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(Following Roll No. to be filled by candidate)

Roll No. 1 2 0 4 3 4 4 4 5 2

B. TECH.
FIFTH SEMESTER EXAMINATION 2014-15
EEE503
ELEMENT OF POWER SYSTEM

Time:3 Hour **Max. Marks: 100**

Note:
- Attempt all questions.
- Marks and number of questions to be attempted from the section is mentioned before each section.
- Assume missing data suitably. Illustrate the answers with suitable sketches

1. Attempt **any two** questions **[2x10]**

a. Discuss the technology of transmitting large amounts of power for long distances by mean of high-voltage direct current (H.V.D.C). What are the advantages and difficulties of H.V.D.C. transmission as compared to the usual three phase A.C. transmission?

b. Answer followings:
i. Compare the volume of conductor material required in case of A.C. three phase three wire system with D.C. two wire system.
ii. Draw and explain the single line diagram of typical power system.

c. Write short notes on followings:
i. Skin effect
ii. Proximity effect
iii. Kelvin's law
iv. Circuit breaker

2. Attempt **any four** questions **[2x10]**

a. Answer the followings:
i. Show that the inductance per unit length of an over head line due to internal flux linkage is constant and is independent of size of the conductor.
ii. A single 3-phase line operated at 50 Hz is arranged as shown in fig. 1, the conductor diameter is 8 mm and the line is regularly transposed. Determine the inductance and capacitance per km.

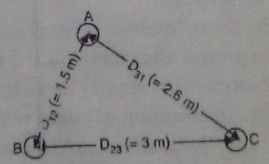

Fig. 1

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b. Explain the physical significance of the generalized ABCD constants of transmission line. State the units of these constants. Determine these constant for a medium transmission line with nominal-T configuration. Draw neatly corresponding diagram.

c. Define the term voltage regulation. A 3-phase, 50 Hz., 20 Km long overhead transmission line supplies 1100 kW at 11 kV, 0.8 power factor lagging. The line resistance and inductance are 0.04 Ω and 0.8 mH per phase per km.
Determine:
i. The line sending end voltage.
ii. Percentage regulation.
iii. Transmission efficiency of the line.

3. Attempt **any four** questions [4x5]

a. What is the string efficiency? Explain why the potential distribution is not in general uniform over string in suspension type of insulators. Each of the tree insulators forming a string has a self capacitance is C farad. The shunting capacitance of a connecting metal work of each insulator is 0.2 C farad to earth and 0.05 C farad to line. Calculate the voltage across each insulator as a percentage of the line voltage to earth and also the string efficiency.

b. What is the corona and what are the advantages and disadvantages? Describe the visual critical voltage and derive expression for disruptive critical voltage.

c. Answer the followings:
i. What is the electromagnetic effect? Derive expression for voltages induced due to electrostatic effect.
ii. What is the Peek's formula? Discuss the factors affecting corona. A 3-phase, 220 kV, 50 Hz. Transmission line consists of 30 mm diameter conductor spaced 2.5 m apart in the form of an equilateral triangle. In the temperature is 38 °C and atmospheric pressure is 76 cm, calculate corona loss per km of the line. Assume the irregularity factor as 0.83.

4. Attempt **any two** questions [2x10]

a. What is the grading of the cables? Explain the following methods of the grading of the cables.
i. Capacitance grading
ii. Intersheath grading

b. Answer the followings:
i. Explain the term "dielectric loss" and "power factor angle" in cables with the help of the phasor diagram. How does dielectric loss vary with the change in voltage, frequency of supply and capacitance of the cables.
ii. Explain the construction of cable with neat and clean diagram.

c. What is the "sag"? An overhead transmission line at river crossing is supported from two towers at height of 40 m and 90 m above water level. The horizontal distance between tower is 400 m. If the weight of the conductor is 1 kg/m and

allowable tension is 2000 kg, find the clearance between the conductor and water at a point mid-way between the towers.

5. Attempt **any *two*** questions [2x10]

a. Define term "earthing", and what are the necessities of neutral earthing? Explain.
b. Explain the meaning of the term "Resonant Grounding". Derive an expression for the reactance of the Peterson's coil in terms of the capacitance of the protected line. Calculate the reactance of the coil suitable for a 33 kV, 3-phase transmission system of which the capacitance to earth of each conductor is 5.0 μF.
c. Discuss the harmonics and reactive power in HVDC and also write the short notes on followings:
   i. Monopolar link
   ii. Bipolar link
   iii. Homopolar link