



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

**UNIVERSITY EXAMINATIONS FOR THE DEGREE IN SCIENCE IN RENEWABLE
ENERGY, TECHNOLOGY AND MANAGEMENT**

3RD YEAR 1ST SEMESTER 2021/2022 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TEB 1303

COURSE TITLE: WIND ENRGY TECHNOLOGY I

EXAM VENUE:

STREAM: BSc REN TECH & MGT

DATE: ../11/2022

EXAM SESSION:

DURATION: 2 HOURS

Instructions

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

QUESTION ONE

- (a). Discuss briefly the role of catchment descriptors in translation of rainfall to runoff. **[4 marks]**
- (b). using a clearly labeled diagram of shape of hydrograph name the components and discuss their role in flood runoff. . **[5marks]**
- (c). Define a unit hydrograph and describe the basic assumptions in unit hydrograph theory. . **[4 marks]**
- (d). Using the hydrograph table below, derive a unit hydrograph for the 8640 km² drainage area. What is the intensity of effective rain fall?. . **[5marks]**

Determination of a Unit Hydrograph from Isolated Storm						
1	2	3	4	5	6	7
Time Unit (day)= 86400 Sec.	Total Runoff (m ³ /sec	base Flow	Total Direct Runoff : DR (2)-(3) m ³ /sec	Δt (hrs)	Direct Runoff : DR* (5) in (m ³)	Unit hydrograph ordinate, (4) divide by 20.3mm
1	66	66	0	24		
2	971	74	897	24		
3	708	82	626	24		
4	396	92	304	24		
5	254	100	154	24		
6	163	110	53	24		
7	122	122	0	24		
8	91	91	0	24		
9	76	76	0	24		
10	66	66	0	24		
			2034			
			in m ³ /24hrs		in mm	

- (e). given excess rainfall of 1 and 2 mm during time units 1, 2 respectively (24 hours) calculate the hydrograph of outflow using the unit hydrograph calculated in (d) above. . **[10marks]**

Unit Hydrograph Application					
1	2	3	4		5
Time Unit (day)	Unit hydrograph ordinates (m ³ /sec mm)	Excess Rainfall (mm)	hydrograph ordinates for rainfall Units 1 2		Total Outflow Hydrograph ordinates
1	44.10	1			
2	30.8	2			
3	15.0				
4	7.6				
5	2.6				
6					

QUESTION TWO

(a). Hydropower technology has been practiced globally for a long time and hydro schemes are spread in all regions worldwide. The potentials of hydro schemes and their classification vary significantly between regions, however with respect to “head and size of river flow three main types off hydropower schemes are categorized identify and discuss them. **[9marks]**

(b). Briefly explain the function of these components of hydro power scheme. **[11marks]**

- I. Side intake with weir
- II. Power Channels
- III. Settling basin
- IV. Spillways
- V. Forebay tank
- VI. Penstock

QUESTION THREE

(a) The theoretical electrical power output of hydropower scheme is a function of two major variables, discuss the influences each variable have on scheme power generation. **[6marks]**

(b) A stream of fluid could do work as a result of its pressure P , velocity v , and elevation z . The total energy per unit weight of the fluid is given by $H = \{P/\rho g\} + \{V^2/ 2g\} + Z$ **[6marks]**

IF the weight per unit of fluid flowing is known, develop the power of the stream.

Where

P = pressure head

V = velocity head

ρ = density of water (1,000 kg/m³),

g = the acceleration of gravity (9.81 m/s²)

Z = Potential head , depth

(c) Water is drawn from a reservoir in which the water level is 260m above datum, at the rate of 0.14 m³/s. The outlet of the pipe is at datum level and is fitted with a nozzle to a Pelton wheel turbine type. If the velocity of the jet is 68m/sec. calculate **[8marks]**

- I. The power of the jet
- II. The power supplied FROM THE rese
- III. The used to overcome losses
- IV. The efficiency of the pipeline and nozzle in transmitting power.

QUESTION FOUR

- a) Describe the two fundamental and basic mechanism how turbines in hydropower schemes convert the stream potential energy to power. **[4 marks]**
- b) Describe two classification methods which is used in turbine selection and name a turbine type falling in each category. **[4 marks]**
- c) There is a wide spread perception that small hydropower schemes is more “pro poor” than other forms of rural electrification yet this perception is not necessarily true scientific literature and recent evaluation suggest that management policy with appropriate program that may lead to improved uptake of electricity is critical discus. . **[6 marks]**
- d) Describe Governing in hydroelectric power station. **[6 marks]**

QUESTION FIVE

- a) Differentiate between Synchronous generators and Asynchronous **[8marks]**
- b) Hydropower is a renewable, clean and non-polluting energy resource with high conversion efficiency operational and economic superiority over other power generation means however depending on the site and layout of the scheme, temporary and permanent impacts have been reported to occur during construction and operational phases of Small Hydropower Plants. As a Environmental and impact assessment officer what are the matter you wound critical address in your report when assessing it for an hydropower project **[12marks]**