COURSE SYLLABI

Course Code and Name	CE456 Groundwater Engineering			
Credits hours	3 Credit hours			
Contact hours	**Contact**	**Lecture**	**Lab.**	**Tutorial**
	3	3	0	0
Instructor name	Prof. Dr. Yasser A. Mohamed Moussa			
Textbook	Todd, D, K, Larry W. M. Groundwater Hydrology, John Wiley & Sons, 2004			
Other supplemental materials	Bauwer, H. Groundwater Hydrology. Mc-Graw Hill, Kogakusha, Tokyo. 1978 The journal of hydrology, journal of hydrological sciences and journal of hydrological processes may be referred to by the students interested in advanced research in the field of hydrology and water resources engineering - Digital library of jazan university, http://deanships.jazanu.edu.sa/lib/Pages/Default.aspx			

Specific course information

a. Catalog description	**This course cover the following; Introduction to hydrogeology**, forms and classification of subsurface water, Characteristics of porous media, types of aquifers and their properties, porosity, specific yield, specific retention-Flow hydraulics,Darcy's law, coefficient of permeability, transmissibility, constant head and falling head permeameters, stratification. **Geological formations as aquifers**, compressibility of aquifers, specific storage, storage coefficient-Equations of flow, confined groundwater flow between two water bodies, diffusion equation, Laplace equation- Unconfined flow by Dupuit's assumptions, One dimensional Dupuit's flow with and without recharge-**Wells,** steady flow into a well – confined flow and unconfined flow,Thiem's equation, pumping tests, drawdown test, recovery test, well loss, artificial and natural recharge, estimation of recharge.
b. Prerequisite	CE352, Fluid mechanics
c. Required / Elective	Elective

Course Specific Goals & Course Learning Outcomes (CLOs)

By the end of this course, the student will be able to:
1. Qualitatively categorize the various forms of subsurface water
2. Understand the types of aquifers and their properties
3. Understand the porous media properties that control groundwater flow and transport, including porosity, hydraulic conductivity, and compressibility
4. Appreciate the importance of groundwater in the management and augmentation of water resources of a region

5. Understand and apply Darcy's law for solving groundwater movement problems
6. Identify geological formations as potential aquifers for groundwater development
7. Solve basic problems related to confined and unconfined aquifers
8. Understand the concept of continuity of motion governing unsteady and steady groundwater flow in a homogeneous isotropic confined aquifer
9. Understand expressions for the steady state radial flow into a well under both confined and unconfined aquifer conditions

10 Understand different types of pump tests, and analyze pump test data to determine aquifer properties

CLOs

CLO#1 Student able to define and recognize principles of groundwater
<u>CLO (#2):</u> **Student able to write Darcy's law for solving groundwater movement**
<u>CLO (#3):</u> **Students able to estimate discharge from well**
<u>CLO (#4):</u> **Student able to describe drawdown and recovery test**