Strathmore
UNIVERSITY

SCHOOL OF COMPUTING AND ENGINEERING SCIENCES

MASTER OF SUSTAINABLE ENERGY TRANSITION

END OF SEMESTER EXAMINATION

MSSET 8503: POWER SYSTEMS FUNDAMENTALS

DATE: 14th December 2023 **Time: 18:00-20:30 Hours**

Instructions

1. This examination consists of **FOUR** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

QUESTION ONE [20 MARKS]

a)

i) Differentiate between a chronological load curve and a load duration curve as used in power systems.

ii) Plot the load duration curve for the chronological load curve given in figure Q 1 a) below. **[5 marks]**

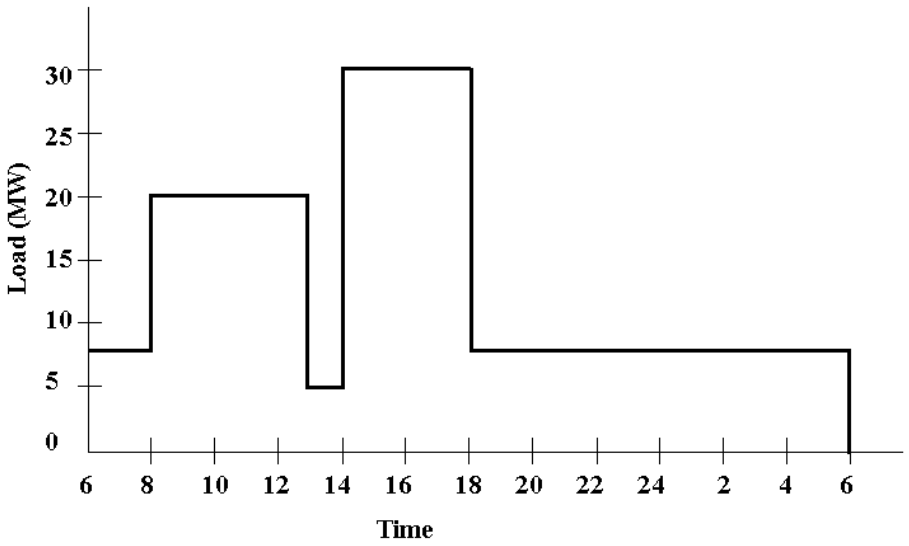

Figure Q 1 a)

b) Classify power system protection circuit breakers based on the arch quenching mechanism used during their operation. Briefly describe each classification.

[5 marks]

c) Name and describe the demand drivers considered in electricity demand forecasting in Kenya. **[4 marks]**

d) Describe the role of the following players with respect to the Kenyan power market.

i) Kenya Electricity Generating Company (KenGen)

ii) Kenya Power and Lighting Company (KPLC)

iii) Kenya Electricity Transmission Company Limited (KETRACO)

iv) Rural Electrification and Renewable Energy Corporation (REREC)

[6 marks]

QUESTION TWO [15 MARKS]

a)

(i) What are unsymmetrical faults in power systems?

(ii) Briefly discuss the main types of unsymmetrical faults in power systems.

[6 marks]

b) While a transformer is the major equipment in a substation. Describe the main types of these power substations as used in power systems networks. **[4 marks]**

c) Describe the main factors that limit the amount of power transmitted over 3-phase AC transmission lines **[5 marks]**

QUESTION THREE [15 MARKS]

a)

(i) Distinguish between centralized and decentralised/distributed power generation as used in power systems.

(ii) Give the main applications that can necessitate the use of decentralised generation as a way of meeting the electricity requirements

[8 marks]

b) Describe and compare bottom up and top-down electricity demand forecasting approaches, highlighting the advantages and disadvantages of each **[7 marks]**

QUESTION FOUR [15 MARKS]

a) Discuss the difference between base load, intermediate and peak load generating plants as used in an interconnected power system such as Kenya's. **[5 marks]**

b) The daily demands of three consumers are given below:

Time	**Consumer 1**	**Consumer 2**	**Consumer 3**
12 midnight to 8 A.M.	No load	200 W	No load
8 A.M. to 2 P.M.	600 W	No load	200 W
2 P.M. to 4 P.M.	200 W	1000 W	1200 W
4 P.M. to 10 P.M.	800 W	No load	No load
10 P.M. to midnight	No load	200 W	200 W

Plot the load curve and find

(i) Maximum demand of individual consumer

(ii) Load factor of individual consumer

(iii) Diversity factor and

(iv) Load factor of the station. **[10 marks]**