B.E. ELECTRICAL ENGINEERING THIRD YEAR SECOND SEMESTER SUPPLEMENTARY EXAM - 2023

SUBJECT: HIGH VOLTAGE ENGINEERING

Time: Three Hours

Full Marks 100

(50 Marks for each part)

Use a separate Answer-Script for each part

Two marks for neat and well-organized answers

Question No.	Part I	Marks

Answer any three questions

1.	(a)	Correct and/or justify the statement- "Corona is a self-checking process".	4
	(b)	Mention some of the effects associated with corona in high voltage transmission line.	4
	(c)	Show that for a single phase two conductor system V_d is proportional to $\left[r \times \ln \dfrac{d}{r} \right]$ (kV_{rms} to neutral), where the symbols have usual meaning.	8
2.	(a)	Deduce the general expression of surge impedance.	6
	(b)	Show that surge impedance of transmission line is almost ten times more than that of cables.	6
	(c)	Explain the advantages of using suspension insulators in high voltage transmission system.	4
3.	(a)	What do you understand by transmission and reflection of travelling waves? Explain with a suitable example why tower footing resistance should be kept as low as possible.	4+6
	(b)	A rectangular surge of 100kV travels along an overhead line of surge impedance 400Ω towards a junction comprising of another overhead line of 350Ω. Find out the reflected and transmitted voltage and the current waves as applicable in the junction.	6

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4. (a) Define and explain string efficiency in the case of suspension disc insulators.   3

    (b) A three phase transmission line is arranged in an equilateral triangle. This transmission line has a total corona loss of 53kW at line voltage of 106kV and a loss of 98kW at line voltage of 110.9 kV. Calculate the disruptive critical voltage with respect to neutral. Also calculate the corona loss at 132 kV.   6

    (c) Explain with suitable phasor diagram how Peterson Coil can prevent arcing ground condition.   7

5. (a) Why bundle conductors are used in high voltage transmission line?   3

    (b) Show how the switching of breakers in a charged high voltage line can give rise to overvoltage.   7

    (c) Discuss about comparative gain in case of an optimum size normal single core cable to that of an inter sheath cable.   6

Ex/EE/PC/B/T/322/2023(S)

B.E. ELECTRICAL ENGINEERING EXAMINATION, 2023

(3rd Year, 2nd Semester, Supplementary)

HIGH VOLTAGE ENGINEERING

Time: Three Hours   Full Marks: 100

(50 marks for each part)

Use a separate Answer-script for each Part

PART- II

Answer any *three questions*

(*Two marks are reserved 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) Draw an asymmetric voltage doubler circuit for HVDC generation and explain its principle of operation under no-load condition.   6

   b) A Cockcroft-Walton voltage doubler circuit is used to test a cable at 150 kV DC. The insulation resistance of the cable is $2.5 \times 10^7 \Omega/m$ and the length of the cable is 12 m. Stage capacitances are 0.12 µF and 0.15 µF, respectively. The doubler is supplied from a 400V/200kV testing transformer. Calculate the voltage to be applied at the input of the transformer at 50Hz.   6

   c) Draw the circuit diagram of a symmetric voltage doubler circuit for HVDC generation in which the isolating transformer is not required.   4

3. a) With proper schematic, explain the operation of a multi stage impulse generator circuit.   10

   b) Why triggering is required in an impulse generator? Describe a typical triggering arrangement.   6

4. a) Draw the circuit diagram of a peak voltmeter that contains a bleeder resistance. Describe the principle of operation of such a peak voltmeter and state in details the errors associated with peak voltage measurement using such a peak voltmeter.   10

   b) With the help of circuit and phasor diagrams explain why capacitive voltage transformers are used in resonant condition.   6

5. Write short notes on any two of the following: 2×8

   a) Representation of standard lightning impulse voltage waveform by two exponential curves.
   b) Measurement of high voltage using sphere gap
   c) Advantages of HVAC generation using series resonance circuit

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