Code No: R31023 **R10** **Set No: 1**

III B.Tech. I Semester Regular Examinations, November/December - 2012

POWER SYSTEMS - II

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

*****

1. (a) A 3- phase 50Hz transmission line has conductor of section 90 sq.mm. And effecting diameter of 1 cm and are placed at the vertices of an equilateral triangle of side 1m. The line is 40 km long and delivers a load of 10MW at 33kv and pf=0.9. Compute the efficiency and regulation of the line. Neglect capacitance and assume temperature of 20degree centigrade.
(b) Derive an expression for the capacitance per km of single phase line taking into account the effect of ground.

2. (a) Evaluate the generalized circuit constraints for short and medium (both T and π) transmission lines
(b) A 3-phase 50Hz over head transmission line has the following distributed constraints R=28 ohms, Inductive reactance= 63 ohms, capacitive reactance= $4x10^{-4}$ mho. If the load at the receiving end is 75 MVA at 0.8 pf. Lagging with 132 kv between lines, calculate (i) Voltage (ii) Current (iii) Power facto at the sending end (iv) Regulation (v) Efficiency of transmission for this load. Use Nominal T method and also draw phasor diagram.

3. (a) What do understand by long transmission lines? How capacitance effects are taken into account in such lines?
(b) For a 215 kv, 400km, 60 Hz, 3-phase long transmission line, Z=(0.1+j0.5) Ω/km, and $y=j3.2x10^{-6}$ mho/km. The line supplies a 150 µW load at unity pf. Determine
(i) The voltage regulation (ii) The sending end power (iii) The efficiency of transmission.

4. (a) Explain the variation of current and voltage on an overhead line when one end of the line is short circuited and at the other end a source of constant e.m.f V is switched in.
(b) An overhead line with surge impedance of 500 ohms and an effective resistance of 6 ohms per km. If a surge of 400 kv enters the line at a certain point, calculate the magnitude of this surge after it has travelled 100 km and calculate the power loss and heat loss of the wave over this distance. Assume if any data required.

5. (a) Deduce from first principle expressions for the disruptive critical voltage between two smooth circular wires and potential gradient any point along a line joining their centres.
(b) Find the ratio of critical voltage when the distance between the conductors is halved, other data remaining the same.

6. (a) Derive expressions for sag and tension in a power conductor strung between two supports at unequal heights taking into account the wind and ice loadings also.
(b) Describe the vibration of power conductors and explain the methods used to damp out these vibrations.

7. (a) Write short notes on different types of insulators used for overhead lines.
(b) Each conductor of a 33kv, 3-phase system is suspended by a string of three similar insulators; the capacitance of each disc is nine times the capacitance to ground. Calculate the voltage across each insulator. Determine the string efficiency also.

8. (a) What are the types of power factor improvement equipments? Explain in details.
(b) A single phase motor connected to 400V, 50 Hz supply takes 31.7 A at a power factor of 0.7 lagging. Calculate the capacitance required in parallel with the motor to raise the power factor to 0.9 lagging.

*****

Code No: R31023 **R10** **Set No: 2**

III B.Tech. I Semester Regular Examinations, November/December - 2012

POWER SYSTEMS - II

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

*****

1. (a) Show how the capacitance of a 3-phase transmission line with unsymmetrical spacing between conductors can be calculated. Assume no transposition.
(b) A 1-phase overhead line consists of a pair of parallel wires 10mm in diameter spaced uniformly 2 meters apart in air. Find the capacitance per km length. If the line is 30 km long and its one end is connected to 50kv, 50Hz system what is the charging current with the other end open circuited?

2. (a) A 3-phase 50Hz over head transmission line has the following distributed constraints R=28 ohms, Inductive reactance= 63 ohms, capacitive reactance= $4x10^{-4}$ mho. If the load at the receiving end is 75 MVA at 0.8 pf. Lagging with 132 kv between lines, calculate (i) Voltage (ii) Current (iii) Power facto at the sending end (iv) Regulation (v) Efficiency of transmission for this load. Use Nominal π method and also draw phasor diagram.

   (b)Explain the classification of lines based on their length of transmission.

3. Starting from first principle show that surges behaves as travelling waves. Find expressions for surge impedance and wave velocity.

4. (a) What is a travelling wave? Explain the development of such a wave on an overhead line.
(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.

5. (a) What is corona? Explain the theory of corona formation in detail?
(b) A conductor with 3.0 cm dia is passed centrally through a porcelain bushing ϵ_r=4 having internal and external diameters of 3.5 cm and 9 cm respectively. The voltage between the conductor and an earthed clamp surrounding the porcelain is 25 kv rm. Determine whether corona will be present is the air space around the conductor.

6. (a) Derive the sag magnitude when
   (i) When supports are at equal levels
   (ii) When supports are at unequal levels
(b) A 132 kv transmission line has the following data:
Wt. Of conductor = 680 kg/km ; Length of span =260 m
Ultimate strength = 3100 kg ; Safety factor = 2
Calculate the height above ground at which the conductor should be supported. Ground clearance required is 10 meters.

7. (a) A string of 6 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.
(b) Write short notes on pin type insulator? What are its limitations?

8. (a) Explain any two methods of voltage control in a power system.
(b) A 3-phase, 50 Hz, 400V motor develops 100 HP, the power factor being 0.75 lagging and efficiency 93 %. A bank of capacitors is connected in delta across the supply terminals and power factor raised to 0.95 lagging. Each of the capacitance units is built of 4 similar 100V capacitors. Determine the capacitance of each capacitor.

*****

Code No: R31023 **R10** **Set No: 3**

III B.Tech. I Semester Regular Examinations, November/December - 2012

POWER SYSTEMS - II

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

*****

1. (a) Derive expression of the capacitance per phase of a 3-phase line with (i) equilateral and (ii) unsymmetrical spacing. Assume transposition in (ii)
(b) A wire 4 mm in diameter is suspended at a constant height 10 meters above the sea level which constitute the return conductor. Calculate the inductance of the system per km.

2. A transmission line has a series impedance of 20+j40 ohms and a shunt admittance of $4x10^{-4}$ ohms. Find A,B,C,D constraints based on
(a) Nominal T method (b) Nominal π method

3. Deduce expression for the magnitudes of incident and reflected voltages at any point on a transmission line in terms of voltage and current at receiving end characteristic impedance and propagation constant of the line. Show how these expressions are useful in determining voltage and current distribution along the line.

4. Explain the variation of current and voltage on an overhead line when one end of the line is
(a) Short circuited
(b) Open circuited.
Assume at the other end a source of constant voltage V is switched in both the cases.

5. (a) Write short notes on (i) Skin Effect (ii) Proximity Effect (iii) Advantages of bundle conductors for overhead transmission lines.
(b) A certain 3-phase equilateral transmission line has a total corona loss of 53 KW at 106 KV and a loss of 98 KW at 110.9 KV. What is the disruptive critical voltage? What is the corona loss at 113 KV?

6. (a) Derive and explain the sag magnitude under wind and ice loading conditions.
(b) The towers of height 30m and 90 m respectively support a transmission line conductor at water crossing. The horizontal distance between the towers is 500 m. Is the tension in the conductor is 1600 kg. Find the minimum clearance of the conductor and water and clearance mid-way between the supports. Weight of conductor is 1.5 kg/m. Bases of the towers can be considered to be at water level.

7. Explain the various methods for equalizing the potential across the various units in an insulator string and discuss the methods for improving the string efficiency in a string of insulators.

8. (a) Explain in detail how to control the voltage by using tap changing transformer and booster transformer.
(b) A 3-phase overhead line has per phase resistance and reactance of 6 ohms and 20 ohms respectively. The sending end voltage is 66 KV while the receiving end voltage is maintained at 66 KV by synchronous phase modifier. Determine the KVAr of the modifier when the load at the receiving end is 75 MW at pf. 0.8 lagging also determine the maximum load that can be transmitted.

*****

Code No: R31023 **R10** **Set No: 4**

III B.Tech. I Semester Regular Examinations, November/December - 2012

POWER SYSTEMS - II

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

*****

1. (a) Derive expressions for the flux linkages of one conductor in a group of n conductors carrying currents whose sum is zero. Hence derive an expression for inductance of composite conductors of a 1-phase line consisting of m strands in one conductor and n strands in the other conductor.
   (b) Explain the concept of self GMD and mutual GMD for evaluating inductance of transmission lines.

2. Derive the A,B,C,D parameters of medium lines from
   (a) Nominal T method
   (b) Nominal π method.

3. (a) With reference to long transmission line, give physical interpretation of the terms of characteristic impedance and propagation constant? What is meant by surge impedance?
   (b) Determine ABCD constant for 3-phase 50 Hz transmission line 200 km long having the following distributed parameters. L= 1.20×10^{-3} H/km, C= 8×10^{-9} F/km, R = 0.15 Ω/km, G=0.
4. (a) Explain the variation of current and voltage on an overhead line when one end of the line is open circuited and at the other end a source of constant voltage V is switched in.
   (b) The effective inductance and capacitance of a faulted system as viewed from the contacts of a breaker are 2.5 mH and 600pF respectively. Determine the restriking voltage across the breaker contacts when a fault current of 150 amps is chopped.

5. (a) What are the factors which effect corona?
   (b) A 132 kv line with 1.956 cm dia. Conductor is built so that corona takes place if the line voltage exceeds 210kv (rms). If the value of potential gradient at which ionisation occurs can be taken as 30 kv per cm, find the spacing between the conductors.

6. (a) Is sag a necessity or an evil? Discuss and what are the mechanical principles should be followed while designing the transmission line?
   (b) A transmission line conductor at a river crossing is supported from two towers at heights of 45 meters and 75 meters above water level. The span length is 300 meters. Weight of the conductor 0.85kg/m. Determine the clearance between the conductor and water at a point midway between towers if the tension is the conductor is 2050 kg.

7. (a) Write a short note on different types of insulators used for overhead lines and their applications. Show with the help of a neat sketch, the electrostatic field of a pin insulator and explain how far the shape of modern insulator conforms to these requirements.
   (b) What are the basic tests to be carried out on insulators?

8. Explain how to control voltage by using
   (a) shunt capacitors
   (b) Synchronous capacitors
   (c) Tap changing transformers
   (d) Booster transformer.

*****