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Code No: 07A50202 **R07** **Set No. 2**

**III B.Tech I Semester Examinations,May 2011**
**POWER SYSTEMS-II**
**Electrical And Electronics Engineering**

**Time: 3 hours** **Max Marks: 80**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. (a) What is meant by capacitance grading of a cable ?
   (b) Derive expressions for capacitance of and maximum potential gradient in two ( or more ) dielectric of a graded cable in terms of a dielectric constants and radius of core and overall radius etc. [8+8]
2. Starting from first principles show that surges behave as traveling waves. Find expressions for surge impedance and wave velocity. [16]
3. Explain the following in terms with reference to corona?
   (a) Critical disruptive voltage
   (b) Visual critical voltage
   (c) Power loss due to corona. [16]
4. What is Ferranti effect? Deduce a simple expression for the voltage rise of an unloaded line. Also draw the corresponding vector diagram. [16]
5. Each line of a three phase system is suspended by a string of 4 similar insulators. If the voltage across the second unit is 15 kv and across the third unit is 27.0KV. Calculate the voltage between conductors e and string efficiency? [16]
6. The three conductors of a 3-phase line are arranged in a horizontal plane with a spacing of 4 m between adjacent conductors. The diameter of each conductor is 2.5 cm. Determine the inductance per km per phase of the line assuming that the lines are transposed. [16]
7. A square wave voltage surge of magnitude $E_0$ and length D is travelling at speed $\gamma$ on a transmission line of surge impedance Zs. A capacitor C is connected between line and ground at the mid point of the line. Derive analytically the expression for the voltage surge that travels along the line beyond the point where the capacitor is connected. Also sketch the voltage waveform. [16]
8. A transmission line has a span of 200m between level supports. The cross sectional area of the conductor is1.29 $cm^2$ weighs 1170Kg/Km and has breaking stress of 4218$Kg/cm^2$. Calculate the sag for a factor of safety of 5, allowing wind pressure of 122 Kg per square meter of projected area. What is the vertical sag? [16]

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**POWER SYSTEMS-II**
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**Time: 3 hours** **Max Marks: 80**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. (a) What do you understand by the constants of an over head transmission line?
   (b) A single phase transmission line has two parallel conductors 1.5 meters apart, the diameter of each conductor being 0.5 cm. Calculate line to neutral capacitance for a line of 150 km long [8+8]

2. (a) What are the factors which effect corona?
   (b) Describe the various methods for reducing corona effect in an overhead transmission line? [8+8]

3. The generalized circuit constants of a transmission line are
   A = 0.93 + j0.016
   B = 20 + j140
   The load at the receiving end is 60 MVA, 50 HZ, 0.8 p.f. lagging. The voltage at the supply end is 220 KV. Calculate the load voltage [16]

4. An over head transmission line at a river crossing is supported from two towers of heights of 40m and 90 at the water crossing. The horizontal distance between the towers is 500m. If the maximum allowable tension is 1650 Kg and the conductor weighs 1 kg/m. find the minimum clearance of the conductor and water at a point mid-way between the supports. Bases of the towers can be considered to be at water level. [16]

5. Evaluate the generalized circuit constants for long transmission lines. [16]

6. A 1-core cable has a core diameter of 8 mm and a diameter under the sheath of 2 cm. The relative permittivity of the dielectric is 4. The power factor on open circuit is 0.03. Calculate for 1 km length of the cable
   (a) the capacitance
   (b) its equivalent insulation resistance
   (c) the charging current
   (d) the dielectric loss when the cable is connected to 10 kv, 1-phase 50 Hz supply system. [16]

7. (a) Step wave of 100 KV travels on a line having a surge impedance of 400Ω. The line is terminated by an inductance of 4000$\mu$H. Find the voltage across the inductance and the reflected voltage wave.
   (b) Write short notes on Bewleys lattice diagram. [8+8]



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8. Each of the three insulators forming a string has a self capacitance of C farad. The shunt capacitance of each insulator is 0.2C to earth and 0.1C to line. A guard ring increases the capacitance of line of metal work of the lowest insulator to 0.3C.calculate the string efficiency of the arrangement with and without guard ring. [16]

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Code No: 07A50202 **R07** **Set No. 1**

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**Time: 3 hours** **Max Marks: 80**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. (a) Show that in a capacitance graded cable the position of different layers is decided by the product $\varepsilon_r$ g Where $\varepsilon$ is the relative permittivity of the dielectric and g is the dielectric strength (potential gradient) and that for a cable with overall radius R having (say) 3 dielectrics with all dielectrics working at the same maximum potential gradient $\varepsilon_{r1} r = \varepsilon_{r2} r_1 = \varepsilon_{r3} r_2$
   where r, $r_1$, $r_2$ are the radii of conductor, inner and middle dielectric respectively.
   (b) Write a short note on single core cable with a neat diagram? [8+8]

2. (a) What is corona?
   (b) Explain the theory of corona formation in detail? [16]

3. The three bus bar conductors in an outdoor sub-station are supplied by units of post insulators. Each unit consists of stack of 3-pin insulators fixed one on the top of the other. The voltage across the lowest insulator is 8.45kv and that across the next is 7.25Kv.Find the bus-bar voltage of the station? [16]

4. A medium length power transmission line is represented as a nominal-$\pi$ equivalent circuit with lumped parameters. The total series impedance of the line is Z $\Omega$ and the total shunt capacitance is Y = j$\omega$C siemens. Derive equations for the sending end voltage and current and there from determine the ABCD constants of the line. Prove that AD-BC = 1. [16]

5. Figure 1 shows the spacings of a double circuit 3-phase over head line. The phase sequence is ABC and the line is completely transposed. The conductor radius is 1.3 cm. Find the inductance per phase per km.

   [16]

6. Find the following for a single circuit transmission line delivering a load of 50 MVA at 110 KV and 0.8 p.f. lagging:
   (a) sending end voltage
   (b) sending end current
   (c) sending end power
   (d) efficiency of transmission

   Given A = D = $0.98\angle 4^0$; B = $110\angle 75^0$ ohm; C = $0.0005\angle 80^0$ siemen. [16]



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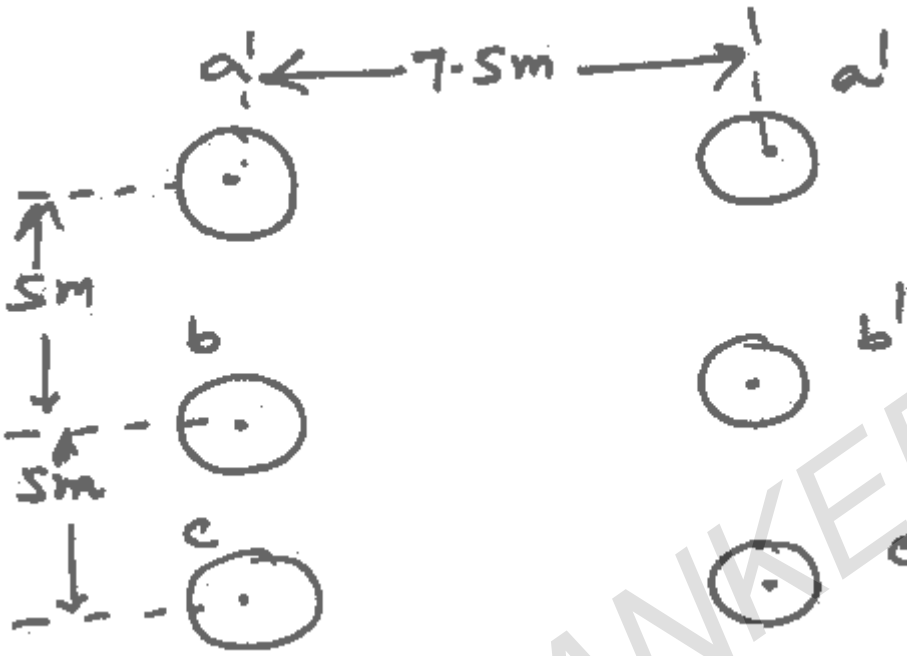


Figure 1:

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7. A unit step voltage surge is travelling on a long line of surge impedance $Z_1$. It reaches the junction with a cable of finite length whose far end is open. The cable has a surge impedance of $Z_2$ and the time of one-way wave travel on it is T. Draw the Bewley lattice diagram and find from it the value of voltage at the junction at time 4T after the surge reaches the line-cable junction. [16]

8. An over head transmission line at a river crossing is supported from two towers of heights of 50m and 100m above the water level. The horizontal distance between the towers is 400m. If the maximum allowable tension is 1800 Kg and the conductor weighs 1 kg/m. find the clearance between the conductor and water at appoint mid-way between the supports. [16]

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**Time: 3 hours** **Max Marks: 80**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. (a) What is skin effect? Why is it absent in the D.C system?
   (b) A 200 km, 3-phase transmission line has its conductors placed at the corners of an equilateral triangle of 2.5 m side. The radius of each conductor is 2 cm. Calculate:
      i. Line to neutral capacitance of the line
      ii. Charging current per phase if the line is maintained at 66 KV, 50Hz.

   [8+8]

2. (a) Define and explain string efficiency. Can its value be equal to 100%?
   (b) Give the reasons for unequal potential distribution over a string of suspension insulators?
   (c) Explain how the electric break down can occur in an insulator? [16]

3. Discuss the phenomenon of wave reflection and refraction. Derive expressions for reflection and refraction coefficients. [16]

4. Show that in a three-core ( belted type ) cable the neutral capacitance of each conductor $C_n$ is equal to where $C_e + 3\ C_c$ are the capacitance of each conductor to sheath and to each other respectively. Explain how these capacitance can be measured experimentally.

   [16]

5. A 3-phase, 50 Hz transmission line has conductors of cross section 90 $mm^2$ and effective diameter of 1 cm and are placed at the vertices of an equilateral triangle of side 1 m. The line is 20 km long and delivers a load of 10 MW at 33KV and p.f. 0.8. Neglect the capacitance and assume temperature of $20^0$C. Determine the efficiency and regulation of the line, [16]

6. (a) Define disruptive critical voltage and derive the expression for it?
   (b) A three phase 220KV 50Hz transmission line consists of 1.2cm radius conductor spaced 2 meters apart in equilateral triangular formation. Find the disruptive critical voltage between the lines if the temperature is $20^oC$ and atmospheric pressure is 72.2cm.. Take $m_o$=0.96.Dielectric strength of air=21.1KV (rms)/cm?

   [8+8]

7. Two 3-phase lines have the following constants:
   A1 = D1 = $0.98\angle 2^0$, B1 = $28\angle 69^0$ ohms, C1 = $0.0002\angle 80^0$ siemens



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A2 = D2 = $0.95\angle 3^0$, B2 = $40\angle 85^0$ ohms, C2 = $0.0004\angle 90^0$ siemens
The two lines are connected in cascade. Find

(a) ABCD constants for the composite system.

(b) Sending end voltage, current and power factor if the composite system delivers 200 A at 110 KV and 0.95 p.f. lagging. [16]

8. A transmission line has a span of 150m between level supports. The cross sectional area of the conductor is $2cm^2$.The tension in the conductor is 2000Kg/ $cm^2$.and safety factor is 5. The specific gravity of the material is 9.9 $gm/cm^3$. If the wind pressure is 1.5Kg/m.Calculate the height of the conductor above the ground level at which it should be supported if a minimum clearance of 7m is to be left between the ground and the conductor. [16]

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