King Fahd University of Petroleum & Minerals

Electrical Engineering Department

EE 465: Power Transmission & Distribution

(First Semester 051)

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Final Exam: January 29, 2006

Time: 7:00 -9:00 pm

Student Name:

Student ID #:

Question #	Mark
1	/5
2	/5
3	/10
4	/5
5	/5
6	/10
7	/12
8	/9
9	/15
10	/4
11	/10
12	/10
Total	/100

Q1) [5 points]

A 60-Hz, 765 kV three phase transmission line has four ACSR 1113 kcmil 54/3 conductors per phase. Determine the 60 Hz resistance of this line in ohms per km per conductor at 50^0 C.

Q2) [5 points]

A 60-Hz three phase, three wire transmission line has solid cylindrical conductors arranged in the form of an equilateral triangle with 4 ft conductor spacing. Conductor diameter is 0.5 inch. Calculate the positive sequence inductance in H/m.

Q3) [10 points]

Calculate the capacitance to neutral in F/m for a bundled 500 kV, 60 Hz three phase completely transposed transmission line having three ACSR 11113 kcmil conductor per bundle with 0.5 m between conductors in the bundle. The horizontal phase spacing between bundle centers are 10, 10 and 20 m.

Q4) [5 points]

A 150 km, 230 kV, 60 Hz, 3-phase line has a positive sequence series impedance $z = 0.08 + j0.48\ \Omega/km$ and a positive sequence shunt admittance $y = j3.33\times10^{-6}\ S/km$. Using the nominal Π circuit, calculate:

Parameter C=

Q5) [5 points]
A 150 km, 230 kV, 60 Hz, 3-phase line delivers 250 MW at 0.99 pf lagging at 220 kV. Calculate the receiving end current.

$I_R =$

Q6) [10 points]
A 100 km, 230 kV, 60 Hz three phase transmission line has the following ABCD parameters:

$A = D = 0.9918 \angle 0.0999^0 \ p.u$

$B = 51.1 \angle 82.11 \ \Omega$

$C = 3.216 \times 10^{-4} \angle 90.033 \ S$

The line delivers 300 MVA at 218 kV to the receiving end at full load where the receiving end current is
$I_R = 794.5 \angle 0 \ A$

Using the nominal Π circuit, calculate:

(a) the sending end voltage

(b) Percentage voltage regulation

Q7) [12 points]

The following parameters are based on a preliminary line design:

$V_S = 1.0\ p.u \quad ; V_R = 0.9\ p.u \quad ; \lambda = 5000\ km; \quad ; Z_C = 320\ \Omega; \quad \delta = 36.8^0$

A three phase power of 700 MW is to be transmitted to a substation located 315 km from the generation plant. Determine a nominal voltage level for the three phase transmission line based on the practical line loadability equation.

Q8) [9 points]

A single phase lossless overhead line with $Z_A = 400\Omega$ is connected to a single phase lossless cable with $Z_B = 100\Omega$. The cable is short circuited and the source impedance equals $Z_G = 100\Omega$.

(a) Γ_{AA}

(c) Γ_{AB}

(d) Γ_S

Q9) [15 points]

For the Bewlley Lattice diagram shown in the figure, draw the junction voltage for $0 \le \tau \le 0.6\ ms$.

Q10) [4 points]

(a) Name two cable insulator materials

1-

2-

Q11) [10 pints]

A XLPE underground cable is operating at 69 kV and 60 Hz frequency. The dielectric constant of the cable insulation is 5 and the diameter over insulation and over conductor shield is 6 and 2 cm, respectively.
Calculate the charging current of a single conductor.

Q12) [10 points]

Write (T) for True or (F) for False against the following statements:

(1) Wet flashover test is used for line insulators and cable insulation ( )

(2) Air capacitance between each pin/cap junction is greater than that for each insulator unit. ( )

(3) Water trees occur in cable insulation but not in line insulators. ( )

(4) Voltage distribution on a string of line insulators can be more more uniform by using shield wires. ( )

(5) Bundle wires are used to reduce corona but reduced the power transfer capacity. ( )