowns that would arise from each of the well independently.
23. In cases where great accuracy is not required ρ_s = ... can be assumed for most mineral soils.

24. what is ρ_s ....

25. The practical disadvantage pumping test method lies in it ....

26. The .... shall be new, seamless or electric-resistance welded galvanized or black steel pipe.

27. .... shall mean that capacity that is equal to the yield that is specified prior to construction of the well.

28..............is define as the maximum quantity of water that a well will yield continuously as determined by methods outlined in literatures

29. .... is an underground container for temporary storage of liquid waste and sewage

30. .... is define as the water level in the water well when a pump has not been running.

31. The well shall not be located in an area generally subject to ....

32. The .... of a porous medium is defined as change in volume or strain, induced in a material under an applied stress, in porous medium

33. .... means the introduction of foreign materials of such nature, quality, and quantity into the groundwaters as to exceed the groundwater quality standards

34. The source of water for any well intended for domestic use shall not be from a water bearing zone or aquifer that is known to be ....

35. .... Includes the pumping water level, discharge pressure, and any gauge corrections.

36. ...... means water used for drinking, bathing, or other household purposes, livestock, or gardens.

37. An understanding of transient flow is required for the analysis of well hydraulic, **groundwater recharge**, and many of the geochemical and geotechnical application.

38. All water supply wells shall be developed by the **well driller**

39. Standard methods for testing domestic well capacities include pump method, **Bailer Method**, Air rotary Drill method and Air Lift Method

40. In water disinfection, chlorine tablets may be dropped in the top of the well and allowed to settle to the **bottom**

41. The pump test results are only valid for the combination (or combinations) of flow and total lift measured.

Section B: Answer ANY Two Questions
15 Marks

1. Fill in the spaces below of these well drilling methods

	Other Names	Drilling Motion	Drill String	Casing Installation Method	Drilling fluid Type	Direction of fluid flow	Retrieval of Cuttings
Cable Tool							
Hallow Rod							
Jetting							

2. A well is 0.4 m in diameter and pumps from an unconfined aquifer 30 m deep at an equilibrium (Steady State) rate of 1000m^3 per day. Two observations well are located at distance 50 m and 100 m and they have been drawn down by 0.2 m and 0.3 m respectively. What is the coefficient of permeability and estimated drawdown at the well?

15 Marks

3. (A) Compute the velocity of groundwater flow in an aquifer that has a coefficient of permeability K = 0.5mm/s. the water table slopes at a rate of 2 m over a distance of 500m, express your answer in metre/day

15 Marks

(B) Define Anisotropic and Isotropic medium