****

**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY SCHOOL OF SPATIAL PLANNING**

**UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN WATER RESOURCE AND ENVIRONMENTAL MANAGEMENT**

 **SEMESTER 2016/2017 ACADEMIC YEAR**

**CENTRE: MAIN CAMPUS**

**COURSE CODE: PWE 3323**

**COURSE TITLE: GROUND WATER ASSESSMENT, DEVELOPMENT AND MANAGEMENT**

**EXAM VENUE: LR 18 STREAM: SPATIAL PLANNING**

**DATE: 27/04/17 EXAM SESSION: 9.00 – 11.00 AM**

**TIME: 2 HOURS**

**Instructions:**

1. **Answer question 1 ( compulsory ) and ANY other 2 questions.**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

**QUESTION ONE**

1. Discuss hydrologic cycle processes. (9 marks)
2. With the aid of a sketch discuss the zones of underground water. (9 marks)
3. Differentiate between the following terms:
4. Porosity and specific yield. (2 marks)
5. Confined and unconfined aquifer. (2 marks)
6. Flowing artesian well and non-flowing artesian well (2 marks)
7. Discuss the construction features of a strainer well. (6 marks)

**QUESTION TWO**

1. Define Darcy’s Law and explain its assumptions and limitations. (5 marks)
2. Describe assumptions and limitations of Dupuit’s theory for unconfined aquifer.

 (6 marks)

1. Calculate the discharge from a well 1.5 m in diameter for which pumping at a steady rate gives a drawdown of 3.0 m. the height of the aquifer from the bottom of the well is 16 m and the bottom is near the impervious stratum. The radius of influence is 160 m and the value of the coefficient of permeability is 24.5 m/day. (9 marks)

**QUESTION THREE**

1. Explain how well development is carried out and outline its objectives.(10 marks)
2. Explain the purpose of pumping test and describe a procedure for carrying it.

 (10 marks)

**QUESTION FOUR**

1. Discuss any three methods of artificial recharge of ground water. (10 marks)
2. Explain saltwater intrusion. (4 marks)
3. Discuss the construction features of cavity type tube well. (6 marks)

**QUESTION FIVE**

1. Discuss conjunctive use of surface and groundwater. (5 marks)
2. Discuss possible sources of groundwater contamination and their remediation.

 (8 marks)

1. Derive an expression for discharge from a well fully penetrating a confined aquifer. (7 marks)