



(University of Choice)
**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

**UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR**

SECOND YEAR SECOND SEMESTER EXAMINATIONS

**FOR DIPLOMA
IN
ELECTRICAL AND ELECTRONICS ENGINEERING**

COURSE CODE: DEE 076
COURSE TITLE: POWER SYSTEMS I

DATE: Tuesday 19th April, 2022 **TIME: 12.00 pm – 2.00 pm**

INSTRUCTIONS TO CANDIDATES

Question ONE (1) is compulsory
Answer Any Other TWO (2) questions

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.



QUESTION ONE

- a) Define the following terms as used in power systems *(3 marks)*
- i) Variable load
 - ii) Load factor
 - iii) Relay
- b) i) State any two significance payed by a well plotted load curve *(2 Marks)*
- ii) A 100 MW power station delivers 100MW for 2 hours, 50MW for 6 hours and is shut down for the rest of each day. It is also shut down for maintenance for 45 days each year. Calculate its annual load factor. *(4 Marks)*
- c) i) Explain any four fundamental requirements of a protective relay *(4 Marks)*
- ii) With an aid of a well-labelled diagram, explain the operation of a differential relay *(5 Marks)*
- d) i) Discuss the following terms as used in circuit breaker analysis *(3 Marks)*
- i Arc voltage
 - ii Restriking voltage
 - iii Recovery voltage
- ii) Explain hoe Buchholz relay system works in order to protect a transformer against an over-current fault *(6 Marks)*
- e) Explain any three advantages associated with generation of power using hydro-electric power projects *(3 Marks)*

QUESTION TWO

- a) State any two fundamental economic principles that govern electrical design of transmission lines (2 marks)
- b) A generating station has the following daily loads cycle

<i>Time (Hours)</i>	0 - 6	6 - 10	10 - 12	12 - 16	16 - 20	20 - 24
<i>Load (MW)</i>	40	50	60	50	70	40

Using the data above, draw the load curve and use it to find

- i) Maximum demand ii) Units generated per day
iii) Average load iv) Load factor (10 Marks)
- c) Explain two effects a variable load can have on power system (4 Marks)
- d) A generating station has a connected load of 43MW and a maximum demand of 20MW; the units generated being 61.5×10^6 per annum. Calculate
i) Demand factor (2 Marks)
ii) Load factor (2 Marks)

QUESTION THREE

- a) Explain any three faults that may occur in an alternator and how they can be protected from re-occurring (6 Marks)
- b) i) Explain the operating principle of a circuit breaker (4 Marks)
ii) With an aid of a well-labelled diagram, explain the working principle of the following circuit breakers:
i) Air-blast circuit breaker (4 Marks)
ii) Oil circuit breakers (4 Marks)
- c) Briefly explain how oil circuit breakers are maintained (2 Mark)

QUESTION FOUR

- a) With an aid of a diagram, explain how a relay works *(4 marks)*
- b) Explain how the following relay systems works
- i) Distance relay *(4 Marks)*
 - ii) Electro-Magnetic attraction relays *(4 Marks)*
- c) Explain how a differential protection system protects a busbar during a fault condition *(5 Marks)*
- d) State any three types of power generation station found in Kenya *(3 Marks)*