



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**MAIN CAMPUS**

**UNIVERSITY EXAMINATIONS  
2021/2022 ACADEMIC YEAR**

**THIRD YEAR SPECIAL/SUPP EXAMINATIONS**

**FOR THE AWARD  
OF  
DIPLOMA IN ENGINEERING**

**COURSE CODE: DEE 087**

**COURSE TITLE: POWER SYSTEMS II**

**DATE: Thursday 6<sup>th</sup> Oct, 2022**

**TIME: 2.00p.m – 4.00P.m**

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**INSTRUCTIONS TO CANDIDATES**

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS.  
QUESTION ONE CARRIES 30 MARKS AND ALL OTHERS 20 MARKS EACH.

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over. 

**Q1.**

- a) (i) Define the term corona as commonly used in transmission lines. (2 mks)
- (ii) State the four factors that affect the corona loss on overhead transmission line.(4 mks)
- b) Explain four main parameters which affect performance of a transmission. (8 mks)
- c) Differentiate between the following terms:
- Symmetrical and asymmetrical faults. (4marks)
  - Positive sequence network and negative sequence network. (4 marks)
- d) A 132 KV 3- $\phi$  line with 2.2.cm diameter conductors is built so that corona takes place if the line voltage exceeds 110 KV (r.m.s). If the value of potential gradient at which ionization occur can be taken as 20 KV per cm, calculate the spacing between the conductors. (Assume irregularity factor  $m_0=1$  and standard pressure and temperature, for which air density factor  $\delta=1$ ) (8 marks)

**Q2.**

- a) State two methods to reduce corona loss. (2 marks)
- b) Explain the concept of transposition in power system. (4 marks)
- c) A 1- $\phi$  line has two parallel conductor 2 cm apart. The diameter of each conductor is 1.2cm. Calculate the loop inductance per km of line. (5 marks)
- d) A 3- $\phi$  50Hz, 132KV overhead line has conductors placed in a horizontal plan 4m apart. The conductor diameter is 2 cm. If the line length is 100km, calculate the charging current per phase assuming complete transposition. (9 marks)

**Q3**

- a) Explain each of the following terms as commonly used in analysis of corona effects.
- Critical disruptive voltage. (2 marks)
  - Visual critical voltage. (2 marks)
- b) State four main properties of a good switch gears. (4 marks)

- c) The maximum and minimum stresses in the dielectric of a single core-cable are 40 KV/cm r.m.s and 10 KV /cm r,m,s respectively. Find:
- Thickness of the insulator. (4 marks)
  - Operating voltage. (4 marks)
- d) The capacitance per km of 3- $\phi$  belted cable is 0.3 $\mu$ F between the two cores with the 3<sup>rd</sup> connected to the lead sheath; calculate the charging current taken by 5 km of this cable when connected to 3- $\phi$ , 11KV, 50 Hz. (4 marks)

#### Q4

- a) Explain the following terms as used in arc phenomenon.
- Arc voltage. (2 marks)
  - Restricting voltage. (2 marks)
  - Recovering voltage. (2 marks)
- b) State five advantages of underground cables. (5 marks)
- c) The plant capacity of a 3- $\phi$  generating station consists of 2, 10,000 KVA generator of reactance 12% each and 1, 5000 KVA generator of reactance 180%, from which load is taken through 5000KVA step-up transformers each having reactance of 5%. Determine the maximum fault MVA with the circuit breaker on:
- Low voltage side. (5 marks)
  - High voltage side may have to deal with. (4 marks)

#### Q5

- a) The insulation resistance of a single core cable is 495m $\Omega$ /km. If the core diameter is 2.5cm and  $g=4.5 \times 10^{14} \Omega\text{-cm}$ , find the insulation thickness for 1 km of cable. (6 marks)
- b) Calculate the capacitance and charging current of a single core cable used on a 3- $\phi$  66KV system. The cable is 1km long, has a core diameter of 10cm and impregnated paper insulation of 7cm. The relative permittivity of the insulation may be taken as 4 and supply is at 50Hz. (6 marks)
- c) The P.u values of positive, negative and zero sequence reactance of a network at fault are 0.08, 0.07 and 0.05. Determine the fault current if the fault is double line to ground. (8 marks)