

BTECH
(SEM V) THEORY EXAMINATION 2018-19
POWER TRANSMISSION & DISTRIBUTION

Time: 3 Hours

Total Marks: 100

Notes: Assume any Missing Data.

Section-A

1. **Answer ALL the parts of this section.** **[7X2=14]**
- a. Draw single line diagram of a power system network from generation to distribution showing all the voltage levels at various intermediate stages.
 - b. State Kelvin's law for size of conductor for transmission.
 - c. What are the various factors affecting choice of transmission voltage level?
 - d. What is the Ferranti effect?
 - e. What are the types of insulators used in transmission and distribution?
 - f. What is the range of surge impedance in case of underground cable?
 - g. What is the significance of string efficiency?

Section-B

2. **Attempt any THREE parts. All parts carry equal marks:** **[7x3=21]**
- a. Compare the relative weight of copper required for a distribution network on the dc-3 wire, and 3-phase 4-wire system. Assume in both cases the same voltage at the consumer's terminals, the same copper losses, the loads are balanced, and unity power factor in 3-phase case. Neglect the losses in neutral.
 - b. Give the concept of self GMD. Starting from first principles, derive the expression for capacitance of a 3-phase symmetrical spaced transmission line.
 - c. An 110 kV, 50Hz, 175km long, 3-phase transmission line consists of 1.2 cm diameter stranded copper conductor spaced in 2m delta arrangement. Assume that temperature is 25°C and barometric pressure is 74 cm. Assume surface irregularity factor $m=0.85$, m_v for local corona = 0.72 and m_v for general corona = 0.82. Find
 - (i) Disruptive critical voltage
 - (ii) Visual corona voltage for local corona
 - (iii) Visual corona voltage for general corona
 - (iv) Power loss due to Corona using Peek's formula under fair weather and wet weather conditions.

- d. A transmission line has a span of 150m between level supports. The line conductor has a cross-sectional area of 1.25 cm^2 and it weighs 120 kg per 100 m. if the breaking stress of the copper conductor is 4220 kg/cm^2 . Calculate the maximum sag for a safety factor of 4. Assume maximum wind pressure of 90 kg/m^2 of projected surface.
- e. Explain the phenomena of neutral grounding using Peterson coil.

Section-C

3. Attempt any one part:

[7x1=7]

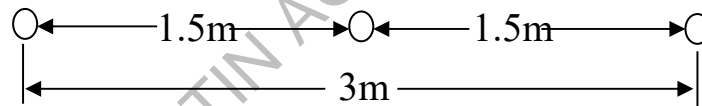
- a. Explain briefly 'skin effect' and 'proximity effect' in reference to over head lines.
- b. A 50Hz, three-phase transmission line has total series impedance per phase of $(40 + j125)$ ohms and shunt admittance of 10^{-3} mho. The load is 50 MW at 220 kV, 0.8 p.f. lagging.

Using nominal π method, calculate the sending end voltage, current and power factor.

4. Attempt any one part:

[7x1=7]

- a. A single circuit 3-phase line operated at 50 Hz is arranged as follows. The conductor diameter is 0.6cm. Determine the inductance per km.



- b. In a 3-phase line with 132kV at the receiving end the following are the transmission constants.

$$A = D = 0.98 \angle 30^\circ$$

$$B = 110 \angle 750^\circ \Omega$$

$$C = 0.0005 \angle 880^\circ \text{ S}$$

If load at the receiving end is 50 MVA at 0.8pf lagging, determine the value of the sending end voltage.

5. Attempt any one part:

[7x1=7]

- a. Explain why the voltage does not divide equally across the units of a string insulator. Find the voltage distribution and string efficiency of a three unit suspension insulator string if the capacitance of the link pins to earth and to the line are respectively 20% & 10% of the self capacitance of each unit. If a guard ring increases the capacitance to the line of lower link pin to 35% of the self-capacitance of each unit, find the redistribution of voltage and string efficiency.
- b. Explain the phenomenon of corona. What are the various factors affecting it? How can it be reduced?

6. Attempt any one part:

[7x1=7]

- a. Deduce an expression for sag in overhead transmission lines when
 - (i) Supports are at equal levels
 - (ii) Supports are at unequal levels
- b. Derive the expression for insulation resistance of single core cable.

7. Attempt any one part:

[7x1=7]

- a. A 220-kV, 3-phase, 50 Hz transmission line of 150 km consists three conductor equilaterally spaced with 7 m and having effective diameter of 3 cm. Find the inductance and MVA rating of the peterson's coil in system.
- b. What are the design considerations of distribution system? Give the classification of distribution system with diagram.

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