

BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING (EVENING) EXAMINATION, 2018

(3RD YEAR, 2nd Semester)

HIGH VOLTAGE ENGINEERING

Time: Three hours

Full Marks: 100
(50 marks for each part)

Use a separate Answer - Script for each part.

Part I

Answer *any three* questions.

Two marks are reserved for neat and well organized answers.

1. a) Name the different types of insulators used in power systems. Mention the use of each type of insulator. 6
- b) Discuss why provision of a grading ring improves string efficiency. 4
- c) In a three unit string insulator, the joint to tower capacitance is 20% of the capacitance of each unit. By how much should the capacitance of the lowest unit be increased to get a string efficiency of 90%. The remaining two units are left unchanged. 6
2. a) Describe the phenomenon of corona. Discuss the factors which affect the corona loss. 9
- b) Find the disruptive critical voltage and visual critical voltage (for local and general corona) for a three phase line having 1 cm diameter conductors spaced in 3 m delta arrangement. Assume temperature 26°C, pressure 74 cm of mercury, surface factor 0.85 and irregularity factor for local visual corona 0.72 and for general visual corona 0.82. 7
3. a) Draw the cross section of a three core belted cable. Discuss the function of each part. 8

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- b) Show that for a given voltage V and maximum stress in the dielectric of a single core cable, the sheath diameter is minimum where $D : d = e$, where d = conductor diameter and e = base of natural logarithms. Determine D and d for $V = 10$ kV and a maximum stress of 23 kV/cm. 8
4. a) Explain what you mean by 'back - flashover'. Show that low value of tower footing resistance reduces chance of occurring back flashover. 6
- b) Discuss the conditions to be satisfied so that proper protection from ground wire is obtained. 4
- c) An overhead transmission line with surge impedance 500 ohm bifurcates into two lines of surge impedance 500 ohm and 50 ohm respectively. If a surge of 25 kV is incident on the overhead line, determine the magnitudes of voltage and current which enter the bifurcated lines. 7
5. a) Explain the phenomenon of lightning. Also explain the terms direct and indirect lightning strokes. 8
- b) Explain what you mean by arcing ground. With the help of circuit diagram and phasor diagram explain the working of Peterson coil. 8

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PART-II**Answer any three questions***(Two marks are reserve for neatness and well organized answers)*

1. a) Give a comparative analysis between a high voltage power transformer and a high voltage testing transformer. 6
- b) With a neat sketch, explain the principle of a three-stage cascade connection in testing transformer for producing high ac power frequency voltage. Why the lowest unit is loaded more? 10
2. a) With the help of a schematic, explain the working principle of a Cockcroft-Walton voltage doubler circuit. 8
- b) A Cockcroft-Walton voltage doubler circuit is used to test a cable at 175 kV. The insulation resistance of the cable is $3 \times 10^7 \Omega/\text{m}$ and the length of the cable is 15 m. Stage capacitances are $0.15 \mu\text{F}$ and $0.20 \mu\text{F}$ respectively. The doubler is supplied from a 300V/250 kV testing transformer. Calculate the voltage to be applied to the input of the transformer at 50Hz. 8
3. a) Draw the circuit diagram of a Chuub-Fortescue peak voltmeter circuit. Describe the principle of operation of this peak voltmeter circuit and discuss about the limitation of this peak voltage measurement. 8
- b) With a neat sketch, explain the operation of Electrostatic voltmeter. 8
4. a) With a neat sketch, explain the operation of a multi stage Marx generator circuit for generating lightning impulse. 10
- b) Why is triggering required in an impulse generator? Describe a typical triggering arrangement. 6

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5. Write short notes on any two of the following: 2x8=16
- a) Capacitive Voltage Transformer (CVT)
 - b) Symmetric voltage doubler circuit
 - d) High voltage generation by series resonance circuit

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