SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR
Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code : EPTS(16EE218) **Course & Branch**: B.Tech EEE

Year & Sem: III-B.Tech & I-Sem **Regulation:** R16

UNIT –I

TRANSMISSION LINE PARAMETERS

1. (a) Derive the expression for capacitance of a single phase two-wire line system. 5 M

   (b) A single phase transmission line has two parallel conductors 3ma part, the radius of each conductor being 1cm.Calculate the loop inductance per km length of the line if the material of the conductor is: (i)Copper.(ii) Steel with relative permittivity of 100. 5M

2. (a) Find the expression for Inductance of a single phase two-wire Transmission line system.5M

   (b) Calculate the Inductance and capacitance of a 100km long 3- phase,50Hz overhead transmission line consisting of 3 conductors, each of diameter 2 cm and spaced 2.5 m at the corners of an equilateral triangle. 5M

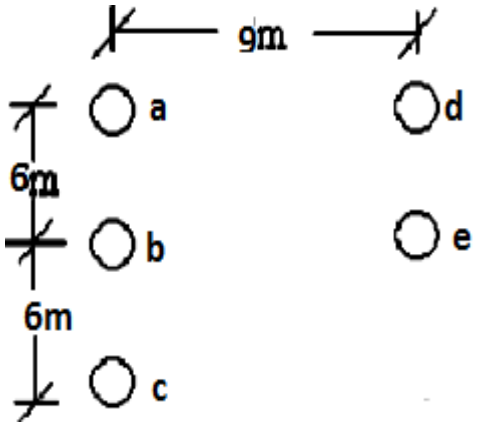
3. (a) Derive the expression for capacitance of a single-phase line by considering the effect of earth. Why for all practical purposes the effect of earth on the capacitance can be neglected? 5M

   (b) A Three phase line 3km long delivers 3000KW at pf 0.8 lagging to the load . The resistance and reactance per km of each conductor are 0.4 Ω and 0.3Ω respectively. If the voltage at the supply end is maintained at 11KV. Calculate receiving end voltage, line current and transmission efficiency. 5M

4. Derive an expression for the inductance per phase for a 3-phase overhead transmission line when conductors are symmetrically placed and un symmetrically spaced. 10M

5. (a) Clearly explain what you understand by GMR and GMD of a transmission line.

   (b) Determine the inductance of a single phase transmission line consisting of three conductors of 2.5mm radii in the GO conductors and two conductors of 5mm radii in the RETURN conductors. The configuration of the line is as shown in figure bellow. 6M



6. (a) Derive an expression for the capacitance per phase for a 3-phase overhead transmission line when conductors are symmetrically placed. 5M

(b) A 1-phase line constructed 13.5 m above ground has spacing between the conductors 3.9m. The radius of the conductor is 1.78 cm .Determine the capacitance of the line per length, considering the effect of earth and neglecting it. 5M

7. (a) Derive the expression for the capacitance of a three phase double circuit hexagonal spacing configuration. 5M

(b) Determine the inductance/phase/km of a double circuit 3-phase line. The radius of each conductor is 20mm and the conductors are placed on the circumference of an imaginary circle at a distance of 7m forming a regular hexagonal figure. 5M

9. a) What is skin effect and proximity effect? 2M

b) What is the bundling of the conductor? 2M

c) Explain the transposition of transmission lines. 2M

d) Why transpositions of transmission lines are required? 2M

e) On what factors does Skin effect depend. 2M

10. a) Define GMD & GMR. 2M

b) Why all overhead lines use ACSR conductors? 2M

c) Derive the expression for internal flux linkage in a conductor. 2M

d) For 1-Ø transmission lines Write inductance and capacitance expressions in mH/km & µF/km. 2M

e) Write inductance and capacitance expressions for 3-Ø symmetrical and unsymmetrical spacing. 2M

UNIT –II

PERFORMANCE OF TRANSMISSION LINES

1. Write all equations for finding sending end voltage, current, power factor, power and regulation and transmission efficiency for (i) short transmission line (ii) medium line nominal T method (iii) medium line nominal π method. 10M
2. (a) Explain the terms efficiency and regulation in relation to transmission lines. 4M

   (b)A3-phase, 50Hz, 15km transmission line supplying a total load of 850kW at 0.8p. Flagging and 11kVhasthefollowinglineconstants:r=0.45ohms/km,x=0.6ohms/km.Calculatetheline current, receiving end voltage, voltage regulation and efficiency of transmission. 6M
3. A 100km long,3-phase,50Hz transmission line has following line constants: Resistance/ph/km=0.1ohm,Reactance/ph/km= 0.2ohm, Susceptance/ph/km= $4*10^{-6}$siemen. Determine (i) Sending end voltage and current (ii) Sending end power factor (iii)Transmission efficiency when supplying a balanced load of 10,000KW at 66KVat 0.8 p.f lagging.By using nominal T method. 10M
4. A 100km long,3-phase,50Hz transmission line has following line constants: Resistance/ph/km=0.1ohm, Reactance/ph/km=0.5ohm, Susceptance/ph/km=$10*10^{-6}$siemen.If the line supplies load of 20MW at 0.9 p.f lagging at 66KV at the receiving end, calculate
   (i) Sending end power factor
   (ii) % regulation
   (iii) Transmission efficiency. By using nominal π method. 10M
5. (a) Derive the expression for A, B, C, D parameters for long transmission lines (rigorous method). 5M

   (b) Anoverhead3-phasetransmissionlinedelivers5000kWat22kVat0.8p.flagging.Theresistanceand reactanceofeachconductoris4ohms6ohmsrespectively.Determine:

   (i)Sending end voltage. (ii)Regulation. (iii) Efficiency. 5M
6. Derive the expressions for A, B, C, D parameters of a nominal–T and π of a medium length transmission lines. And also prove AD-BC = 1 for the same network. 10M
7. A 50Hz, 3-phase transmission line is 280 km long. It has a total series impedance of (35 + j140) ohms and shunt admittance of $930*10^{-6}$ siemen. It delivers 40,000 KW at 220KV with 90% p.f lagging. Find the Generalized circuit Constants, Sending end voltage and current. By using (i) medium line nominal - T method (ii) medium line nominal - π method. 10M
8. Determine the Characteristic impedance, Propagation Constant and A,B,C,D constants for a three phase 50Hz transmission line,250km long having the following distributed

parameters: l = 1.15 x 10^{-3} H/km, c = 7.8 x 10^{-9} F/m, r = 0.14 ohms/km, g = 0. 10M

9. a) Define short, medium and long transmission lines? 2M

b)Define voltage regulation& transmission efficiency of transmission lines. 2M

c) Draw the Equivalent circuit &phasor diagram of short transmission line. 2M

d) Draw the Equivalent circuit &phasor diagram of medium transmission line nominal T method. 2M

e) Draw the Equivalent circuit &phasor diagram of medium transmission line nominal π method. 2M

10. a) Write the ABCD constants of nominal T method. 2M

b) Write the ABCD constants of nominal π method? 2M

c) Explain Ferranti effect and also draw its phasor diagram. 2M

d) Define characteristic impedance, propagation constant and surge impedance. 2M

e) Define surge impedance loading. Determine the surge impedance loading for a 400KV Transmission line. 2M

UNIT –III

MECHANICAL DESIGN OF TRANSMISSION LINES

1. (a) Explain various types of insulators with neat diagrams and compare them? 5M

   (b) A three phase overhead line is suspended by a suspension type insulator, which Consists of three units. The potential across top unit and middle unit are 12 kv and 18 kv Respectively. Calculate: (i) the ratio of capacitance between pin and earth to the self Capacitance of each unit (ii).The line voltage and (iii) String efficiency. 5M

2. (a) What are the factors affecting corona? And derive the expressions for critical disruptive and visual critical voltage 4M

   (b) Determine the corona characteristics of a 3-phase line 160km long, conductor diameter 1.036cm, 2.44m delta spacing, air temperature 26.67oC, altitude 2440m, corresponding to an approximate barometric pressure of 73.15cm of Mercury, operating voltage 110kv at 50Hz. Assume data if required.(irregularity factor etc.) 6M

3. (a)Derive the expression for sag and tension when the supports are at unequal heights 5M

   (b)An overhead transmission line at a river crossing is supported from two towers at heights of 40m and 90 m above water level. The horizontal distance between the towers being 400m.If the allowable tension is 2000kg, find the clearance between the conductor and water at a point mid-way between the towers. Weight of conductor is 1kg/m 5M

4. (a) A string of six insulator units has a self capacitance is equals to 10 times the pin to earth capacitance. Find (i) voltage distribution across various units as a percentage of total voltage across the string. (ii) the string efficiency. 5M

   (b) A certain 3-phase equilaterally spaced transmission line has a total corona loss of 55KW at 110 KV and a loss of 110KW at 120 KV. What is the disruptive critical voltage between lines? What is the corona loss at 125KV? 5M

5. (a)Each line of a three phase system is suspended by a string of three identical insulators of self capacitance of C farad. The shunt capacitance of connecting metal work of each insulator is 0.2C to earth and 0.1C to line. Calculate the string efficiency of the system and also calculate string efficiency if a guarding increases the capacitance to the line of metal work of the lowest insulator to 0.3C 6M

   (b) What do you understand by grading of insulators? Explain. 4M

6. (a) Write a short note on (i) effect of Wind and ice loading on calculation of sag and (ii) sag-template. 4M

(b) An overhead line erected across a span of 250 meters on level supports. The conductor has a diameter 1.4cm and has a dead weight of 1.9kg/m. The line is subjected to wind pressure of 37.8 kg/m^2 of projected area. The radial thickness of ice is 1.3cm.calculate (i) the sag in an inclined direction (ii) the sag in vertical direction. Assume maximum working stress 1050kg per sq. cm. One cubic meter of ice weight 913.5kg. 6M

7. (a) Explain about the improvement of string efficiency by grading of units and guard ring. 4M

(b) An overhead line has a span of 150 m between level supports. The conductor has a cross sectional are of 2cm^2. The ultimate strength is 5000kg/cm^2 and safety factor is 5. The specific gravity of the material is 8.9gm/cm^3. 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 7 m is to be left between the ground and the conductor. 6M

8. (a) Derive the expression for sag for equal supports 4M

(b) Each conductor of a three phase over head line is suspended from a cross arm of a steel tower by a string of 4 suspension insulators. The voltage across the second unit is 14.2kv and across the third 20kv. Find the voltage between the conductors and the string efficiency. 6M

9. (a) Explain the concept and phenomenon of corona. 5M

(b) Write short notes on String chart. 5M

10. (a) Define string efficiency . 2M

(b)What is puncture and flash over in an insulator? 2M

(c)Define critical disruptive voltage and visual critical voltage also write the formulae 2M

(d) Define sag. Write the formula for sag. And draw the unequal supports structure. 2M

(e) What is local corona? 2M

UNIT –IV

POWER SYSTEM TRANSIENTS & TRAVELLING WAVES

1. Derive the expression for transient current wave, show that transient current is sum of incident current, and reflected current. 10M
2. (a) How can the analysis of a wave travelling on a line terminated by an inductance be carried out? 5M
   (b) Write short notes on Beweley's lattice diagram 5M
3. A surge of a 200kv travelling on a line of natural impedance 500ohms arrives at a junction with two lines of impedances 700ohms and 300ohms respectively. Find the surge voltages and currents transmitted into each branch line. Also find the reflected surge voltage and current. 10M
4. What is meant by power system transients? Develop the differential equation for a transient in the transmission system. How voltage and current expressions are established from the above differential equations? 10M
5. Discuss the phenomenon of reflection and refraction in travelling waves. Derive the expressions for reflection and refraction coefficients when a travelling wave is terminated through a resistance. 10M
6. A surge of 15KV magnitude travels along a cable towards its junction with an overhead line. The inductance and capacitance of the cable and overhead line are respectively 0.3mH, 0.4μF and 1.5 mH,0.012μF per Km. find the voltage rise at the junction due to the surge. And derive the formula used. 10M
7. Discuss the phenomenon of reflection and refraction in travelling waves. Derive the expressions for reflection and refraction coefficients when a travelling wave is terminated through an Open circuited line, short circuited line and reactance. 10M
8. A cable with a surge impedance of 100 ohms is terminated in two parallel- connected, open-wire lines having surge impedance of 600 and 1000 ohms respectively. If a steep fronted voltage wave of 1000V travels along the cable, find from the first principles the voltage and current in the cable and the open-wire lines immediately after the travelling wave has reached the transition point. The line may be assumed to be of infinite length. 10M
9. A surge of 220kV travelling in a line of natural impedance 500Ω arrives at a junction with two lines of impedances 700Ω and 400Ω respectively. Find the surge voltages and currents transmitted into each branch line. Also find the reflected surge voltage and current. 10M
10. a) Explain about propagation of surges . 2M
    b)Explain reflection and refraction coefficients 2M

c)Define surge impedance loading. 2M

d) Define surge impedance. 2M

e) Define refraction co efficient for current 2M

UNIT –V

CABLES

1. Derive the following (i) Insulation resistance of a cable. 5M
   (ii) Capacitance of a single core cable . 5M
2. Write short notes on: (a) Intersheath grading (b) capacitance grading 10M
3. (a)What are the limitations of belted cable? How these are can be overcome in pressurized cables?
   (b) A33KV single core cable has a conductor diameter of 10mm and sheath of inside diameter of 40mm. find the maximum and minimum stress in the insulation. 10M
4. (a) Distinguish between Underground cables and overhead lines. 5M
   (b) Explain the pressure cables with a neat sketch. 5M
5. (a).Show that in a three core belted cable the neutral capacitance to earth conductor C_n is equal to C_s+3C_c where C_s and C_c are capacitances of each conductor to sheath and to each other respectively. 5M
   (b) Show that the ratio of maximum potential gradient to the minimum potential gradient is R/r. Where r and R are the conductor radius and sheath radius. 5M
6. (a) Distinguish between the advantages & disadvantages of underground cable over overhead lines.
   (b) The maximum and minimum stresses in the dielectric of a single core cable are 40kv/cm (r.m.s) and 10kv/cm (r.m.s) respectively. If the conductor diameter is 1cm,
   find: (i) Thickness of insulation & (ii) Operating voltage. 10M
7. (a) What is the necessity of grading of cables? Explain briefly the various grading methods of cables**?** 5M
   (b) Explain the classification of cables. 5M
8. (a) Derive a relation between the conductor radius and inside sheath radius of a single core cable so that the electric stress of the conductor surface may be minimum. 4M
   (b) A cable has been insulated with two insulating materials having permittivity of 6 and 4 respectively. The inner and outer diameter of a cable is 3cms and 7cms. If the dielectric stress is 50kV/cm and 30kV/cm, calculate the radial thickness of each insulating layer and the safe working voltage of the cable. 6M
9. Explain the construction of underground cables. 10M
10. a) What is a cable? What types of insulating materials are used in cables? 2M
    b) what is a dielectric test? 2M
    c)Draw 3-core cable and indicate its parts. 2M

d) Classify the cables based on voltage and type of insulating materials used in them. 2M

e) Write a short note on screened cable. 2M

Prepared by:T.J.DEEPTHI