Code No: 125AG

R15

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, February - 2022
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) Show that the inductance per unit length of an overhead line due to internal flux linkages is constant and is independent of size of conductor.

b) Determine the inductance of a 1-phase transmission line having the following figure 1 arrangement of conductors. One circuit consists of three wires of 2 mm dia each and the other circuit two wires of 4 mm dia each. [7+8]

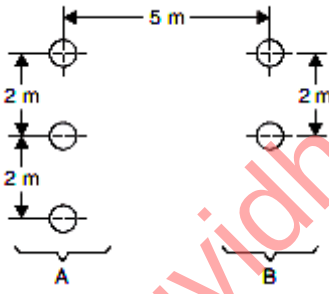

Figure 1

2.a) Derive an expression for the capacitance per km of a single-phase line considering the effect of ground.

b) Determine the capacitance and charging current per unit length of the line when the arrangement of the conductors is as shown in Figure 2. [8+7]

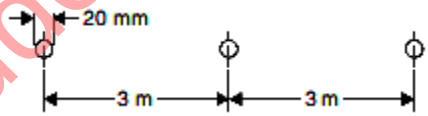

Figure 2

3.a) Derive the expression for regulation and efficiency of a medium transmission line using nominal π method. Draw phasor diagram also.

b) Determine the sending end voltage, current, power factor of a 1-phase 50 Hz, 76.2 kV transmission delivering a load of 12 MW at 0.8 p.f. The line constants are R = 25-ohm, inductance 200 mH and capacitance between lines 2.5 μF. Also determine the regulation and η of transmission. Use nominal-π method. Draw phasor diagram. [7+8]

4. Derive for a long line the sending end voltage and current relations in terms of receiving end voltage and current and the parameters of the line. [15]

5.a) Explain clearly the 'Ferranti effect' with a phasor diagram.

b) Determine the corona loss for a 3-phase 110kV, 50Hz, 160km long line, with conductor diameter 1.036cm, 2.44m delta spacing, air temperature 26.67 ^{0}C and pressure of 73.15cm. [8+7]

6.a) Show that a travelling wave moves with a velocity of light on the overhead line and its speed is proportional to $1/\sqrt{\varepsilon_r}$ on a cable with dielectric material of permittivity ε_r.

b) An overhead transmission line with surge impedance 400 ohms is 300 km long. One end of this line is short-circuited and at the other end a source of 11 kV is suddenly switched in. Calculate the current at the source end 0.005 sec after the voltage is applied. [8+7]

7.a) Define String Efficiency? Explain the methods for improving of it.

b) A string of six insulator units has mutual capacitance 10 times the capacitance to ground. Determine the voltage across each unit as a fraction of the operating voltage. Also determine the string efficiency. [7+8]

8.a) With neat sketch explain about construction of underground cable.

b) A 33kV, 50 Hz, 3-phase underground cable, 4Km long uses three single core cables. Each of the conductor has a diameter of 2.5cm and the radial thickness of insulation is 0.5cm. Determine (i) Capacitance of the cable (ii) Charging current/ phase (iii) Total charging KVAR. The relative permittivity of insulation is 3. [8+7]

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