PAVENDAR BHARATHIDASAN
INSTITUTE OF INFORMATION TECHNOLOGY
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An ISO 9001:2008 Certified Institution
Learning for Excellence

DEPARTMENT OF EEE

QUESTION BANK

(As Per AUT 2008 REGULATION)

SUB CODE: EE1004

SUB NAME: POWER SYSTEM TRANSIENTS

YEAR : IV

SEM : VIII

PREPARED BY

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UNIT-I

SWITCHING TRANSIENTS

PART-A

1.What are the Sources of transients?

The sources of transients are classified as

i) Internal sources ii) External sources

The internal sources are classified as

a) Switching surges i.e., due to the opening and closing of a switch in power system

b) Insulation failures

c) Arcing ground

d) Ferro resonance

The external source for power system transient is lightning.

2. What is meant by resistance switching

A delibrate connection of a resistance in parallel with the contact space (arc) is made to overcome the effect of transient recovery voltage. This is known as Resistance switching. The shunt resistors connected across circuit breaker have two functions.

1. To distribute the transient recovery voltage more uniformly across theseveral breaks.
2. To reduce the severity of transient recovery voltage at the time of interruption by introducing damping into oscillation.

3. What are the types of power system transients?

4. State the importance of transient study in planning.

5. List the effects of transients in power system.

6. Name the various types of Transients in power system.

7. What are the effects of lightning transients?

8. Define transient.

9. What is ferroresonance?

10. What is lightning?

11. What are the types of lightning?

PART-B

1. Explain the various types of power system transients.
2. Explain the effects of transients on power system.
3. Briefly explain the importance of study of transients in planning.
4. What are the broad classifications of power system transients? Describe its different types depending upon its nature.

UNIT-II

LOAD SWITCHING

PART-A

1.Define current chopping.

When breaking low currents (ie) unloaded transformer or reactor magnetizing current, the powerful deionizing effect of air blast circuit breaker (CB) causes the current abruptly to zero well before the natural current zero is reached. This phenomenon is called current chopping and it produces high voltage transients across the breaker contacts, The transient over voltage due to current chopping is prevented by resistance switching.

2. What is restriking voltage?

It is the transient voltage that appears across the contacts of the circuit breaker at or near the zero current instant during arcing period. A high frequency transient voltage appears across the contacts and is caused by the rapid distribution of energy between the magnetic & electric field associated with the station & transmission lines of the system at the zero current. This transient voltage is known as restriking voltage.

3. What is capacitance switching?

The shunt capacitors are employed to correct a lagging power factor, or in some cases, to provide voltage support for the system. In some applications they are switched in and out quite frequently as the system load varies and the system voltage fluctuates. The switching operations are nontrivial and should be carefully considered when designing capacitor banks and their associated switching equipment. This is called as capacitance switching.

4.What are the causes of switching surges?

5.What are the observations in RLC circuit?

6.Draw the equivalent circuit for interrupting the resistor current.

7.What is meant by load switching?

8.Define normal and abnormal switching transients.

9.What are the effects of source regulation?

10.Draw double frequency transient circuit with an example.

11.Give the relation between time constant of parallel and series circuit.

12.What is the need for resistance switching?

PART-B

1. Explain with appropriate waveform,
   - (i) Current suppression.
   - (ii) Current chopping
   - (iii) Capacitance switching with one and multiple restrikes.
   - (iv) Ferro resonance.
2. Explain in detail about,

(i) Resistance switching and

(ii) Load switching with their equivalent circuits.

3. Explain the load switching in both normal and abnormal conditions with neat sketches.
4. What is capacitance switching? Explain in briefly the effects of source regulations and capacitance switching with a restrike.

UNIT-III

LIGHTNING TRANSIENTS

PART-A

1.What are the causes of over voltage?

The causes of transients are classified as

i) Internal cause ii) External cause

The internal causes are classified as

a) Switching surges i.e., due to the opening and closing of a switch in power system

b) Insulation failures

c) Arcing ground

d) Ferro resonance

The external cause for power system transient is lightning.

2. Define tower footing resistance.

Tower footing resistance is the resistance offered by tower footing to the dissipation of current. The effective of a ground wire depends to a large extend on the tower footing resistance. The tower top potential depends on this resistance.

Significance of Tower footing resistance

- A low value of tower footing resistance results in less voltage stresses across line insulation.
- A tower footing resistance of 200 for EHV lines and 100 for HV lines provides sufficient lightning protection.
- Tower footing resistance depends on

i) Type of electrode configuration employed

ii) Soil resistivity

3. Give the factors contributing to good line design.

In order to reduce the hazard that lightning poses to power system, certain factor that determine the line performance must be understood.

- First we try to keep the incidence of stokes to the system to a minimum.
- The objective of good line design is to reduce the number of outages caused by lightning.
- First we try to keep the incidence of stokes to the system to a minimum.
- Then we try to minimize the effects of those strokes that do terminate on the system.
- Lightning problems can be eliminated if all transmission was through tunnels at least 20ft under the ground.
- Tall towers are more vulnerable than low goal post-like structures. In order to prevent the lightning, some adequate clearances must be provided.
- High ground impedance or tower footing resistance is to be avoided. High surge impedance in ground wires, tower structures are to be avoided.

4.List the characteristics features of lightning strokes.

5.What is arcing ground?

6.Define lightning phenomenon.

7.Define Isokeraunic level.

8.What are the types of protection afforded by ground wires?

9.Define dart leader.

10.Write short note about stepped leader and pilot streamer.

11.Differentiate lightning and switching over voltages.

12.Define overvoltage factor.

13.State Mason's theory of lightning.

14.What are the characteristics of lightning strokes?

PART-B

1. Discuss the mechanism of lightning strokes and over voltages on transmission lines.
2. Discuss the different theories of charge formation of thunder clouds.
3. Explain in detail how the charges are formed in the clouds.
4. Discuss the interaction of lightning with power system.
5. What are the factors contributing to good line design?
6. Explain the counter-poise method of protection.
7. (a) Give the mathematical models for lightning discharges and explain them.
   (b) Explain the different characteristics of the lightning strokes.

UNIT-IV

TRAVELLING WAVES ON TRANSMISSION LINE AND TRANSIENTS

PART-A

1. **Draw the circuit of long transmission line with lumped parameters.**

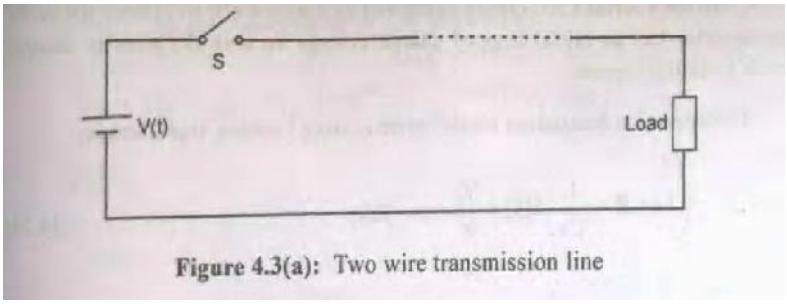

Figure 4.3(a): Two wire transmission line

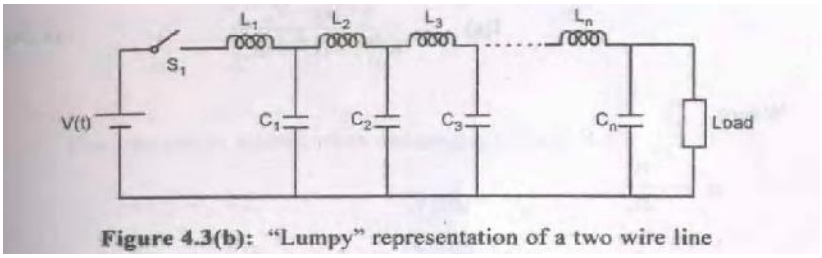

Figure 4.3(b): "Lumpy" representation of a two wire line

2.Give the concept of traveling wave in brief.

Any disturbance on a transmission line (or) system such as sudden opening or closing of line, a short circuit or a fault results in the development of over voltages or over current at that point. This disturbance propagates as a travelling wave to the ends of the line (or) to a termination, such as a substation. Usually these travelling waves are high frequency disturbances and travel as waves. They may be reflected, transmitted, attenuated or distorted during propagation until the energy is absorbed.

3.What are the specifications of a traveling wave?

4.Write the expression for series and shunt lumped parameters in distributed lines.

5.Define standing waves and natural frequencies.

6.What is meant by reflection and refraction of traveling waves.

PART-B

1. Discuss transient response of systems with series and shunt lumped parameters and distributed lines.
2. With neat sketch explain Bewley's Lattice diagram.
3. Derive the reflection and refraction coefficients of a traveling wave.
4. Write short notes on standing waves and natural frequency.
5. Explain the various type of traveling wave concept in step response.

UNIT-V

TRANSIENTS IN INTEGRATED POWER SYSTEM

PART-A

1.Define is kilometric fault.

The Circuit breakers undergo less difficulty in interrupting current to a fault located close to their terminals than the current to a similar fault located away from the terminals. Kilometric fault is the fault located beyond the terminals and thus the current can be easily interrupted due to the added impedance of the line. This added impedance not only limits the current but also supports some of the system voltage.

2. What is meant by distribution of voltage in a power system?

In an integrated power system the voltage produced will be distributed to the consumer ends through transmission line .If a fault occurs at transmission line then the CB operates and interrupt the fault current. During the interruption of fault the voltage will be distributed along the lines according to its added impedance.

3.Define over voltage in the context of integrated power system.

In integrated power system the lightning transients produce the highest voltage and The switching transients geared with the system voltage and consequently produces a very high voltage. In integrated system the over voltage produced will be very high.

4.What are the applications of EMTP?

The EMTP is a comprehensive computer program designed to solve electrical transient problems in lumpy circuits, distributed circuits. This program is capable of solving steady-state circuit problems. Transient analysis can be carried out in circuits with any arbitrary configuration of lumped parameters (R, L and C).
Transmission lines with distributed parameters, transposed (or) untransposed, can be included in the network.

5.What is load rejection?

6.How does a surge occur during switching?

7.What meant by distribution of voltage in a power system?

8.What is meant by line dropping?

9.Explain the over voltage induced by faults.

10.What are the switching surges on integrated system?

11.Explain EMTP for transient computation.

PART-B

1. Explain short line kilometric fault.
2. What is line dropping and load rejection? Explain.
3. Explain switching surges on integrated system.
4. Explain EMTP for transient computation.
5. Explain the over voltage induced by faults.