Code No: 115AG

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November - 2015
POWER SYSTEMS-II
(Electrical and Electronics Engineering)

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

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A (25 Marks)

1.a) Why do we find line to neutral capacitance in a 3-phase system? [2]
b) What is the significance of equivalent symmetrical spacing of a three phase line? [3]
c) What is the importance of generalized circuit constants of a transmission line? [2]
d) Why is leakage conductance negligible in overhead lines? [3]
e) A transmission line of surge impedance Z_0 is terminated by (i) an inductance (ii) a capacitance? [2]
f) Write about Visual critical voltage with reference to corona. [3]
g) Can string efficiency in an a.c. system be 100%? [2]
h) Explain how the electrical breakdown can occur in an insulator. [3]
i) What is meant by charging current of a cable? [2]
j) Why the capacitance of the cable is very high than the capacitance of the overhead lines? [3]

PART - B (50 Marks)

2.a) Derive the expression for capacitance of three phase transmission line with asymmetrical spacing.
b) Derive the expression for inductance of three phase transmission line with symmetrical spacing. [5+5]

OR

3.a) Discuss the effect of bundling on capacitance of transmission lines
b) A stranded conductor consists of seven identical strands each having a radius r as shown in Figure 1. Determine the GMR of the conductor in terms of r. [5+5]

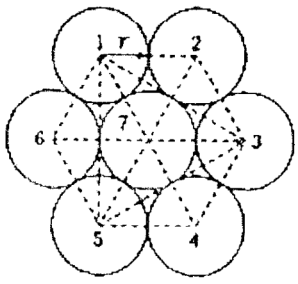

Figure 1

4 a) A balanced 3-phase load of 30 MW is supplied at 132 kV, 50 Hz and 0·85 p.f. lagging by means of a transmission line. The series impedance of a single conductor is (20 + j52) ohms and the total phase-neutral admittance is 315×10^{-6} siemen. Using nominal T method, determine:(i) the A, B, C and D constants of the line (ii) sending end voltage (iii) regulation of the line.

b) Derive the expressions for regulation and efficiency of a short transmission line. Draw required circuit and phasor diagram. [5+5]

OR

5. A three –phase, 220 kV, 50 Hz transmission line supplies a power of 100 MW at a power factor of 0.8 lagging at the receiving end. The series resistance, series reactance and shunt susceptance per phase per km are 0.08 Ω, 0.8 Ω, and 6×10^{-6} mho respectively. Consider four possible transmission lengths of 60, 200, 300 and 500 km. Find out the efficiency and regulation in each case. Also find the reactive power at the sending end and the reactive power absorbed by line. [10]

6.a) A cable has a conductor of radius 0.75 cm and a sheath inner radius 2.5 cm. Find (i) the inductance per meter length (ii) capacitance per meter length (iii) surge impedance and (iv) velocity of propagation, if the permittivity of insulation is 4.

b) A transmission tower on a level ground gives a minimum clearance of 8 meter for its lowest conductor with a sag of 10 m for a span of 300 m. If the same tower is to be used over a slope of 1 in 15, find the minimum ground clearance obtained for the same span, same conductor and same weather conditions. [5+5]

OR

7.a) A 132 kV line with 1·956 cm dia. conductors is built so that corona takes place if the line voltage exceeds 210 kV (r.m.s.). If the value of potential gradient at which ionization occurs can be taken as 30 kV per cm, find the spacing between the conductors.

b) Show that surges behave as travelling waves. Derive expressions for surge impedance and wave velocity. [5+5]

8.a) Determine the voltage across each disc of suspension insulators shown in figure 2 and percentage of the line voltage to earth. The self and capacitance to ground of each disc is C and 0.2C respectively. The capacitance between the link pin and the guard ring is 0.1C.

b) If the capacitance to the line of the lower link pin were increased to 0.3C by means of a guard ring determine the redistribution of voltage.
Also determine the string efficiency in each case. [5+5]

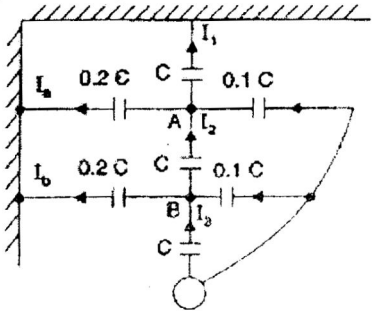

Figure 2

OR

9. An overhead line has a conductor of cross-section 2.5 cm^2 hard drawn copper and a span length of 150 mts. Determine the sag which must be allowed if the tension is not exceeded one-fifth of the ultimate strength of 4175 kg/cm^2 a) in still air, and b) with a wind pressure of 1.3 kg meter and an ice costing of 1.25 cms. Determine also the vertical sag in the latter case. [10]