DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY

UNIVERSITY EXAMINATIONS 2020/2021 ACADEMIC YEAR

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION TECHNOLOGY IN CIVIL ENGINEERING, AND BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2513/ECE 5102: WATER RESOURCES ENGINEERING I

DATE: 23RD SEPTEMBER 2021 **TIME: 2:00-4:00PM**

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **four** questions.

Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

QUESTION ONE (COMPULSORY)

a. Using a neat diagram/schematization discuss the hydrological cycle indicating the various storages and fluxes (10 Marks)

b. Describe the types of embankment dams and the main design analysis for their construction. (8 Marks)

c. Using practical examples, discuss the watershed management interventions used to enhance soil and water conservation practices in a catchment (4 Marks)

d. What is sustainable development in water resources? Describe THREE types of sustainability that relate to water resources (8 marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 Marks)

a. Consider the following geological formations: a) heavily karstified limestone (20% of the rock has been dissolved), b) well sorted sandstone, c) clay, d) well sorted sand, e) massive granite (10 marks)
   i. Order these geological formation in decreasing porosity
   ii. Order these geological formations in decreasing permeability and indicate for each formation if you would consider it an aquifer, aquitard, aquiclude or aquifuge

b. Using a neat diagram, discuss the THREE types of aquifers (10 marks)

QUESTION THREE (20 Marks)

a. Explain the following curves in respect to reservoir capacity planning (5 Marks)

i. Area elevation curve

ii. Elevation capacity curve

b. Describe the type of forces acting on a buttress dam that a design engineer must consider when designing. (5 Marks)

c. An unconfined aquifer has a thickness of 30 m. a fully penetrating 20 m diameter well in this aquifer is pumped at the rate of 35 litres per second. The drawdown measured in two observation wells located at distance of 10 m and 100 m from the well are 7.5 m and 0.5 m respectively. Determine the average hydraulic conductivity of the aquifer. At what distance from the well the drawdown is insignificant i.e. is zero. (10 Marks)

QUESTION FOUR (20 Marks)

a. With a neat diagram, citing the components of a run-off hydropower system, discuss how it works and its advantage (5 Marks)

b. Discuss the requirements needed for the construction of a hydropower plant (5 marks)

c. The following catchment characteristics are available for estimate sediment yields in a reservoir. Area = 37.5km2; MAP = 770mm; slope (elevation = 300m; distance = 6km). The catchment has moderately good vegetation cover (score= 10); moderately well drained soil of medium texture (score = 20) and no visible gullies (score = 10). The reservoir volume to annual inflow is assumed to be equal. The dam original capacity at full supply level is 0.34Mm3.Estimate the proportion of the dam capacity lost over 20 years. (10Marks)

Sediment trapping efficiency

Dam capacity/inflow ration	Sediment trap efficiency
1.0	1.00
0.5	0.99
0.4	0.98
NB: **Assume settled density of dam sediment deposits as 1.2 t/m^3**	