Fifth Semester Examination – 2007

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

   (i)   What is the effect of using bundled
        conductors on the inductance ?

   (ii) Differentiate between nominal-T and
        nominal-π method.

   (iii) What is Feranti effect ?

(iv) How does grading ring improve string efficiency ?

(v) Discuss why the voltage distribution across the units of a string insulator is not uniform ?

(vi) How is conductor spacing related to line voltage ?

(vii) What is the difference between visual critical voltage and disruptive critical voltage ?

(viii) Why the current rating of a cable buried in soil is less than that of a similar cable in air ?

(ix) Why do most HVDC systems use 12 pulse converters ?

(x) What type of dc links are used in present day systems ?

2. (a) Derive expressions for the inductance per phase of a 3-phase line with

    (i) equilateral spacing,

    (ii) unsymmetrical spacing.   5

(b) A 3-ph 3-wire system consisting of 12.50 dia conductors spaced 3 meters apart in a horizontal plane supplies a balanced load. Calculate the inductance per km. of each conductor (line to neutral).

What will be the average inductance of each phase if conductors were regularly transposed ?   5

3. (a) How a transmission line is represented ? What is surge impedance and surge impedance loading ?   3

(b) Determine the regulation and efficiency of transmission for a 3-phase, 100 km.

50 Hz transmission line delivering 20 kW at 0.8 p.f. lagging and 66 kV to a balanced load. The inductive reactance is 35. 1 Ω per phase and capacitive reactance is 0.995 μF per phase. Assuming the total resistance of the line to be 10 ohm/phase. Use nominal T method. 7

4. (a) Write a short note on different types of insulators used for overhead lines and their applications. 5

(b) A string of eight insulators is to be graded to obtain uniform distribution of voltage across the string. If the capacitance of the top units is 10 times the capacitance to ground of each unit, determine the capacitance of the remaining seven units. 5

5. (a) Discuss different type of cables used for three phase service. 4

(b) Determine the maximum working voltage of a single core lead sheathed cable having a conductor 1 cm dia and sheath of 5 cm dia inside. Two insulating materials with permittivities and maximum stress 4, 2.5, 60 kV/cm and 50 kV/cm respectively are used. 6

6. (a) Distinguish between a feeder, distributor and service mains in a distribution scheme. Show that with an increase in working voltage to n-times, the cross section of a feeder and a distributor would be reduced to 1/n and $1/n^2$ of their respective values. 4

(b) A 2-coir dc distributor AB 900 meters long is fed at A at 400 V and loads of 50 A,

100 A and 150 A are trapped off from C, D and E which are at a distance of 200 m, 500 m and 800 m from point A respectively. The distributor is also loaded uniformly at the rate of 0.5 A/m. If the resistance of distributor per meter (go and return) is 0.0001 ohm, calculate voltage at (i) point B and (ii) point D. 6

7. (a) Show how the effects of wind and ice loading are taken into account while determining the sag and stress of an overhead live conductor ? 4

(b) An overhead line at a river crossing is supported from two towers at heights of 40 m and 90 m above water level, the horizontal distance between the towers being 400 m. If the maximum allowable tension is 200 kg, find the clearance between the conductor and water at a point mid-way between the towers. Weight of conductor is 1 kg/m. 6

8. Write short notes on : 2×5

(i) Methods of equalizing the potential distribution in a suspension type insulator

(ii) Travelling waves in overhead transmission line.

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