Ref. No. Ex/EE/T/423B/2017

Bachelor of Electrical Engineering, 4th Year, 2nd Semester examination 2017

Elective – II

High Voltage Technology – II

Time: 3 Hours **Full Marks: 100**

Use Separate Answer scripts for Each Part

Part – I

Answer any three questions. 2 marks for neat and well organized answer scripts.

1. (a) Explain how a non-linear branch can be taken care of in computing the transient response of an otherwise linear circuit, with the help of EMTP.
   (b) Derive the [Y] matrix for the determination of output of a single-stage impulse generator. 08+08
2. (a) Discuss series ferro-resonance.
   (b) Derive the equivalent circuit for a 3-ph switching scheme where one of the switches has failed to make while charging a transformer on no-load through cables, from a 3-ph a.c. source. 08+08
3. (a) Show analytically how the insulation of a transformer winding is affected by the winding parameters while encountering a steep fronted surge. Justify the equivalent circuit considered for this purpose.
   (b) Discuss in details, Protective Level in a substation. 10+06
4. (a) Explain how the IEC regulation links the Critical Flashover Voltage of an insulator with the Withstand Voltage. Also explain the problem of determining probability of flashover accurately for large departures from the mean.
   (b) Discuss Basic Insulation Level for the equipment of a substation. 10+06
5. Write short Notes on any two :
   (a) Ferro-resonance in grounded and ungrounded neutral systems (b) Modal transformation
   (c) Transformer winding equivalent circuit and its step response. 08+08

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Ex/EE/T/423B/2017

BACHELOR OF ENGINEERING IN

ELECTRICAL ENGINEERING (FINAL) EXAMINATION, 2017

(4th 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-II

Answer ***any three*** questions

Two marks are reserved for neatness and well organized answer script

1. a) Briefly discuss about the layout of high voltage laboratories. 6

   b) Explain the different type of grounding used in high voltage laboratories with neat sketches. 10

2. a) 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

   b) Give the relative merits and demerits of single diode rectifier circuit and Cockroft-Walton voltage multiplier circuit in the charging stage of an impulse generator. 6

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

   b) A generating voltmeter with a four pole synchronous motor drive has to be designed so that it can have a range of 20-200kV d.c. If the indicating meter reads a minimum current of 2μA, what should be the capacitance of the generating voltmeter? Also give the maximum range of the indicating instrument. 8

4. a) 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

b) 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

5. 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

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