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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B Tech (Power System Engineering), B Tech (Electrical) — **Semester – V**
Subject (Course): Power Transmission and Distribution — **Max. Marks : 100**
Course Code : PSEG 308 — **Duration : 3 Hrs**
No. of page/s: 02

Section – A

Answer All Questions — **5 x 4 = 20 Marks**

1. [CO1, CO2] Draw and Label the parts of cable used in 66 kV transmission lines between Roorkee and Dehradun feeder.
2. [CO2, CO3] List the limitations of high voltage AC transmission system.
3. [CO2] Describe the importance of transposition in transmission lines and distribution lines.
4. [CO3] Define Corona and describe the various methods of reducing corona effect in Over Head Transmission lines.
5. [CO4] Draw a neat diagram on shackle type insulators used in 11 kV/ 400 V distribution lines.

Section – B

Answer All Questions — **4 x 10 = 40 Marks**

6. [CO2] Draw a neat diagram of Oil filled Cables used in 132 kV transmission system and explain its advantages when compared with overhead lines.

7. [CO1, CO3] In a 33 kV overhead transmission line between Meerut substation and Muzzaffanagar substation, there are three units in the string of insulators. If the capacitance between each insulator pin and earth is 11 % of self – capacitance of each insulator,
find (i) the distance of voltage over 3 insulators (ii) string efficiency.

8. [CO2, CO3] A medium single phase transmission line of 100 km long from Muzzaffarnagar to Dehradun has following data recorded:

Resistance/km = 0.25 Ω Reactance/km = 0.8 Ω

Susceptance/km = 14 x 10^{-6} Siemen Receiving end line voltage = 66 kV

Assuming that the total capacitance of the line is localized at Dehradun substation,

Find the (i) Voltage regulation (ii) Sending end power factor.

Consider the line delivering 15000 kW at 0.8 pf lagging.

Draw the phasor diagram as per your calculations.

9. [CO4] In a present in Dehradun to Tehri 220 kV transmission line, one conductor have an overall diameter of 3.0 cm each and are arranged in delta formation. Assuming a critical disruptive voltage of 250 kV between the lines, an air density factor of 0.90 and m_0 = 0.95, find the minimum spacing between conductors that is allowable. Assume fair weather conditions are available in Dehradun surroundings.

OR

10. [CO3] Explain with a neat diagram about Thyristor Switched Capacitor (TSC) used in Flexible AC Transmission Systems.

Section – C

Answer All Questions **2 x 20 = 40 Marks**

11. [CO1, CO2] A transmission line has a span of 150 m between supports, the supports being at the same level. The conductor has a cross – sectional area of 2 cm^2. The ultimate strength is 5000 kg/cm^2. The specific gravity of the material is 8.9 gm/cm^3. IF the coating of ice is 1.0 cm, calculate the sag at the center of the conductor if safety factor is 5.

12. [CO1, CO3] A inner and outer diameter of a cable is 3cm and 8cm, respectively. The cable is insulated with two materials having permittivity of 5 and 3.5 with corresponding stresses of 38 kV/cm and 30 kV/cm. Calculate the radial thickness of each insulating layer and the safe working voltage of the cable.

OR

13. [CO4] a) Draw and explain the types of HVDC transmission system in detail. [15M]

b) Draw and explain about radial type distribution system and its disadvantages. [5M]

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Section – A

Answer All Questions **5 x 4 = 20 Marks**

1. [CO1,CO2]Describe the phenomenon of corona and factors effecting corona.
2. [CO2, CO3] List the type of cables based on voltage and service requirements.
3. [CO3] List the milestone in development of HVDC technologies.
4. [CO2] Describe the skin effect and proximity effect in transmission lines.
5. [CO4] Draw a neat diagram on Disc type insulators used in 11 kV distribution lines.

Section – B

Answer All Questions **4 x 10 = 40 Marks**

6. [CO2] A string of suspension insulators consists of three units. The capacitance between each pin and earth is 15% of the self-capacitance of the unit. If the maximum peak voltage per unit is not to exceed 35 kV, determine the greatest working voltage and the string efficiency.

7. [CO1, CO3] Explain the methods followed in laying of cables for 132 kV underground transmission line.

8. [CO3, CO2] Explain the testing done on cables as per British standards for quality and reliability in transmission lines.

9. [CO4] Explain with a neat diagram about Thyristor Controlled Reactor (TCR) in FACTS technologies.

OR

10. [CO3] A transmission line has a span of 275m between level supports. The conductor has an effective diameter of 1.96 cm and weights 0.865 kg/m. Its ultimate strength is 8060 kg. If the conductor has an ice loading of radial thickness 1.27 cm and is subjected to a wind pressure of 3.9 gm/ cm^2 of projected area, calculate sag for the safety of 2. Weight of 1 c.c. of ice is 0.91 gm.

Section – C

Answer All Questions **2 x 20 = 40 Marks**

11. [CO1,CO2] A three phase 220 kV 50 Hz, transmission line consists of 1.5 cm radius and the conductor is spaced 2 meters apart in equilateral triangular formation. If the temperature is 40 degrees centigrade and atmospheric pressure is 76 cm, calculate the corona loss per km of a transmission line. Take $m_o = 0.85$

12. [CO2,CO3] A single core 11 kV, 50 Hz system, has a conductor area of 0.645 cm^2 and internal diameter sheath is 2.18 cm. the permittivity of the dielectric used in the cable is 3.5 Find (i) the maximum electrostatic stress in the cable (ii) minimum electrostatic stress in the cable (iii) capacitance of the cable per km length (iv) charging current.

OR

13. [CO4] **a)** Draw and explain the typical layout of HVDC transmission system

[CO3] **b)** Explain the essential requirements of HVDC system