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Total number of printed pages – 2

B. Tech
PCEE 4401

Seventh Semester Examination – 2011

ELECTRICAL POWER TRANSMISSION AND DISTRIBUTION

Full Marks – 70

Time : 3 - Hours

Answer Question No. 1 which is compulsory and any **five** from the rest.

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10
 - (a) Explain why the inductance per unit length of an overhead line due to internal flux linkage is independent of the size of conductor.
 - (b) Narrate the advantages of using bundled conductors in place of solid or stranded conductors. Draw a clear comparison between the two schemes.
 - (c) Explain the meaning of the term “charging current” and also explain the cause of its origin and effects in the transmission system.
 - (d) Explain the criteria for classification of transmission lines into short, medium and long lines.
 - (e) Indicate with figure the T-model and Pi-Model for representing transmission lines with clear labeling of each element.
 - (f) Draw the neat sketch with single line diagram of part of a transmission system containing transformer, lines, circuit breakers and induction motor loads.
 - (g) Explain the term “String Efficiency” and narrate its significance.
 - (h) List the factors for which the sag in transmission lines may be affected.
 - (i) List three advantages of AC transmission over HVDC transmission.
 - (j) Why grounding is considered important in transmission and distribution networks ?
2. (a) Determine the inductance per kilometer/phase of a single circuit 3-phase 3-wire transmission line having the structure of an equilateral triangle. The radius of each conductor is 20mm and spacing between conductors is 2 m.

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- (b) Explain clearly the terms “skin effect” and “proximity effect” as regards to overhead transmission lines. Also suggest individual schemes to get rid of these effects. 5
3. (a) Determine the capacitance and charging current per unit length of an overhead transmission line having 3-phase, 3-wire structure with horizontal structure. Further assume that the radius of the conductors is 15 mm and spacing between two closely situated conductors is 2.5 m. 5
- (b) Derive the expression for capacitance per unit running length of a three phase three wire overhead transmission line taking the effect of earth. 5
4. (a) What do you mean by lumped parameter model of representation used for modeling transmission lines ? How does this model differ from the distributed model of representation ? 5
- (b) The line resistance of each conductor of a 400 V, 3-phase, 4-wire system is 0.02 ohms per km per phase and that of the neutral wire is 0.04 ohms per km run. Calculate the load end voltage if the line is supplying power to a symmetric load of 10 kw/phase with 0.85 lagging power factor considering the line length to be 10 km. 5
5. Draw the neat sketch of the cross sectional diagram of a three phase 4-core cable with armor and sheath. Also explain why grading of cables are done and how does it affect the parameters of a cable ? 10
6. Consider that a transmission line has resistance per unit length per phase as ‘r’ and inductance per unit length per phase as ‘l’. Ignoring capacitance of the line Draw the phasor diagram with respect to sending end voltage considering that length of the line is ‘x’ and the current per phase is ‘I’ with power factor 0.9 lagging. Clearly indicate the magnitude of each part of the phasor diagram with proper labeling. 10
7. (a) Draw the equivalent circuit diagram of a long transmission line and explain the need for reactive compensation for necessary injection of active power into the line at the sending end. 5
- (b) Draw the circuit diagram of two AC systems connected by a DC link and identify each element of the system. 5
8. Write short notes on any *two* : 5x2
- (a) Need and types of Testing of Insulators
- (b) Voltage drop calculation in DC distributors
- (c) Kelvin’s law and its limitations.