B.ELECTRICAL ENGG. (Evening) Examination, 2017
(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)   State the advantages of glass insulators. Define string efficiency.   4

   b)   Define protected creepage distance and mention its significance.   3

   c)   In a string of five identical disc units, each disc can be subjected to a power   9
        frequency voltage of 30 kV (peak) safely. If the ratio of the pin to earth
        capacitance to that of self-capacitance of each disc is 0.17, find the voltage of
        the three–phase system which can be safely insulated by this string. Calculate
        string efficiency.

2. a)   Arcing horns protect the insulators from damage due to flashover - justify.   3

   b)   Mention the effects that are associated with corona formation. Justify the   6
        statement - corona is a self-checking process.

   c)   A three phase 220 kV, 50 Hz transmission line has conductors spaced in 5   7
        meters at the corners of a delta. Each conductor has a radius of 1 cm with
        surface irregularity factor of 0.92. Weather conditions are: temperature 40^{0}C
        and pressure 75.2 cm of Hg. Find the corona loss/km of the transmission line if
        there is an over voltage of 1.8 p.u. For a surface correction factor of 0.82
        calculate visual corona voltage.

3. a)   Give an idea of development of switching overvoltage in power system.   6

[Turn over

b) Explain the terms i) return stroke, ii) direct lightning stroke and iii) indirect 6
lightning stroke.

c) With the help of a neat diagram explain the working principle of a protector 4
tube.

4. a) Explain what is meant by insulation co-ordination. State the utility of using 7
arcing horns.

b) Explain in brief what do you mean by arcing ground phenomenon. 3

c) A 33 kV, 50 Hz network has the capacitance to neutral of 1.0 µF per phase. 6
Calculate the value of the inductance that is to be added to prevent the arcing
ground condition. Draw the phasor diagram.

5. a) With help of a neat diagram explain the stress distribution in a bushing. State 5
how stress distribution improves in a condenser bushing.

b) State the requirements of EHV cables. 3

c) An 85 kV, single-core metal sheath cable has a dielectric material which can 8
withstand maximum stress 60kV/cm. This cable is to be graded by means of
metallic sheath. Find the diameter of inter sheath and voltage at which the
inter sheath must be maintained in order to obtain minimum overall diameter.
Compare the conductor and outside diameter with those of an ungraded cable.
What will be the maximum allowable voltage if inter sheath supply is
disconnected in the 1st case.

Ex/EE/5/T/322/2017

BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING (EVENING)EXAMINATION, 2017

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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 multiplier circuit.   8

b) A Cockcroft-Walton voltage doubler circuit is used to test a cable at 150 kV. The insulation resistance of the cable is $2.5 \times 10^7 \Omega$ and the length of the cable is 15 m. Stage capacitances are 0.1 µF and 0.15 µF respectively. The doubler is supplied from a 230V/200kV 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 peak voltmeter that contains a bleeder resistance. Describe the principal of operation of such a peak voltmeter and discuss about the errors associated with peak voltage measurement.   10

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

4. a) With a neat sketch explain the operation of multi stage impulse generator circuit.   10

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

5. Write short notes on any two of the following: 2x8=16

a) Electrostatic voltmeter

b) Symmetric voltage doubler circuit

d) High voltage generation by series resonance circuit

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