BACHELOR OF ENGINEERING IN

ELECTRICAL ENGINEERING (EVENING) EXAMINATION, 2017

(5th Year, 2nd Semester, Old Syllabus)

HIGH VOLTAGE TECHNIQUE - II

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 neatness and well organized answer script

1. a) A transformer has an impulse insulation level of 1050kV and is to be operated with an insulation margin of 15% under lightning impulse conditions. A transformer has a surge impedance of 1600Ω and is connected to a transmission line having a surge impedance of 400Ω. A short length of overhead earth wire is to be used for shielding the line near the transformer from direct strikes. Beyond the shielded length, direct strokes on the phase conductor can give rise to voltage waves of the form $1000e^{-0.05t}$kV (t in μs).
If the corona distortion in the line is represented by the expression

$$\frac{\Delta t}{x} = \frac{1}{B}\left[1 - \frac{e_0}{e}\right] \text{ μs/m}$$

Where x is the length of wire in m, B = 110m/μs and e_0 = 200kV, determine the minimum length of shielding wire necessary in order that the transformer insulation will not fail due to lightning surges. 8

b) What are the types of grounding used in high voltage laboratories? Explain with sketches wherever applicable. 8

2. a) Discuss about modern triggering arrangement used in multiplier stage of impulse generator circuit. 8

b) Explain the terms (i) Factor of Earthing, (ii) Effectively Earthed System, (iii) Insulation Level and (iv) Conventional Impulse Withstand Voltage, with respect to insulation coordination. 4×2

3. a) Briefly state the various methods of measurement of high DC, AC and impulse voltages and currents in the laboratory. 6

b) Estimate the clearances required and the approximate dimensions of the test room for a high voltage laboratory with the following equipment.
A.C. testing transformer : 25 kVA, 250 kV; Size : 1.2 m dia x 3m (including bushing height)
Impulse voltage generator: 800 kV, 24 kJ, 8 stage; Size: 1.5m x 1.5m x 3m
Charging unit requires a space of 1 m x 1 m x 1 m.
Accessories include a 75 cm sphere gap, 900 kV capacitance potential divider and a 200 kV gas filled standard capacitor. 10

4. a) Explain how a high voltage Schering bridge can measure the capacitance along with dielectric dissipation factor of a high voltage capacitor under test. Give suitable schematic. 8

b) With suitable illustration, show how a Schering bridge arrangement can be modified for grounded capacitors. 8

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

(i) Non-contact type high voltage measuring instrument.
(ii) Surge diverters.
(iii) Lichtenberg figures in lightning impulse voltage measurement.

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Ref. No. Ex/EE/5/T/522B/2017 (old)

B.E. ELECTRICAL ENGINEERING (PART TIME) FIFTH YEAR SECOND SEMESTER (Old)- 2017

SUBJECT : HIGH VOLTAGE TECHNIQUE-II

Time : Three hours **Full Marks: 100**
(50 marks for each part)

Use Separate Answer scripts for each part

No. of questions	Part II Answer any three questions (Two marks reserved for neat and well-organized answers)	Marks
1. a)	Explain how the statistical approach to insulation coordination combines the insulation breakdown probability function of an insulation structure with the overvoltage probability density function.	8
b)	Explain how the protection level of a protective gap is related to the insulation level of the protected device such as an insulator string, with the help of a neat diagram.	8
2. a)	What is EMTP and why is it important in the context of simulation of transient phenomena?	4
b)	Starting from the basic differential equations, deduce the equivalent model of a series connected RLC branch in EMTP.	12
3. a)	Show how a direct lightning stroke on a line or tower can lead to flashover. Assume suitable values wherever needed.	6
b)	Explain how ground wires can protect the transmission line from a direct lightning strike.	6
c)	Explain the significance of a low footing resistance of a transmission tower in the context of protection of the transmission line.	4
4.a)	Briefly explain the ferroresonance phenomenon with the help of neat diagrams.	8
b)	Explain with the help of graphs how the voltage and capacitance values can affect the ferroresonant operating points.	8
5.	Write short notes on the following:	
a)	Lightning Impulse Test on Transformers	8
b)	Insulation Coordination	8