

NNAMDI AZIKIWE UNIVERSITY, AWKA  
FACULTY OF PHYSICAL SCIENCES  
DEPARTMENT OF GEOLOGICAL SCIENCES

SECOND SEMESTER EXAMINATION 2018/2019 SESSION  
COURSE TITLE: APPLIED HYDROGEOLOGY  
COURSE CODE: GLS 412  
TIME: 2HOURS

INSTRUCTIONS: Answer four questions in all. Note: One from each Section. Diagrams and other illustrations are very important.

SECTION A:

1. (i) Define the following terms and give examples: (a) Aquifer (b) Aquitard (c) Aquiclude  
(ii) Draw a well labelled diagram of the hydrologic cycle  
(iii) Briefly discuss five processes of the hydrologic cycle
2. (a) Illustrate with a diagram storage coefficient of confined and unconfined aquifers  
(b) Differentiate between hydraulic conductivity and transmissivity  
(c) An aquifer with hydraulic conductivity of 10ft/day has a saturated thickness of 25ft. Calculate the transmissivity in gallons/day.

SECTION B:

3. (a) Concisely discuss the major differences between point sources and non point sources of pollution/contamination  
(b) Outline three examples of each in three above.
4. (a) Discuss the effects of high concentration of the following in water with respect to water quality (i) iron (ii) sulphate (iii) calcium  
(b) Briefly explain the treatment of iron in non acidic water.

SECTION C:

5. (a) Explain each of the following as applied in hydrogeological studies: (i) water table (ii) piezometric surface (iii) Isotropic flow medium (iv) anisotropic flow medium and (v) homogeneous flow medium.  
(b) Using a well-labelled diagram of elemental control volume of a porous medium, show that for a steady-state saturated flow through a porous medium of linear dimensions x, y, z, and hydraulic head h,  

$$\frac{\partial^2 h}{\partial x^2} + \frac{\partial^2 h}{\partial y^2} + \frac{\partial^2 h}{\partial z^2} = 0$$
 State one hydrological significance of this equation.

6. (a) Briefly explain the necessary parameters to determine the hydraulic head at any given point in a flow field.  
(b) Define: (i) fluid potential (ii) steady state flow  
(c) Considering the various possible components of work involved in fluid flow through porous medium, show that the fluid potential  $\phi$  can be expressed as  

$$\phi = gZ + \frac{p - p_0}{e}$$
 Where Z relates to elevation, e = fluid density

SECTION D:

7. (i) Discuss in details the drawdown response of different aquifers to pumping (diagram necessary) 10marks.  
(ii) What is the difference between the rotary drilling method and the cable tool method? 5marks  
(iii) Describe the term "well efficiency" 5marks.
8. (i) Give a detailed explanation of the three types of flow boundaries in a homogeneous, isotropic system 10marks.  
(ii) State five objectives of pumping test 5marks.  
(iii) Draw Darcy's experimental apparatus explaining terms 5marks.

Cross Sectional Area

Important  
 $Q = -\frac{db}{dt}$