R09

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B. Tech III Year I Semester Examinations, May/June – 2013
Power Systems-II
(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1.a) Derive the expression for capacitance of three phase line with symmetrical spacing.
b) Find inductance per phase per km length of the system of conductors shown in Figure 1. Self GMD of one conductor is 0.90 cm. Assume transposition. [15]

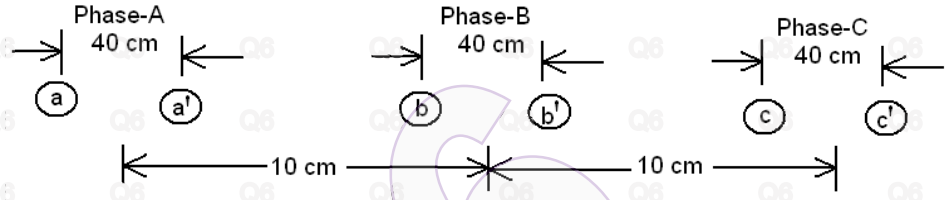

Figure.1

2.a) Obtain the equivalent Π model of medium transmission line.
b) Define efficiency and regulation of transmission line.
c) A 3-phase, 400kV, 100km long transmission line is supplying a load of 100Mw at 0.8 p.f lagging. The resistance, inductance and capacitance of a line are 0.01Ω per Km/phase; 2mH per Km per phase and 10 μF per Km per phase respectively. Calculate efficiency and regulation of the line using T-model of a transmission line. [15]

3.a) Explain how long lines are represented by equivalent T model.
b) For a 3-phase 400 kV line A=D=0.86, B=13.2Ω, C=0.002 mho, obtain the regulation when the line is delivering 120 MVA at 0.9 pf. lagging. [15]

4.a) Starting from the fundamentals, show that surges behave as travelling waves.
b) The ends of two long transmission lines, P and R are connected by a cable Q 10 Km long. The surge impedances of P, Q, R are 450, 40 and 500 ohms respectively. A rectangular voltage wave of 22 kV magnitude and of infinite length is initiated in P and travels to R. Determine the first and second voltages impressed on R. [15]

5.a) Explain the phenomenon of Corona. What are the factors that affect the Corona?
b) A 220 kV overhead line conductor of radius 1.5 cm is built so that corona takes place if the line voltage is 310 kV (rms). If the value of voltage gradient at which ionization occurs can be taken as 21.21 kV (rms) per cm, determine the spacing between the conductors. [15]

6.a) Explain why suspension type of insulators are preferred for high voltage overhead lines. Sketch a sectional view of one unit of the suspension type insulator and describe the construction.

b) Derive the expression for string efficiency of a string of 3-insulators. [15]

7.a) A transmission line conductor at a river crossing is supported from two towers at heights of 70 and 90 meters above water level. The horizontal distance between the towers is 350 m. If the tension in the conductor is 1000 kg.
Find:
i) The maximum clearance between the conductor and water.
ii) The clearance between the conductor and water at a point mid way between the towers. Weight of the conductor is 0.856 kg/m. Assume that the conductor takes the shape of a parabola. [15]

8.a) Derive the formula for dielectric stress in an underground cable.

b) Single core, lead covered cable is to be designed for 66 KV to earth. Its conductor radius is 8 mm and its three insulating materials P, Q and R have relative permittivities of 6, 5 and 4 respectively and corresponding maximum permissible stresses of 4.2, 3.8 and 3.4 kV/mm (rm) respectively. Find the minimum diameter of the lead sheath. [15]

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