# COURSE OBJECTIVES

**Academic Year**: 2013-2014  
**Semester**: I  

**Name of the Program**: B.Tech  
**Year**: I  
**Section**: A  

**Course/Subject**: NETWORK THEORY  
**Course Code**: GR11A2018  

**Name of the Faculty**: M. Srikanth  
**Dept.**: EEE  
**Designation**: ASST.PROFESSOR

On completion of this Subject/Course the student shall be able to:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To prepare the students to have a basic knowledge in the analysis of Electric Networks</td>
</tr>
<tr>
<td>2</td>
<td>To solve the given circuit with various theorems and methods.</td>
</tr>
<tr>
<td>3</td>
<td>To analyse the various three phase circuits star and delta connections.</td>
</tr>
<tr>
<td>4</td>
<td>To distinguish between tie set and cut set methods for solving various circuits.</td>
</tr>
<tr>
<td>5</td>
<td>To design various types of filters.</td>
</tr>
<tr>
<td>6</td>
<td>To relate various two port parameters and transform them.</td>
</tr>
</tbody>
</table>

Signature of HOD  
Signature of faculty  

Date:  
Date:
COURSE OUTCOMES

Academic Year : 2013-2014

Semester : I

Name of the Program: B.Tech …………………. Year: …..II……. Section: A

Course/Subject: ……………..NETWORK THEORY ……………Course Code: GR11A2018

Name of the Faculty: …………..M.Srikanth……………………………..Dept.: EEE………

Designation: ASST.PROFESSOR.

The expected outcomes of the Course/Subject are:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Will able to articulate in working of various components of a circuit.</td>
</tr>
<tr>
<td>2</td>
<td>Will be familiar with ac and dc circuits solving.</td>
</tr>
<tr>
<td>3</td>
<td>Will be ready with the most important concepts like mesh and nodal analysis.</td>
</tr>
<tr>
<td>4</td>
<td>Ability to Solve Circuits using Tree, Node, Branch, Cut set, Tie Set Methods.</td>
</tr>
<tr>
<td>5</td>
<td>Ability to measure Three phase voltages and current, active, reactive powers</td>
</tr>
<tr>
<td>6</td>
<td>Ability to convert Three phase Star to Three phase Delta circuits and Vice-Versa.</td>
</tr>
<tr>
<td>7</td>
<td>Ability to Express given Electrical Circuit in terms of A,B,C,D and Z,Y Parameter Model and Solve the circuits.</td>
</tr>
</tbody>
</table>

Signature of HOD                                               Signature of faculty
Date:                                                         Date:
Gokaraju Rangaraju Institute of Engineering and Technology

(An Autonomous Institute under JNTUH)

Department/Program-EEE

Vision of the Institute

To be among the best of the institutions for engineers and technologists with attitudes, skills and knowledge and to become an epicenter of creative solutions.

Mission of the Institute

To achieve and impart quality education with an emphasis on practical skills and social relevance.

Vision of the Department

To impart technical knowledge and skills required to succeed in life, career and help society to achieve self sufficiency.

Mission of the Department

- To become an internationally leading department for higher learning.
- To build upon the culture and values of universal science and contemporary education.
- To be a center of research and education generating knowledge and technologies which lay groundwork in shaping the future in the fields of electrical and electronics engineering.
- To develop partnership with industrial, R&D and government agencies and actively participate in conferences, technical and community activities.

Program Educational Objectives:
This programme is meant to prepare our students to professionally thrive and to lead.

During their progression:

**PEO 1:** Graduates will have a successful technical or professional careers, including supportive and leadership roles on multidisciplinary teams.

**PEO 2:** Graduates will be able to acquire, use and develop skills as required for effective professional practices.
**PEO 3:** Graduates will be able to attain holistic education that is an essential prerequisite for being a responsible member of society.

**PEO 4:** Graduates will be engaged in life-long learning, to remain abreast in their profession and be leaders in our technologically vibrant society.

Program outcomes.

- a) Ability to apply knowledge of mathematics, science, and engineering.
- b) Ability to design and conduct experiments, as well as to analyze and interpret data.
- c) Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- d) Ability to function on multi-disciplinary teams.
- e) Ability to identify, formulates, and solves engineering problems.
- f) Understanding of professional and ethical responsibility.
- g) Ability to communicate effectively.
- h) Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- i) Recognition of the need for, and an ability to engage in life-long learning.
- j) Knowledge of contemporary issues.
- k) Ability to utilize experimental, statistical and computational methods and tools necessary for engineering practice.
- l) Graduates will demonstrate an ability to design electrical and electronic circuits, power electronics, power systems; electrical machines analyze and interpret data and also an ability to design digital and analog systems and programming them.

**Name of the Course: Network Theory**

**Course educational objectives:**

On completion of this Subject/Course the student shall be able to

1. Prepare the students to have a basic knowledge in the analysis of Electric Networks.
2. Solve the given circuit with various theorems and methods.
3. Analyse the various three phase circuits star and delta connections.
4. Distinguish between tie set and cut set methods for solving various circuits.
5. Design various types of filters.
6. Relate various two port parameters and transform them.
Course outcomes:

At the end of the course student will have ability to
1. Articulate in working of various components of a circuit.
2. Familiar with ac and dc circuits solving.
3. Ready with the most important concepts like mesh and nodal analysis.
5. Measure Three phase voltages and current, active, reactive powers.
6. Convert Three phase Star to Three phase Delta circuits and Vice-Versa.
7. Express given Electrical Circuit in terms of A,B,C,D and Z,Y Parameter model and solve the circuits.

Assessment methods:

1. Regular attendance to classes.
2. Written tests clearly linked to learning objectives
3. Classroom assessment techniques like tutorial sheets and assignments.
4. Seminars.

1. Program Educational Objectives (PEOs) – Vision/Mission Matrix (Indicate the relationships by mark “X”)

<table>
<thead>
<tr>
<th>PEOs</th>
<th>Mission of department</th>
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<tbody>
<tr>
<td></td>
<td>Higher Learning</td>
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<tr>
<td>Graduates will have a successful technical or professional careers,</td>
<td>X</td>
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<td>including supportive and leadership roles on multidisciplinary teams</td>
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<td>Graduates will be able to acquire, use and develop skills as</td>
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<td>required for effective professional practices</td>
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<td>Graduates will be able to attain holistic education that is an</td>
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<td>essential prerequisite for being a responsible member of society</td>
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<td>Graduates will be engaged in life-long learning, to remain abreast</td>
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<tr>
<td>in their profession and be leaders in our technologically vibrant</td>
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<tr>
<td>society.</td>
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</table>
2. Program Educational Objectives (PEOs)-Program Outcomes (POs) Relationship Matrix (Indicate the relationships by mark “X”)

<table>
<thead>
<tr>
<th>P-Outcomes</th>
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3. Course Objectives-Course Outcomes Relationship Matrix (Indicate the relationships by mark “X”)

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4. Course Objectives-Program Outcomes (POs) Relationship Matrix (Indicate the relationships by mark “X”)

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</table>
5. Course Outcomes-Program Outcomes (POs) Relationship Matrix (Indicate the relationships by mark “X”) 

<table>
<thead>
<tr>
<th>P-Outcomes</th>
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</tbody>
</table>

6. Courses (with title & code)-Program Outcomes (POs) Relationship Matrix (Indicate the relationships by mark “X”) 

<table>
<thead>
<tr>
<th>P-Outcomes</th>
<th>a</th>
<th>b</th>
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</table>

7. Program Educational Objectives (PEOs)-Course Outcomes Relationship Matrix (Indicate the relationships by mark “X”) 

<table>
<thead>
<tr>
<th>P-Objectives (PEOs)</th>
<th>1</th>
<th>2</th>
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</table>
8. Assignments & Assessments-Program Outcomes (POs) Relationship Matrix
   (Indicate the relationships by mark “X”)

<table>
<thead>
<tr>
<th>POs</th>
<th>a</th>
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9. Assignments & Assessments-Program Educational Objectives (PEOs)
   Relationship Matrix (Indicate the relationships by mark “X”)

<table>
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Assessment process and Relevant Surveys conducted:

10. Constituencies -Program Outcomes (POs) Relationship Matrix (Indicate the relationships by mark “X”).

<table>
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<tr>
<th>POs</th>
<th>Constituencies</th>
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</tr>
</tbody>
</table>
**Assessment Process and Areas of improvements:**

**Prepare the following Matrix:**

11. **The improvements Matrix** are summarized below and described in the text that follows.

**Hint:**

**Example:**

<table>
<thead>
<tr>
<th>Proposed Change</th>
<th>Year Proposed</th>
<th>Year Implemented</th>
<th>Old Version</th>
<th>New Version</th>
<th>Comments</th>
</tr>
</thead>
</table>
GUIDELINES TO STUDY THE COURSE / SUBJECT

Academic Year : 2013-2014
Semester : I

Name of the Program: B.Tech ..................... Year: ......II.......... Section: A

Course/Subject: .................NETWORK THEORY.................. Course Code: GR11A2018

Name of the Faculty: .............M.Srikanth...........................................Dept.: EEE.....

Designation: ASST.PROFESSOR.

Guidelines to study the Course/ Subject: NETWORK THEORY.

Course Design and Delivery System (CDD):

- The Course syllabus is written into number of learning objectives and outcomes.
- These learning objectives and outcomes will be achieved through lectures, assessments, assignments, experiments in the laboratory, projects, seminars, presentations, etc.
- Every student will be given an assessment plan, criteria for assessment, scheme of evaluation and grading method.
- The Learning Process will be carried out through assessments of Knowledge, Skills and Attitude by various methods and the students will be given guidance to refer to the text books, reference books, journals, etc.

The faculty be able to –

- Understand the principles of Learning
- Understand the psychology of students
- Develop instructional objectives for a given topic
- Prepare course, unit and lesson plans
- Understand different methods of teaching and learning
- Use appropriate teaching and learning aids
- Plan and deliver lectures effectively
- Provide feedback to students using various methods of Assessments and tools of Evaluation
- Act as a guide, advisor, counselor, facilitator, motivator and not just as a teacher alone

Signature of HOD .........................................................
Date: .................................................................

Signature of faculty ..................................................
Date: .................................................................
### COURSE SCHEDULE

**Academic Year**: 2013-2014  
**Semester**: I  

**Name of the Program**: ……B.Tech ………. Year: …..II……… Section: A  

**Course/Subject**: ……………..NETWORK THEORY………….. Course Code: GR11A2018  

**Name of the Faculty**: ………M.Srikanth…………………………………..Dept.: …….EEE…………

**Designation**: ASST.PROFESSOR.

The Schedule for the whole Course / Subject is:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description</th>
<th>Duration (Date)</th>
<th>Total No. Of Periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Three Phase Circuits</td>
<td>19/07/13 - 06/08/13</td>
<td>16</td>
</tr>
<tr>
<td>2.</td>
<td>Two-Port Networks</td>
<td>07/08/13 - 06/09/13</td>
<td>14</td>
</tr>
<tr>
<td>3.</td>
<td>Transient Analysis</td>
<td>10/09/13 - 24/09/13</td>
<td>10</td>
</tr>
<tr>
<td>4.</td>
<td>Magnetic Circuits and Network Topology</td>
<td>27/09/13 - 16/10/13</td>
<td>13</td>
</tr>
<tr>
<td>5.</td>
<td>Filters</td>
<td>22/10/13 - 01/11/13</td>
<td>10</td>
</tr>
</tbody>
</table>

Total No. of Instructional periods available for the course: …..63………. Hours / Periods
ILLUSTRATIVE VERBS FOR STATING INSTRUCTIONAL OBJECTIVES

These verbs can also be used while framing questions for Continuous Assessment Examinations as well as for End – Semester (final) Examinations

<table>
<thead>
<tr>
<th>Illustrative verbs for stating general objectives/outcomes</th>
</tr>
</thead>
</table>

**ILLUSTRATIVE VERBS FOR STATING SPECIFIC OBJECTIVES/OUTCOMES:**

**A. COGNITIVE DOMAIN (KNOWLEDGE):**

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Comprehension Understanding</th>
<th>Application of knowledge &amp; comprehension</th>
<th>Analysis Of whole w.r.t. its constituents</th>
<th>Synthesis</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define</td>
<td>Convert</td>
<td>Change</td>
<td>Breakdown</td>
<td>Categorize</td>
<td>Appraise</td>
</tr>
<tr>
<td>Identify</td>
<td>Defend</td>
<td>Compute</td>
<td>Differentiate</td>
<td>Combine</td>
<td>Compare</td>
</tr>
<tr>
<td>Label</td>
<td>Describe (a Procedure)</td>
<td>Demonstrate</td>
<td>Discriminate</td>
<td>Compose</td>
<td>Conclude</td>
</tr>
<tr>
<td>List</td>
<td>Distinguish</td>
<td>Manipulate</td>
<td>Separate</td>
<td>Create</td>
<td>Criticize</td>
</tr>
<tr>
<td>March</td>
<td>Distinguish</td>
<td>Modify</td>
<td>Subdivide</td>
<td>Devise</td>
<td>Justify</td>
</tr>
<tr>
<td>Reproduce</td>
<td>Estimate</td>
<td>Predict</td>
<td>Design</td>
<td>Interpret</td>
<td></td>
</tr>
<tr>
<td>Select</td>
<td>Explain why/how</td>
<td>Predict</td>
<td>Generate</td>
<td>Support</td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>Extend</td>
<td>Prepare</td>
<td>Generate</td>
<td>Support</td>
<td></td>
</tr>
<tr>
<td>Generalize</td>
<td></td>
<td>Relate</td>
<td>Organize</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Give examples</td>
<td>Solve</td>
<td>Show</td>
<td>Plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illustrate</td>
<td></td>
<td></td>
<td>Plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infer</td>
<td>Summarize</td>
<td></td>
<td>Plan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**B. AFFECTIVE DOMAIN (ATTITUDE):**

<table>
<thead>
<tr>
<th>Adhere</th>
<th>Resolve</th>
<th>Bend</th>
<th>Dissect</th>
<th>Insert</th>
<th>Perform</th>
<th>Straighten</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assist</td>
<td>Select</td>
<td>Calibrate</td>
<td>Draw</td>
<td>Keep</td>
<td>Prepare</td>
<td>Strengthen</td>
</tr>
<tr>
<td>Attend</td>
<td>Serve</td>
<td>Compress</td>
<td>Extend</td>
<td>Elongate</td>
<td>Remove</td>
<td>Time</td>
</tr>
<tr>
<td>Change</td>
<td>Share</td>
<td>Conduct</td>
<td>Feed</td>
<td>Limit</td>
<td>Replace</td>
<td>Transfer</td>
</tr>
<tr>
<td>Develop</td>
<td></td>
<td>Connect</td>
<td>File</td>
<td>Manipulate</td>
<td>Report</td>
<td>Type</td>
</tr>
<tr>
<td>Help</td>
<td></td>
<td>Convert</td>
<td>Grow</td>
<td>Move Precisely</td>
<td>Reset</td>
<td>Weigh</td>
</tr>
<tr>
<td>Influence</td>
<td></td>
<td>Decrease</td>
<td>Increase</td>
<td>Paint</td>
<td>Set</td>
<td></td>
</tr>
</tbody>
</table>

**C. PSYCHOMOTOR DOMAIN (SKILLS):**
SYLLABUS

Academic Year : 2013-2014

Semester : I

Name of the Program: B.Tech ...........Electrical.......................... Year: ........II..........

Course/Subject: .............Network Theory................................. Course Code:GR11A2018

Name of the Faculty: ............M.Srikanth..................................Dept.: ...EEE...........

Designation: ASST.PROFESSOR.

NETWORK THEORY.

UNIT – I    Three Phase Circuits- Phase sequence – Star and delta connection – Relation between line and phase voltages and currents in balanced systems – Analysis of balanced and Unbalanced 3 phase circuits – Measurement of active and reactive power.

UNIT – II Network Parameters- Network functions driving point and transfer impedance function networks- poles and zeros –necessary conditions for driving point function and for transfer function

Two port network parameters – Z, Y, ABCD and hybrid parameters and their relations– 2 -port network parameters using transformed variables.

UNIT-III Transient Analysis - Transient response of R-L, R-C, R-L-C circuits (Series and Parallel combinations) for d.c. and sinusoidal excitations – Initial conditions – Classical method and laplace transform methods of solutions

Transient response of the above circuits for different inputs such as step, ramp, pulse and impulse by using laplace transforms method.


Network topology - Definitions – Graph – Tree, Basic cutset and Basic Tieset matrices for planar networks – Loop and Nodal methods of analysis of Networks with dependent & independent voltage and current sources - Duality & Dual networks.

<table>
<thead>
<tr>
<th>Day/Hour</th>
<th>8:00-10:30</th>
<th>10:30-11:00</th>
<th>11:00-12:30</th>
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<td>Tuesday</td>
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<td>NT MS 2103</td>
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<td>Wednesday</td>
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<td></td>
<td>NT MS 2103</td>
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<td>Thursday</td>
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<tr>
<td>Friday</td>
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<td></td>
<td>NT MS 2103(11:00-12)</td>
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<tr>
<td>Saturday</td>
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</tbody>
</table>
### SCHEDULE OF INSTRUCTIONS
#### COURSE PLAN

**Academic Year**: 2013-2014

Semester: I

Name of the Program: B.Tech ……………….. Year: ........II......... Section: A

Course/Subject: ……………NETWORK THEORY……………… Course Code: GR11A2018

Name of the Faculty: …………M.Srikanth…………………………………...Dept.: …EEE……..

**Designation**: ASST.PROFESSOR

<table>
<thead>
<tr>
<th>S.No</th>
<th>Reference Text Books</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>T3</td>
<td>Electric Circuits</td>
<td>A.Chakrabarthy</td>
</tr>
<tr>
<td>T4</td>
<td>Network Theory</td>
<td>A.Sudhakar &amp; Shyammohan S Palli</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Lesson No.</th>
<th>Date</th>
<th>No. of Periods</th>
<th>Topics / Sub-Topics</th>
<th>Objectives &amp; Outcomes Nos.</th>
<th>References (Text Book, Journal…)</th>
<th>Page Nos.: ____to</th>
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<tbody>
<tr>
<td>1.</td>
<td>1.</td>
<td>19/07/13</td>
<td>1</td>
<td>Star &amp; Delta sources and loads, three phase waveform, balanced source and load, phase sequence and problems on phase sequence</td>
<td>CObj:1,2,3 CO:1,2,3,5,6</td>
<td>T1 Pg 479 to 481</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>2.</td>
<td>23/07/13</td>
<td>2</td>
<td>Star-star analysis, phase-line voltages and currents, problems on power</td>
<td>CObj:1,2,3 CO:1,2,3,5,6</td>
<td>T1 Pg 482 to 485</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>3.</td>
<td>24/07/13</td>
<td>2</td>
<td>Delta-delta analysis, phase-line voltages and currents, problems on power</td>
<td>CObj:1,2,3 CO:1,2,3,5,6</td>
<td>T1 Pg 488 to 490</td>
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<tr>
<td>1.</td>
<td>4.</td>
<td>26/07/13</td>
<td>1</td>
<td>Star-delta analysis &amp; Delta-star analysis, Problems</td>
<td>CObj:1,2,3 CO:1,2,3,5,6</td>
<td>T1 Pg 486 to 488 and 490 to 494</td>
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<tr>
<td>1.</td>
<td>5.</td>
<td>30/07/13</td>
<td>2</td>
<td>Unbalanced Circuits, Unbalanced source and loads, delta connected unbalanced connections</td>
<td>CObj:1,2,3 CO:1,2,3,5,6</td>
<td>T1 Pg 500 to 502</td>
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<tr>
<td>1.</td>
<td>6.</td>
<td>31/07/13</td>
<td>2</td>
<td>Four-wire star connected unbalanced load, problems</td>
<td>CObj:1,2,3 CO:1,2,3,5,6</td>
<td>T2 Pg 502 to 503</td>
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<tr>
<td>No.</td>
<td>Date</td>
<td>Time</td>
<td>Lecture Title</td>
<td>CObj:</td>
<td>CO:</td>
<td>Page Numbers</td>
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<td>1.</td>
<td>02/08/18</td>
<td>2</td>
<td>Three wire star connected unbalanced connections, delta to star and Millmans method, Problems</td>
<td>Obj:1,2,3</td>
<td>CO:1,2,3,5,6</td>
<td>T2 Pg503 to 504</td>
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<tr>
<td>1.</td>
<td>05/08/13</td>
<td>2</td>
<td>Power measurement by three wattmeter method, problems</td>
<td>Obj:1,2,3</td>
<td>CO:1,2,3,5,6</td>
<td>T2 Pg 478 to 481</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>06/08/13</td>
<td>2</td>
<td>Power measurement by two wattmeter method, power factor calculation, reactive power measurement by single wattmeter method, problems</td>
<td>Obj:1,2,3</td>
<td>CO:1,2,3,5,6</td>
<td>T2 Pg 481 to 483</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>07/08/13</td>
<td>2</td>
<td>2-port network parameters necessity, advantages and applications, z and y parameters</td>
<td>Obj:1,2,6</td>
<td>CO:1,2,3,7</td>
<td>T3 Pg 485 to 503</td>
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</tr>
<tr>
<td>2.</td>
<td>13/08/13</td>
<td>2</td>
<td>h,g,T,t parameters equations and calculations</td>
<td>Obj:1,2,6</td>
<td>CO:1,2,3,7</td>
<td>T3 Pg 504 to 507</td>
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<tr>
<td>2.</td>
<td>14/08/13</td>
<td>2</td>
<td>Problems on 2-port parameters, interrelation between various parameters</td>
<td>Obj:1,2,6</td>
<td>CO:1,2,3,7</td>
<td>T3 Pg 517 to 520</td>
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<tr>
<td>2.</td>
<td>27/08/13</td>
<td>2</td>
<td>Continuation of interrelation between various parameters</td>
<td>Obj:1,2,6</td>
<td>CO:1,2,3,7</td>
<td>T3 Pg 517 to 520</td>
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<tr>
<td>2.</td>
<td>28/08/13</td>
<td>2</td>
<td>Derivation of conditions for symmetry &amp; reciprocity and problems</td>
<td>Obj:1,2,6</td>
<td>CO:1,2,3,7</td>
<td>T3 Pg 508 to 510</td>
<td></td>
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<tr>
<td>2.</td>
<td>30/08/13</td>
<td>2</td>
<td>2-port networks using transformed variables</td>
<td>Obj:1,2,6</td>
<td>CO:1,2,3,7</td>
<td>T4 Pg 6.20 to 6.24</td>
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<tr>
<td>2.</td>
<td>03/09/13</td>
<td>2</td>
<td>Network functions driving point and transfer impedance function networks</td>
<td>Obj:1,2,6</td>
<td>CO:1,2,3,7</td>
<td>T4 Pg 4.4 to 4.8</td>
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<tr>
<td>2.</td>
<td>06/09/13</td>
<td>2</td>
<td>Poles and zeros, necessary conditions for driving point function and transfer function</td>
<td>Obj:1,2,6</td>
<td>CO:1,2,3,7</td>
<td>T4 Pg 4.16 to 4.25</td>
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<tr>
<td>2.</td>
<td>10/09/13</td>
<td>2</td>
<td>Transient response of series and parallel R-L, R-C circuits and problems with dc excitations.</td>
<td>Obj:1,2</td>
<td>CO:1,2,3</td>
<td>T4 Pg 2.2 to 2.6</td>
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<tr>
<td>3.</td>
<td>11/09/13</td>
<td>2</td>
<td>Transient response of series and parallel R-L-C using DE and L.T approach with dc excitation</td>
<td>Obj:1,2</td>
<td>CO:1,2,3</td>
<td>T4 Pg 2.8 to 2.10</td>
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<tr>
<td>3.</td>
<td>13/09/13</td>
<td>2</td>
<td>Problems on transient analysis using dc excitation</td>
<td>Obj:1,2</td>
<td>CO:1,2,3</td>
<td>T4 Pg 2.10 to 2.11</td>
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<td>17/09/13</td>
<td>2</td>
<td>Transient response of R-L, R-C series circuits for various inputs like step, ramp, pulse and impulse and problems</td>
<td>Obj:1,2</td>
<td>CO:1,2,3</td>
<td>T3 Pg 355 to 360</td>
<td></td>
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<tr>
<td>3.</td>
<td>20/09/13</td>
<td>2</td>
<td>Transient response of series and parallel R-L, R-C circuits with sinusoidal excitation by DE and L.T method</td>
<td>Obj:1,2</td>
<td>CO:1,2,3</td>
<td>T4 Pg 3.1 to 3.5</td>
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</tr>
<tr>
<td>3.</td>
<td>24/09/13</td>
<td>2</td>
<td>Transient response of series and parallel R-L, R-C circuits and problems with dc excitations.</td>
<td>Obj:1,2</td>
<td>CO:1,2,3</td>
<td>T4 Pg 3.1 to 3.5</td>
<td></td>
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<tr>
<td>3.</td>
<td>27/09/13</td>
<td>2</td>
<td>Transient response of series and parallel R-L-C using DE and L.T approach with sinusoidal excitation</td>
<td>Obj:1,2</td>
<td>CO:1,2,3</td>
<td>T4 Pg 3.9 to 3.11</td>
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<tr>
<td>4.</td>
<td>25.</td>
<td>01/10/13</td>
<td>2</td>
<td>Definitions-Graph-Tree-Links-Chords-Cotree-Incidence matrix-Reduced incidencematrix</td>
<td>CObj:1,2,4 CO:1,2,3,4</td>
<td>T3 Pg 667 to 674</td>
<td></td>
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<tr>
<td>4.</td>
<td>26.</td>
<td>08/10/13</td>
<td>2</td>
<td>Basic cutset, basic tieset matrices for planar networks and problems</td>
<td>CObj:1,2,4 CO:1,2,3,4</td>
<td>T3 Pg 674 to 678</td>
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<td>4.</td>
<td>27.</td>
<td>09/10/13</td>
<td>2</td>
<td>Loop and nodal methods of analysis of networks with dependent and independent voltage and current sources. Duality and Dual networks</td>
<td>CObj:1,2,4 CO:1,2,3,4</td>
<td>T3 Pg 681 to 682</td>
<td></td>
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<tr>
<td>4.</td>
<td>28.</td>
<td>11/10/13</td>
<td>1</td>
<td>Faradays laws of electromagnetic induction, Concept of self and mutual inductance</td>
<td>CObj:1,2 CO:1,2,3</td>
<td>T3 Pg 455 to 456</td>
<td></td>
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<tr>
<td>4.</td>
<td>29.</td>
<td>15/10/13</td>
<td>2</td>
<td>Dot convention, coefficient of coupling, analysis of series magnetic circuit</td>
<td>CObj:1,2 CO:1,2,3</td>
<td>T3 Pg 456 to 457</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>30.</td>
<td>16/10/13</td>
<td>2</td>
<td>Analysis of parallel magnetic circuit, composite magnetic circuit and various problems</td>
<td>CObj:1,2 CO:1,2,3</td>
<td>T3 Pg 457 to 458</td>
<td></td>
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SCHEDULE OF INSTRUCTIONS
UNIT PLAN

Academic Year : 2013-2014
Semester : I

Name of the Program: B.Tech .......................... Year: ........II.......... Section: A
Course/Subject: ...............NETWORK THEORY........................ Course Code: GR11A2018
Name of the Faculty: ............M.Srikanth..............................................Dept.: EEE
Designation: ASST.PROFESSOR

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<td>Fundamentals of Electric Circuits(3rd Edition)</td>
<td>Alexander and N.O Sadiku</td>
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<td>unbalanced load, problems</td>
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Date:
### SCHEDULE OF INSTRUCTIONS

#### UNIT PLAN

**Academic Year:** 2013-2014  
**Semester:** I  
**UNIT NO.:** II

**Name of the Program:** B.Tech  
**Year:** II  
**Section:** A

**Course/Subject:** NETWORK THEORY  
**Course Code:** GR11A2018

**Name of the Faculty:** M. Srikanth  
**Dept.:** EEE

**Designation:** ASST. PROFESSOR

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**Academic Year**: 2013-2014  
**Semester**: I  
**Name of the Program**: B.Tech  
**Year**: II  
**Section**: A  
**Course/Subject**: NETWORK THEORY  
**Course Code**: GR11A2018  
**Name of the Faculty**: M. Srikanth  
**Dept.**: EEE  
**Designation**: ASST. PROFESSOR

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approach with sinusoidal excitation

Signature of HOD                Signature of faculty
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### UNIT PLAN

**Academic Year**: 2013-2014  
**Semester**: I  
**UNIT NO.**: ……IV………

**Name of the Program**: B.Tech  
**Year**: ………II…………**Section**: A  
**Course/Subject**: …………….NETWORK THEORY……………….  
**Course Code**:GR11A2018  
**Name of the Faculty**: …………M.Srikanth………………………………………..  
**Dept.**: EEE  
**Designation**: ASST.PROFESSOR

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# SCHEDULE OF INSTRUCTIONS

## UNIT PLAN

**Academic Year**: 2013-2014  
**Semester**: I  
**UNIT NO.**: V

**Name of the Program**: B.Tech  
**Year**: II  
**Section**: A

**Course/Subject**: NETWORK THEORY  
**Course Code**: GR11A2018

**Name of the Faculty**: M. Srikanth  
**Dept.**: EEE

**Designation**: ASST. PROFESSOR

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LESSON PLAN

Academic Year : 2013-2014 Date: 19/07/13

Semester : I

Name of the Program: B.Tech .................................. Year: .....II............ Section: A

Course/Subject: ......................NETWORK THEORY............... Course Code: GR11A2018

Name of the Faculty: .................M.Srikanth.................................Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ......................I........................ Duration of Lesson: 60Min

Lesson Title: Introduction to three phase circuits

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To have a basic knowledge in the analysis of Electric Networks
2. To solve the given circuit with various theorems and methods.
3. To analyse the various three phase circuits star and delta connections.

TEACHING AIDS : Duster, Marker, White Board.

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Three phase sources and loads.
- 30 min.: Three phase waveform and phase sequence and problems on it.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is difference between star and delta connection and what is phase sequence? (COObj:1,2,3/CO:1,2,3,5,6)

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LESSON PLAN

Academic Year : 2013-2014                          Date: 23/07/13

Semester : I

Name of the Program: B.Tech .............................. Year: ......II............. Section: A

Course/Subject: ......................NETWORK THEORY.................. Course Code: GR11A2018

Name of the Faculty: ..................M.Srikanth..........................Dept.: EEE

Designation: ASST.PROFESSOR

Lesson No: ............2........................ Duration of Lesson: 90Min

Lesson Title: Analysis of star-star connection.

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

3. To analyse the various three phase circuits star and delta connections

TEACHING AIDS : Marker, Duster, Whiteboard

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Three phase star-star circuit connection and explanation of terminology.
- 60 min.: Deriving relation between line and phase voltages and currents and expression for power and problems.
- 10 min.: Doubts clarification and Review of the class.

Assignment / Questions: What is the relation between phase and line voltage in a star connection?(COBJ:1,2,3/CO:1,2,3,5,6)

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LESSON PLAN

Academic Year : 2013-2014                     Date: 24/07/13

Semester : I

Name of the Program: B.Tech…………………… Year: ......II............. Section: A

Course/Subject: …………………NETWORK THEORY……………… Course Code: GR11A2018

Name of the Faculty: ………………M.Srikanth……………………………………Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ………………3…………………… Duration of Lesson: 90Min………………

Lesson Title: Analysis of delta-delta connection

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To have a basic knowledge in the analysis of Electric Networks
2. To solve the given circuit with various theorems and methods.
3. To analyse the various three phase circuits star and delta connections

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Three phase delta-delta circuit connection and explanation of terminology.
- 60 min.: Deriving relation between line and phase voltages and currents and expression for power and problems.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is the relation between phase and line voltages and currents in a delta connection? (CObj:1,2,3/CO:1,2,3,5,6)
LESSON PLAN

Academic Year : 2013-2014  Date: 26/07/13

Semester : I

Name of the Program: B.Tech ………………… Year: ……II…………… Section: A

Course/Subject: …………………NETWORK THEORY……………… Course Code: GR11A2018

Name of the Faculty: ………………M.Srikanth…………………………………..Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: …………….4……………………… Duration of Lesson: 60Min………………

Lesson Title: Analysis of star-delta and delta-star connection.

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

3. To analyse the various three phase circuits star and delta connections

TEACHING AIDS :Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Three phase delta-star and star-delta circuit connection and explanation of terminology.
- 30 min.: Deriving relation between line and phase voltages and currents and expression for power and problems for delta-star and star-delta circuit.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is relation of voltages and currents in a star-delta and delta-star connection? (CO:1,2,3/CO:1,2,3,5,6)

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Semester : I

Name of the Program: B.Tech ……………………… Year: ……II…………. Section: A

Course/Subject: …………………NETWORK THEORY…………… Course Code: GR11A2018

Name of the Faculty: ………………M.Srikanth…………………………………..Dept.: EEE

Designation: ASST.PROFESSOR

Lesson No: ……………5………………………… Duration of Lesson: 90Min………………

Lesson Title: Unbalanced circuits

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

3. To analyse the various three phase circuits star and delta connections

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Three phase unbalanced source and load connection and explanation of terminology.
- 60 min.: Analysis of unbalanced delta connected load.
- 10 min.: Doubts clarification and Review of the class.

Assignment / Questions: What is a unbalanced source and load? (CO:1,2,3/CO1,2,3,5,6)

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Academic Year : 2013-2014 Date: 31/07/13.

Semester : I

Name of the Program: B.Tech …………………… Year: ……II…………….. Section: A

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Name of the Faculty: ………………M.Srikanth………………………………..Dept.:EEE

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Lesson No: ……………6.......................... Duration of Lesson: 90Min .................

Lesson Title: Four wire unbalanced star connected load

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

3. To analyse the various three phase circuits star and delta connections.

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Three phase unbalanced 4 wire connection and explanation of terminology.
- 60 min.: Analysis of unbalanced 4 wire star connected circuit.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is a unbalanced 4-wire star connection?(CO:1,2,3,5,6)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014 Date: 02/08/13

Semester : I

Name of the Program: B.Tech ……………………… Year: ……II………….. Section: A

Course/Subject: ……………………NETWORK THEORY……………… Course Code: GR11A2018

Name of the Faculty: ………………M.Srikanth…………………………………..Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: …………………7…………………… Duration of Lesson: 90Min………………

Lesson Title: Analysis of unbalanced delta-star connection and Millmans method.

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To have a basic knowledge in the analysis of Electric Networks
2. To solve the given circuit with various theorems and methods.
3. To analyse the various three phase circuits star and delta connections.

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Three phase unbalanced delta star connection and explanation of terminology.
- 60 min.: Analysis of unbalanced delta-star connection and Millmans method.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is Millmans method?(CObj:1,2,3/CO:1,2,3,5,6)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014                    Date: 05/08/13
Semester : I

Name of the Program: B.Tech ………………… Year: ….II………… Section: A

Course/Subject: …………………NETWORK THEORY……………… Course Code:GR11A2018

Name of the Faculty: ………………M.Srikanth………………………………….Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ………………8……………… Duration of Lesson: 90Min………………

Lesson Title: Three wattmeter method

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

3. To analyse the various three phase circuits star and delta connections.

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Three wattmeter method connection and explanation of terminology.
- 60 min.: Analysis of 3 wattmeter method of power measurement.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is a 3 wattmeter method of power measurement?(COObj:1,2,3/CO:1,2,3,5,6)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014                           Date:06/08/13

Semester : I

Name of the Program: B.Tech                        Year: …..II………… Section: A

Course/Subject: …………………..NETWORK THEORY…………….. Course Code:GR11A2018

Name of the Faculty: ………………M.Srikanth……………………………………Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ……………….9…………………. Duration of Lesson: 90Min

Lesson Title: 2 wattmeter method………………………………………………………………………

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

3. To analyse the various three phase circuits star and delta connections.

TEACHING AIDS :Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Two wattmeter method connection and explanation of terminology.
- 60 min.: Analysis of 2 wattmeter method of power measurement.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is a 2 wattmeter method?(CObj:1,2,3/CO:1,2,3,5,6)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014                       Date: 07/08/13
Semester : I

Name of the Program: B.Tech ........................... Year: ......II............. Section: A

Course/Subject: .....................NETWORK THEORY ................ Course Code: GR11A2018
Name of the Faculty: .................M.Srikanth...............................Dept.: EEE
Designation: ASST.PROFESSOR

Lesson No: ..................10........................ Duration of Lesson: 90Min.....................

Lesson Title: Two-por networks introduction

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks.

2. To solve the given circuit with various theorems and methods.

3. To relate various two port parameters and transform them.

TEACHING AIDS : Duster, Marker, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Two port networks introduction explanation.
- 60 min.: Explanation of z and y parameters and problem solving.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What are two port networks and Z, Y parameters?(CO:1,2,6/CO:1,2,3,7)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014 Date: 13/08/13

Semester : I

Name of the Program: B.Tech …………………… Year: ……II………….. Section: A

Course/Subject: …………………NETWORK THEORY……………… Course Code: GR11A2018

Name of the Faculty: ………………M.Srikanth…………………………………..Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: …………………11…………………… Duration of Lesson: 90Min………………

Lesson Title: h, g, T, t parameters………………

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks.

2. To solve the given circuit with various theorems and methods.

3. To relate various two port parameters and transform them.

TEACHING AIDS : Duster, Marker, White board.

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Two port networks explanation.
- 60 min.: Explanation of h, g, T, t parameters and problem solving.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What are h, g, T, t parameters?(CObj:1,2,6/CO:1,2,3,7)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014                     Date: 14/08/13
Semester : I

Name of the Program: B.Tech                      Year: ……II………….. Section: A
Course/Subject: ………………….NETWORK THEORY……………… Course Code: GR11A2018
Name of the Faculty: ………………M.Srikanth………………………………….Dept.: EEE
Designation: ASST.PROFESSOR
Lesson No: ………………….12……………………. Duration of Lesson: 90Min…………

Lesson Title: Interrelation of various parameters

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks.

2. To solve the given circuit with various theorems and methods.

3. To relate various two port parameters and transform them.

TEACHING AIDS : Duster, Marker, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Two port networks interrelation.
- 60 min.: Interrelation solving.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is interrelation of parameters? (CO:1,2,6/CO:1,2,3,7)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014
Semester : I

Name of the Program: B.Tech ……………………… Year: …..II………… Section: A

Course/Subject: …………………NETWORK THEORY……………… Course Code: GR11A2018

Name of the Faculty: …………….M.Srikanth……………………………….Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ……………13………………………… Duration of Lesson: 90Min………………

Lesson Title: Continuation of interrelation of various parameters

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks.

2. To solve the given circuit with various theorems and methods.

3. To relate various two port parameters and transform them.

TEACHING AIDS :

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Two port networks interrelations.
- 60 min.: Interrelations solving.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is interrelations?(CObj:1,2,6/CO:1,2,3,7)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014 Date: 28/08/13

Semester : I

Name of the Program: B.Tech ................................ Year: ......II............. Section: A

Course/Subject: .....................NETWORK THEORY.................. Course Code: GR11A2018

Name of the Faculty: .................M.Srikanth...........................................Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: .................14........................ Duration of Lesson: 90Min...........

Lesson Title: Symmetry and Reciprocity conditions..............................................

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks.

2. To solve the given circuit with various theorems and methods.

3. To relate various two port parameters and transform them.

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

• 5 min.: Taking attendance
• 15 min.: Two port networks symmetry and reciprocity introduction.
• 60 min.: Conditions of symmetry and reciprocity for various parameters.
• 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What are conditions of symmetry and reciprocity?(COBj:1,2,6/CO:1,2,3,7)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014                                      Date: 30/08/13
Semester : I

Name of the Program: B.Tech ................................ Year: ......II............. Section: A
Course/Subject: ....................NETWORK THEORY............... Course Code: GR11A2018
Name of the Faculty: ...............M.Srikanth..................................Dept.:EEE
Designation: ASST.PROFESSOR
Lesson No: .................15....................... Duration of Lesson: 60Min..............

Lesson Title: Transformed variables

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks.
2. To solve the given circuit with various theorems and methods.
3. To relate various two port parameters and transform them.

TEACHING AIDS : Marker, Duster, White board
TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Two port networks transformation.
- 30 min.: Problems using transformed variables.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What are transformed variables ?(CObj:1,2,6/CO:1,2,3,7)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014
Date: 03/09/13

Semester : I

Name of the Program: B.Tech ........................ Year: ......II............... Section: A

Course/Subject: .......................NETWORK THEORY................... Course Code: GR11A2018

Name of the Faculty: .................M.Srikanth..........................................................Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ...................16........................ Duration of Lesson: 90Min...........

Lesson Title: Driving and transfer impedance functions

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks.

2. To solve the given circuit with various theorems and methods.

3. To relate various two port parameters and transform them.

TEACHING AIDS:
TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Two port networks driving point and transfer impedance introduction.
- 60 min.: Driving point and transfer function problem solving.
- 10 min.: Doubts clarification and Review of the class.

Assignment / Questions: What is driving point and transfer function?(CObj:1,2,6/CO:1,2,3,7)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014 Date: 06/09/13

Semester : I

Name of the Program: B.Tech .......................... Year: ......II ............... Section: A

Course/Subject: ....................NETWORK THEORY ................. Course Code: GR11A2018

Name of the Faculty: ............... M. Srikanth ..................................Dept.: EEE

Designation: ASST.PROFESSOR

Lesson No: ......................17. ...................... Duration of Lesson: 60Min ......................

Lesson Title: Poles and zeros ..............................................................

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks.

2. To solve the given circuit with various theorems and methods.

3. To relate various two port parameters and transform them.

TEACHING AIDS : Duster, Marker, White board.

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Two port networks poles and zeros.
- 30 min.: Necessary conditions for driving point and transfer impedance functions.
- 10 min.: Doubts clarification and Review of the class.

Assignment / Questions: What are poles and zeros?(CObj:1,2,6/CO:1,2,3,7)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014 Date: 10/09/13

Semester : I

Name of the Program: B.Tech …………………. Year: …..II………… Section: A

Course/Subject: …………………NETWORK THEORY…………… Course Code: GR11A2018

Name of the Faculty: …………………M.Srikanth……………….. Dept.: EEE

Designation: ASST.PROFESSOR

Lesson No: …………………18……………… Duration of Lesson: 90Min………………

Lesson Title: DC Transient analysis

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS : 

- 5 min.: Taking attendance
- 15 min.: Transient analysis introduction.
- 60 min.: RL RC series circuits dc transient analysis.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What id transient analysis? (CObj:1,2/CO:1,2,3)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014  Date: 11/09/13

Semester : I

Name of the Program: B.Tech ................................ Year: …..II............ Section: A

Course/Subject: .......................NETWORK THEORY ................... Course Code: GR11A2018

Name of the Faculty: ................... M.Srikanth .........................................Dept.: EEE

Designation: ASST.PROFESSOR

Lesson No: ................... 19.......................... Duration of Lesson: 90Min..................

Lesson Title: DC Transient analysis of RLC circuit

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. 1. To prepare the students to have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

TEACHING AIDS : Marker, Duster, White board
TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Transient analysis introduction.
- 60 min.: RLC series and parallel circuits dc transient analysis.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is RLC transient analysis? (CObj:1,2/CO:1,2,3)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014 Date: 13/09/13
Semester : I
Name of the Program: B.Tech …………………. Year: ……..II………… Section: A

Course/Subject: ………………….NETWORK THEORY……………… Course Code: GR11A2018

Name of the Faculty: ……………….M.Srikanth……………………………….Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ………………….20……………… Duration of Lesson: 60Min………………

Lesson Title: Problems on transient analysis.

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

TEACHING AIDS : Marker, Duster, White board
TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Transient analysis revision.
- 30 min.: Problems on dc transient analysis.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: Problems on transient analysis.(CObj:1,2/CO:1,2,3)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014

Date: 17/09/13

Semester : I

Name of the Program: B.Tech …………………. Year: ……II………….. Section: A

Course/Subject: …………………NETWORK THEORY………………. Course Code: GR11A2018

Name of the Faculty: ………………M.Srikanth…………………………………..Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ……………..21……………………….. Duration of Lesson: 90Min………………

Lesson Title: Step, ramp, pulse, impulse transient analysis

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Step, ramp, pulse, impulse signals introduction.
- 60 min.: Step, ramp, pulse, impulse RL, RC circuits transient analysis.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What are different test signals?(CObj:1,2/CO:1,2,3)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014          Date: 20/09/13

Semester : I

Name of the Program: B.Tech ................................ Year: ......II............. Section: A

Course/Subject: .......................NETWORK THEORY.................. Course Code: GR11A2018

Name of the Faculty: ...............M.Srikanth..............................Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: .................22............................. Duration of Lesson: 60Min................

Lesson Title: Sinusoidal transient analysis of RL, RC circuits

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Sinusoidal analysis introduction.
- 30 min.: Sinusoidal RL, RC circuits transient analysis.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is sinusoidal transient analysis?(COlj:1,2/CO:1,2,3)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014          Date: 24/09/13
Semester : I

Name of the Program: B.Tech ……………. Year: …………… Section: A

Course/Subject: ………………..NETWORK THEORY…………….. Course Code: GR11A2018

Name of the Faculty: ………………..M.Srikanth…………………………………..Dept.: EEE

Designation: ASST.PROFESSOR

Lesson No: ………………..23……………… Duration of Lesson: 90Min………………

Lesson Title: Sinusoidal RLC transient analysis………..

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Sinusoidal analysis introduction.
- 60 min.: Problems on RL, RC circuits transient analysis.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: Problems on RL, RC sinusoidal analysis.(CObj:1,2/CO:1,2,3)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014          Date: 27/09/13

Semester : I

Name of the Program: B.Tech .......................... Year: ......II............. Section: A

Course/Subject: .....................NETWORK THEORY.............. Course Code: GR11A2018

Name of the Faculty: .................M.Srikanth..........................Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: .....................24....................... Duration of Lesson: 90Min.....................

Lesson Title: ........................................................................

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Sinusoidal analysis introduction.
- 60 min.: Sinusoidal RLC circuit transient analysis.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is sinusoidal RLC transient analysis?(COobj:1,2/CO:1,2,3)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014 Date: 01/10/13
Semester : I

Name of the Program: B.Tech .......................... Year: ......II............. Section: A

Course/Subject: ......................NETWORK THEORY ................. Course Code: GR11A2018

Name of the Faculty: .................M.Srikanth ....................................Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ....................25........................ Duration of Lesson: 90Min .....................

Lesson Title: Introduction to Network topology

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks
2. To solve the given circuit with various theorems and methods.
3. To distinguish between tie set and cut set methods for solving various circuits.

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Introduction to network topology.
- 60 min.: Various definitions like graph, tree, link, twig, cotree so on.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is network topology? (CObj:1.2,4/CO:1,2,3,4)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014  Date: 08/10/13
Semester : I

Name of the Program: B.Tech …………………… Year: ……II……………… Section: A

Course/Subject: …………………NETWORK THEORY……………… Course Code: GR11A2018

Name of the Faculty: ………………M.Srikanth…………………………………..Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: …………………26……………………… Duration of Lesson: 90Min………………

Lesson Title: Tieset and Cutset matrices.

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

3. To distinguish between tie set and cut set methods for solving various circuits.

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Introduction to cuset and tieset.
- 60 min.: Various problems on cutset and tieset.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is cutset and tieset?(CObj:1,2,4/CO:1,2,3,4)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014
Date: 09/10/13

Semester : I

Name of the Program: B.Tech .......................... Year: ......II............. Section: A

Course/Subject: .......................NETWORK THEORY .................. Course Code: GR11A2018

Name of the Faculty: .................M.Srikanth.........................................Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: .................27........................ Duration of Lesson: 90Min......................

Lesson Title: Duality and dual networks

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

3. To distinguish between tie set and cut set methods for solving various circuits.

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Introduction to duality.
- 60 min.: Analysis and problems on dual networks.
- 10min.: Doubts clarification and Review of the class.

Assignment / Questions: What is duality? (CO:1,2,4/C0:1,2,3,4)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014 Date: 11/10/13
Semester : I

Name of the Program: B.Tech ………………… Year: ……II………… Section: A
Course/Subject: ………………NETWORK THEORY……………. Course Code: GR11A2018
Name of the Faculty: ………………M.Srikanth…………………Dept.:EEE
Designation: ASST.PROFESSOR
Lesson No: …………………28………………… Duration of Lesson: 60Min………………

Lesson Title: Faradays laws of electromagnetic induction

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:
1. To prepare the students to have a basic knowledge in the analysis of Electric Networks
2. To solve the given circuit with various theorems and methods.

TEACHING AIDS : Marker, Duster, White board
TEACHING POINTS :

● 5 min.: Taking attendance
● 15 min.: Introduction to magnetic circuits.
● 30 min.: Faradays laws of electro magnetic induction, self and mutual inductance.
● 10min.: Doubts clarification and Review of the class

Assignment / Questions: What are Faradays laws of electro magnetic induction? (CObj:1,2/CO:1,2,3,4)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014 Date: 15/10/13

Semester : I

Name of the Program: B.Tech .......................... Year: ......II............. Section: A

Course/Subject: ....................NETWORK THEORY ................ Course Code: GR11A2018

Name of the Faculty: ...............M.Srikanth..............................Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ..................29.......................... Duration of Lesson: 90Min..............

Lesson Title: Dot convention and coefficient of coupling

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Introduction to magnetic circuits.
- 60 min.: Dot convention, coefficient of coupling, series and parallel magnetic circuits.
- 10min.: Doubts clarification and Review of the class

Assignment / Questions: What is dot convention? (CObj:1,2/CO:1,2,3,4)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014                      Date: 16/10/13
Semester : I

Name of the Program: B.Tech ……………….. Year: …..II…………. Section: A

Course/Subject: …………………NETWORK THEORY……………. Course Code: GR11A2018

Name of the Faculty: ……………..M.Srikanth………………………………..Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ………………30………………… Duration of Lesson: 90Min………………

Lesson Title: Composite magnetic circuits

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks

2. To solve the given circuit with various theorems and methods.

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Parallel to magnetic circuits.
- 30 min.: Composite magnetic circuits.
- 10min.: Doubts clarification and Review of the class

Assignment / Questions: What is a composite magnetic circuit (CO:1,2/CO:1,2,3,4)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014  Date: 22/10/13

Semester : I

Name of the Program: B.Tech .......................... Year: ......II............. Section: A
Course/Subject: .....................NETWORK THEORY.................. Course Code: GR11A2018

Name of the Faculty: ................M.Srikanth..........................Dept.:EEE

Designation: ASST.PROFESSOR
Lesson No: ..................31.......................... Duration of Lesson: 90Min..................

Lesson Title: Introduction to filters

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. prepare the students to have a basic knowledge in the analysis of Electric Networks
2. solve the given circuit with various theorems and methods
3. design various types of filters

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Introduction to filters.
- 60 min.: Circuits of various filters.
- 10min.: Doubts clarification and Review of the class

Assignment / Questions: What is a filter?(CO:1,2,5/CO:1,2)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014    Date: 23/10/13

Semester : I

Name of the Program: B.Tech    Year: II    Section: A

Course/Subject: NETWORK THEORY    Course Code: GR11A2018

Name of the Faculty: M. Srikanth

Designation: ASST. PROFESSOR

Lesson No: 32    Duration of Lesson: 90 Min

Lesson Title: Low pass filter

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. prepare the students to have a basic knowledge in the analysis of Electric Networks

2. solve the given circuit with various theorems and methods

3. design various types of filters

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Introduction to low pass filter.
- 60 min.: Circuit and problems of low pass filter.
- 10 min.: Doubts clarification and Review of the class

Assignment / Questions: What is a low pass filter? (CObj: 1, 2, 5/CO: 1, 2)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014          Date: 25/10/13
Semester       : I

Name of the Program: B.Tech ................................ Year: …..II………… Section: A

Course/Subject: …………………..NETWORK THEORY……………… Course Code: GR11A2018

Name of the Faculty: ………………M.Srikanth………………………………………..Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ……………33………………….. Duration of Lesson: 60Min………………

Lesson Title: High pass filter…

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. prepare the students to have a basic knowledge in the analysis of Electric Networks

2. solve the given circuit with various theorems and methods

3. design various types of filters

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Introduction to high pass filter.
- 30 min.: Circuit and problems of high pass filter.
- 10 min.: Doubts clarification and Review of the class

Assignment / Questions: What is a high pass filter?(CO:1,2,5/C0:1,2)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014                     Date: 29/10/13

Semester : I

Name of the Program: B.Tech ……………………… Year: …..I………….. Section: A

Course/Subject: ………………NETWORK THEORY……………. Course Code: GR11A2018

Name of the Faculty: ………………M.Srikanth………………………………..Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ………………34……………………… Duration of Lesson: 90Min………………

Lesson Title: Band pass filter

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. prepare the students to have a basic knowledge in the analysis of Electric Networks
2. solve the given circuit with various theorems and methods
3. design various types of filters

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Introduction to band pass filter.
- 60 min.: Circuit and problems of band pass filter.
- 10min.: Doubts clarification and Review of the class

Assignment / Questions: What is a band pass filter? (CObj:1,2,5/CO:1,2)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014                      Date: 30/10/13
Semester : I

Name of the Program: B.Tech .......................... Year: ......II............. Section: A

Course/Subject: .................NETWORK THEORY............... Course Code: GR11A2018

Name of the Faculty: ..............M.Srikanth.................................Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ..............35........................ Duration of Lesson: 90Min......................

Lesson Title: Applications of filter

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. prepare the students to have a basic knowledge in the analysis of Electric Networks

2. solve the given circuit with various theorems and methods

3. design various types of filters

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 15 min.: Applications of various filters.
- 60 min.: Problems on various filters.
- 10min.: Doubts clarification and Review of the class

Assignment / Questions: What are the applications of filters? (CObj:1,2,5/CO:1,2)

Signature of faculty
LESSON PLAN

Academic Year : 2013-2014 Date: 01/11/13
Semester : I

Name of the Program: B.Tech ………………… Year: ……II………… Section: A

Course/Subject: …………………NETWORK THEORY……………… Course Code: GR11A2018

Name of the Faculty: ………………M.Srikanth…………………………………..Dept.:EEE

Designation: ASST.PROFESSOR

Lesson No: ………………..36…………………… Duration of Lesson: 60Min………………

Lesson Title: Problems on filters

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. prepare the students to have a basic knowledge in the analysis of Electric Networks
2. solve the given circuit with various theorems and methods
3. design various types of filters

TEACHING AIDS : Marker, Duster, White board

TEACHING POINTS :

- 5 min.: Taking attendance
- 45 min.: Problems on filters.
- 10min.: Doubts clarification and Review of the class

Assignment / Questions: Problems on filters. (CObj:1,2,5/CO:1,2)

Signature of faculty
ASSIGNMENT SHEET – 1

Academic Year : 2013-2014
Semester : I

Name of the Program: B.Tech .......................... Year: .......II......... Section: A
Course/Subject: ..................NETWORK THEORY .........................................................
Name of the Faculty: .............M.Srikanth..............................................................Dept.: EEE .........
Designation : ASST.PROFESSOR

This Assignment corresponds to Unit No. / Lesson ......................1........................

Q1. Explain the concept of dot convention in coupled coils. Define self and mutual inductance.

Q2. Two coupled coils have self inductances L1=10mH and L2=20mH. K being 0.75, find voltage in the second coil and the flux of first coil provided the second coil has 500 turns and the circuit current is given by i1=2sin314t A.

Q3. Define graph, tree, link, cotree with an example.

Q4. What are the properties of a tree, incidence matrix.

Q5. Explain the procedure of forming tie-set matrix and cutset matrix

Objective Nos.: ........1,2,4 .................................................................

Outcome Nos.: ........1,2,3,4 .................................................................

Signature of HOD .............................. Signature of faculty
Date: .............................................. Date:
ASSIGNMENT SHEET – 2

Academic Year : 2013-2014

Semester : I

Name of the Program: B.Tech ……………….. Year: …..II………… Section: A

Course/Subject: ………NETWORK THEORY…………………………………………………..

Name of the Faculty: ………M.Srikanth………………………………………Dept.:EEE………………

Designation : ASST.PROFESSOR

This Assignment corresponds to Unit No. / Lesson …………………2………………

Q1. Explain the relationship between line and phase voltages and currents in a delta connection.

Q2. A three phase balanced system supplies 110v to a delta connected load whose phase impedances are equal to (3.54+j3.54) ohm. Determine the line currents and draw the Phasor diagram.

Q3. A balanced 3ph load draws 8kw at a lagging pf of 0.8. If the line voltage applied is 440v, find the complex power and line current.

Q4. A3ph load has a resistance of 10ohm in each ph and is connected in star and delta against a 400v, 3ph supply. Compare power consumed in both cases.

Q5. A 3ph 400v load has a pf of 0.4. Two wattmeters are connected to measure the power. If the input power be 10kw, find the readings of each instrument.

Please write the Questions / Problems / Exercises which you would like to give to the students and also mention the Objectives/Outcomes to which these Questions / Problems / Exercises are related.

Objective Nos.: ………1,2,3…………………………………………………………………………

Outcome Nos.: ………1,2,3,5,6………………………………………………………………………

Signature of HOD Signature of faculty

Date: Date:
ASSIGNMENT SHEET – 3

Academic Year : 2013-2014

Semester : I

Name of the Program: B.Tech ……………………… Year: ………II………… Section: A

Course/Subject: ……………NETWORK THEORY…………………………………………………………

Name of the Faculty: ………M.Srikanth……………………………………………Dept.:EEE……

Designation : ASST.PROFESSOR

This Assignment corresponds to Unit No. / Lesson …………………3…………………………

Q1. A dc of 200v is suddenly applied to a series RL circuit having 20ohm and 0.2H. Determine the voltage drop across the inductor at the instant of switching on and at 0.02sec later.

Q2. A dc source feeds a resistance of 2000kilo ohms in series with a 5microfarads capacitor. Find the time taken for the capacitor when the charge retained will be decayed to 50% of the initial value, the voltage source being short circuited.

Q3. A 10microfarad capacitor is initially charged to 100v dc. It is then discharged through a resistance of Rohms for 20sec when the pd across the capacitor is 50v. Calculate R value.

Q4. In a series RLC circuit of 5ohm, 1H, 1F, a dc voltage of 20v is applied at t=0. Obtain i(t).

Q5. A series RC circuit has 20ohm and 100microfarads. A voltage of 200sin314t is applied at t=2.14msec. Obtain an expression for i.

Please write the Questions / Problems / Exercises which you would like to give to the students and also mention the Objectives/Outcomes to which these Questions / Problems / Exercises are related.

Objective Nos.: ………1,2………………………………………………………………………………

Outcome Nos.: ………1,2,3………………………………………………………………………………

Signature of HOD ................................................ Signature of faculty

Date: ................................................ Date:
ASSIGNMENT SHEET – 4

Academic Year : 2013-2014

Semester : I

Name of the Program: B.Tech .................................. Year: ......II............. Section: A

Course/Subject: ......................NETWORK THEORY.................................................................

Name of the Faculty: ..............M.Srikanth..................................................Dept.:EEE......

Designation : ASST.PROFESSOR

This Assignment corresponds to Unit No. / Lesson .................4.........................

Q1. Obtain the Z and Y parameters for a two port network.

Q2. Obtain the condition for symmetry and reciprocity for h and g parameters.

Q3. Express the ABCD parameters in terms of h and y parameters.

Q4. The z parameters of a circuit are given by 4,1,3,3 ohms respectively. Obtain ABCD parameters.

Q5. A gyrator is terminated by a series RL circuit at its output. Find the equivalent network.

Objective Nos.: .......1,2,6...........................................................

Outcome Nos.: .......1,2,3,7...........................................................

Signature of HOD  Signature of faculty

Date:  Date:
ASSIGNMENT SHEET – 5

Academic Year : 2013-2014

Semester : I

Name of the Program: B.Tech ………………… Year: …..II………… Section: A

Course/Subject: …………………NETWORK THEORY……………………………………………………

Name of the Faculty: ……………….M.Srikanth……………………………………..Dept.:EEE…..

Designation : ASST.PROFESSOR

This Assignment corresponds to Unit No. / Lesson ………5…………………………

Q1. Explain the analysis of prototype low pass filter.

Q2. Design a constant k lpf having fc=2.5Khz and R0=700ohm. Also find the frequency at which this filter produces attenuation of 19.1dB.

Q3. Design a constant k hpf having fc=4KHz and design impedance of 600ohm.

Q4. Explain the analysis of prototype band pass filter.

Q5. Explain the analysis of prototype band stop filter.

Objective Nos.: ………1,2,5…………………………………………………………………………

Outcome Nos.: ………1,2…………………………………………………………………………

Signature of HOD

Date:

Signature of faculty

Date:
TUTORIAL SHEET - 1

Academic Year : 2013-2014
Semester : I

Name of the Program: B.Tech .......................... Year: ......II....... Section: A

Course/Subject: ..................NETWORK THEORY.............................................

Name of the Faculty: .............M.Srikanth..............................Dept.:EEE......

Designation : ASST.PROFESSOR.

This Tutorial corresponds to Unit No. / Lesson .................I..................

Q1. Explain the relation between line and phase voltage in a three phase star connected network.

Q2. Explain the relation between line and phase current in a three phase delta connected network.

Q3. Discuss the analysis of three phase three wire unbalanced star connected circuit.

Q4. Explain the 2-wattmeter method of power measurement.

Objective Nos.: ........1,2,3.................................................................

Outcome Nos.: ........1,2,3,5,6.................................................................

Signature of HOD .................................................................

Signature of faculty .................................................................

Date: .................................................................

Date: .................................................................
TUTORIAL SHEET - 2

Academic Year : 2013-2014

Semester : I

Name of the Program: B.Tech ..................... Year: ......II....... Section: A

Course/Subject: ..................NETWORK THEORY...........................................

Name of the Faculty: .............M.Srikanth..................................................Dept.:EEE......

Designation : ASST.PROFESSOR.

This Tutorial corresponds to Unit No. / Lesson ..................II.........................

Q1. Explain the Z and Y parameters.

Q2. Derive the condition of symmetry for various parameters.

Q3. Derive the condition of reciprocity for various parameters.

Q4. Write down the necessity conditions for driving point and transfer functions.

Objective Nos.: .............1,2,6..............................................................

Outcome Nos.: .............1,2,3,7..............................................................

Signature of HOD Signature of faculty

Date: Date:
TUTORIAL SHEET - 3

Academic Year : 2013-2014
Semester : I

Name of the Program: B.Tech .......................... Year: ......II....... Section: A

Course/Subject: ..................NETWORK THEORY........................................

Name of the Faculty: ..............M.Srikanth................................................Dept.:EEE......

Designation : ASST.PROFESSOR.

This Tutorial corresponds to Unit No. / Lesson .....................III..........................

Q1. Explain the transient analysis of RL circuit with DC excitation.

Q2. Explain the transient analysis of RC circuit with DC excitation.

Q3. Explain the transient analysis of RLC circuit with sinusoidal excitation.

Q4. Explain the transient analysis of RL and RC circuit with step, ramp, pulse, impulse excitation.

Objective Nos.: ........1,2................................................................................

Outcome Nos.: ........1,2,3................................................................................

Signature of HOD  

Signature of faculty

Date:  

Date:
TUTORIAL SHEET - 4

Academic Year : 2013-2014
Semester : I

Name of the Program: B.Tech .......................... Year: ......II....... Section: A
Course/Subject: ....................NETWORK THEORY.............................................
Name of the Faculty: ............M.Srikanth..............................................Dept.:EEE......
Designation : ASST.PROFESSOR.
This Tutorial corresponds to Unit No. / Lesson ......................IV..........................

Q1. Define tree, co-tree, link, twig, incidence matrix.

Q2. Explain the procedure for writing tieset and cutset matrices.

Q3. Explain Faradays laws of electro magnetic induction.

Q4. Define self and mutual inductance, coefficient of coupling.

Objective Nos.: ......1,2,4.................................................................

Outcome Nos.: ......1,2,3,4.................................................................

Signature of HOD Signature of faculty
Date: Date:
Q1. Explain the analysis of low pass filter.

Q2. Explain the analysis of high pass filter.

Q3. Explain the analysis of band pass filter.

Objective Nos.: ……1,2,5……………………………………………………………

Outcome Nos.: ……1,2……………………………………………………………

Signature of HOD  Signature of faculty

Date:  Date:
1. (a) Two coupled coils have self-inductances 50mH and 70mH. The coefficient of coupling being 0.65 in the air, find voltage in the second coil and the flux of the first coil provided the second coil has 500 turns and the circuit current is given by \( i = 5\sin314t \) amps. 7MARKS
(b) Explain the relation between twigs and links in graph theory and what are the properties of a tree in a graph. 8MARKS

2. (a) A 3-phase 4000V system has a delta connected load with \( Z_{ab} = (8+j6) \) \( Z_{bc} = (12+j16) \) and \( Z_{ca} = (6-j8) \). Find the phase currents and line currents. Determine the power consumed by each load impedance. Draw the phasor diagram. 8MARKS
(b) Three identical resistances are connected in a star fashion against a balanced three phase voltage supply. If one of the resistances be removed, by how much the power be reduced? 7MARKS

3. (a) In the circuit given below (shown in Figure.1) switch ‘k’ is put in position – 1, for 1 m Sec. and then thrown to position – 2. Find the transient current in both intervals. 6MARKS

```
150V
\[ \begin{array}{c}
\text{1} \\
\text{k} \\
\text{2} \\
\end{array} \]
\[ \begin{array}{c}
100V \\
\text{50Ω} \\
\text{1.5mF} \\
\end{array} \]
```

(b) Derive the transient response of RLC series circuit with sinusoidal input. 9MARKS

4. (a) Explain the properties of driving point functions. 6MARKS
(b) For the two port network given below (Shown in Figure.3) determine ABCD & hybrid parameters. 9MARKS
5. Draw the circuit diagram of a High pass filter. Explain the design procedure of the above filter in detail.  

6. (a) Define mutual inductance and self inductance.  
   (b) Explain the initial conditions to be considered in transient analysis.  

7. (a) Explain single wattmeter method of measurement of reactive power.  
   (b) Express the Z-parameters in terms of Y-parameters and h-parameters.
EVALUATION STRATEGY

Academic Year : 2013-2014

Semester : I

Name of the Program: B.Tech ……………… Year: ………II……….. Section: A

Course/Subject: …………………NETWORK THEORY…………………………………….

Name of the Faculty: …………M.Srikanth………………………………..Dept.:EEE……

Designation : ASST.PROFESSOR.

1. TARGET:

   A) Percentage for pass: 40%

   b) Percentage of class: 85%

2. COURSE PLAN & CONTENT DELIVERY

   ● PPT presentation of the Lectures
   ● Solving exercise problems
   ● Model questions

3. METHOD OF EVALUATION

   3.1 □ Continuous Assessment Examinations (CAE-I, CAE-II)
   3.2 □ Assignments/Seminars
   3.3 □ Mini Projects
   3.4 □ Quiz
   3.5 □ Semester/End Examination
   3.6 □ Others

4. List out any new topic(s) or any innovation you would like to introduce in teaching the subjects in this Semester.

   Transient analysis of RL, RC, RLC circuits with exponential signal.

Signature of HOD  Signature of faculty
Date:              Date:
COURSE COMPLETION STATUS

Academic Year : 2013-2014
Semester : I

Name of the Program: B.Tech …………….. Year: ………II……….. Section: A

Course/Subject: ……………..NETWORK THEORY………………. Course Code: GR11A2018

Name of the Faculty: ……………..M.Srikanth………………………………..Dept.: EEE…

Designation: ASST.PROFESSOR.

Actual Date of Completion & Remarks, if any

<table>
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<th>Units</th>
<th>Remarks</th>
<th>No. of Objectives Achieved</th>
<th>No. of Outcomes Achieved</th>
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<td>1,2,3,5,6</td>
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<td>Unit 2</td>
<td>Date of completion is :06/09/2013 Completed in time. But would have been better if more problems were solved.</td>
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<td>1,2,3,7</td>
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<td>Unit 4</td>
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<td>Unit 5</td>
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<td>1,2,3,5</td>
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Signature of HOD | Signature of faculty
Date: | Date:
**PREVIOUS RESULT ANALYSIS (A-Section)**

<table>
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<th>Year</th>
<th>Subject</th>
<th>Total No. of students appeared</th>
<th>No. of students passed</th>
<th>No. of students failed</th>
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<th>60 to 70</th>
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INTRODUCTION

• Almost all electric power generation and most of the power transmission in the world is in the form of three-phase AC circuits. A three-phase AC system consists of three-phase generators, transmission lines, and loads.

• There are two major advantages of three-phase systems over a single-phase system:
  1) More power per kilogram of metal form a three-phase machine;
  2) Power delivered to a three-phase load is constant at all time, instead of pulsing as it does in a single-phase system.

• The first three-phase electrical system was patented in 1882 by John Hopkinson - British physicist, electrical engineer, Fellow of the Royal Society.
1. Generation of three-phase voltages and currents

A three-phase generator consists of three single-phase generators with voltages of equal amplitudes and phase differences of $120^\circ$. 

\[ v_A(t) = \sqrt{2} V \sin(\omega t) \text{ V} \]

\[ V_A = V \angle 0^\circ \text{ V} \]

\[ v_B(t) = \sqrt{2} V \sin(\omega t - 120^\circ) \text{ V} \]

\[ V_B = V \angle -120^\circ \text{ V} \]

\[ v_C(t) = \sqrt{2} V \sin(\omega t - 240^\circ) \text{ V} \]

\[ V_C = V \angle -240^\circ \text{ V} \]
1. Generation of three-phase voltages and currents

Each of three-phase generators can be connected to one of three identical loads.

This way the system would consist of three single-phase circuits differing in phase angle by 120°.

The current flowing to each load can be found as

$$ I = \frac{V}{Z} $$

(3.4.1)
1. Generation of three-phase voltages and currents

Therefore, the currents flowing in each phase are

\[
I_A = \frac{V \angle 0^0}{Z \angle \theta} = I \angle -\theta
\]  
(3.5.1)

\[
I_B = \frac{V \angle -120^0}{Z \angle \theta} = I \angle -120 - \theta
\]  
(3.5.2)

\[
I_A = \frac{V \angle -240^0}{Z \angle \theta} = I \angle -240 - \theta
\]  
(3.5.3)
1. Generation of three-phase voltages and currents

We can connect the negative (ground) ends of the three single-phase generators and loads together, so they share the common return line (neutral).
Generation of three-phase voltages and currents

As long as the three loads are equal, the return current in the neutral is zero!

Such three-phase power systems (equal magnitude, phase differences of 120°, identical loads) are called balanced.

Phase Sequence is the order in which the voltages in the individual phases peak.
Voltages and currents

Each generator and each load can be either Y- or Δ-connected. Any number of Y- and Δ-connected elements may be mixed in a power system.

Phase quantities - voltages and currents in a given phase.
Line quantities – voltages between the lines and currents in the lines connected to the generators.
Voltages and currents

1. Y-connection
Voltages and currents

Y-connection (cont)

\[ V_{an} = V_\phi \angle 0^0 \]
\[ V_{bn} = V_\phi \angle -120^0 \]
\[ V_{cn} = V_\phi \angle -240^0 \]

\[ I_a = I_\phi \angle 0^0 \]
\[ I_b = I_\phi \angle -120^0 \]
\[ I_c = I_\phi \angle -240^0 \]
Voltages and currents

Y-connection (cont 2)

The current in any line is the same as the current in the corresponding phase

\[
V_{ab} = V_a - V_b = V_\phi \angle 0^0 - V_\phi \angle -120^0 = V_\phi - \left( -\frac{1}{2} V_\phi - j \frac{\sqrt{3}}{2} V_\phi \right) = \frac{3}{2} V_\phi + j \frac{\sqrt{3}}{2} V_\phi
\]

\[
= \sqrt{3} V_\phi \left( \frac{\sqrt{3}}{2} + j \frac{1}{2} \right) = \sqrt{3} V_\phi \angle 30^0
\]
An Introduction To Two – Port Networks
Two Port Networks

Generalities:
The standard configuration of a two port:

The network?

The voltage and current convention?

* notes
Two Port Networks

Network Equations:

Impedance Z parameters:

\[ V_1 = z_{11} I_1 + z_{12} I_2 \]
\[ V_2 = z_{21} I_1 + z_{22} I_2 \]

Admittance Y parameters:

\[ I_1 = y_{11} V_1 + y_{12} V_2 \]
\[ I_2 = y_{21} V_1 + y_{22} V_2 \]

Transmission A, B, C, D parameters:

\[ V_1 = A V_2 - B I_2 \]
\[ I_1 = C V_2 - D I_2 \]

Hybrid H parameters:

\[ V_1 = h_{11} I_1 + h_{12} V_2 \]
\[ I_2 = h_{21} I_1 + h_{22} V_2 \]

\[ I_1 = g_{11} V_1 + g_{12} I_2 \]
\[ V_2 = g_{21} V_1 + g_{22} I_2 \]

* notes
Two Port Networks

\[ z_{11} = \frac{V_1}{I_1} \quad \text{I}_2 = 0 \]

\[ z_{12} = \frac{V_1}{I_2} \quad \text{I}_1 = 0 \]

\[ z_{21} = \frac{V_2}{I_1} \quad \text{I}_2 = 0 \]

\[ z_{22} = \frac{V_2}{I_2} \quad \text{I}_1 = 0 \]

* \( z_{11} \) is the impedance seen looking into port 1 when port 2 is open.

* \( z_{12} \) is a transfer impedance. It is the ratio of the voltage at port 1 to the current at port 2 when port 1 is open.

* \( z_{21} \) is a transfer impedance. It is the ratio of the voltage at port 2 to the current at port 1 when port 2 is open.

* \( z_{22} \) is the impedance seen looking into port 2 when port 1 is open.

* notes
Two Port Networks

Y parameters:

$y_{11} = \frac{I_1}{V_1}$  
$y_{11}$ is the admittance seen looking into port 1 when port 2 is shorted.

$y_{12} = \frac{I_1}{V_2}$  
$y_{12}$ is a transfer admittance. It is the ratio of the current at port 1 to the voltage at port 2 when port 1 is shorted.

$y_{21} = \frac{I_2}{V_1}$  
$y_{21}$ is a transfer impedance. It is the ratio of the current at port 2 to the voltage at port 1 when port 2 is shorted.

$y_{22} = \frac{I_2}{V_2}$  
$y_{22}$ is the admittance seen looking into port 2 when port 1 is shorted.

* notes
Two Port Networks

Z parameters: Example 1

Given the following circuit. Determine the Z parameters.

Find the Z parameters for the above network.
**Two Port Networks**

**Z parameters:**

**Example 1 (cont 1)**

For $z_{11}$:

$$Z_{11} = 8 + 20\|30 = 20 \, \Omega$$

For $z_{22}$:

$$Z_{22} = 20\|30 = 12 \, \Omega$$

For $z_{12}$:

$$z_{12} = \frac{V_1}{I_2} \bigg| \quad I_1 = 0$$

$$V_1 = \frac{20 \times I_2 \times 20}{20 + 30} = 8 \times I_2$$

Therefore:

$$z_{12} = \frac{8 \times I_2}{I_2} = 8 \, \Omega = z_{21}$$
The Z parameter equations can be expressed in matrix form as follows.

\[
\begin{bmatrix}
V_1 \\
V_2
\end{bmatrix} =
\begin{bmatrix}
z_{11} & z_{12} \\
z_{21} & z_{22}
\end{bmatrix}
\begin{bmatrix}
I_1 \\
I_2
\end{bmatrix}
\]

\[
\begin{bmatrix}
V_1 \\
V_2
\end{bmatrix} =
\begin{bmatrix}
20 & 8 \\
8 & 12
\end{bmatrix}
\begin{bmatrix}
I_1 \\
I_2
\end{bmatrix}
\]
You are given the following circuit. Find the Z parameters.
Two Port Networks

Z parameters:

\[ z_{11} = \frac{V_1}{I_1} \quad \text{I}_2 = 0 \]

\[ I_1 = \frac{V_x}{1} + \frac{V_x + 2V_x}{6} = \frac{6V_x + V_x + 2V_x}{6} \]

\[ I_1 = \frac{3V_x}{2} ; \quad \text{but} \quad V_x = V_1 - I_1 \]

Substituting gives;

\[ I_1 = \frac{3(V_1 - I_1)}{2} \quad \text{or} \quad \frac{V_1}{I_1} = z_{11} = \frac{5}{3} \quad \Omega \]

Example 2 (continue p2)

![Circuit Diagram]

\[ Z_{21} = -0.667 \quad \Omega \]

\[ Z_{12} = 0.222 \quad \Omega \]

\[ Z_{22} = 1.111 \quad \Omega \]
Two Port Networks

Transmission parameters (A, B, C, D):

The defining equations are:

\[
\begin{bmatrix}
V_1 \\
I_1
\end{bmatrix} =
\begin{bmatrix}
A & B \\
C & D
\end{bmatrix}
\begin{bmatrix}
V_2 \\
-I_2
\end{bmatrix}
\]

\[
A = \frac{V_1}{V_2} \quad | \quad I_2 = 0
\]

\[
B = \frac{V_1}{-I_2} \quad | \quad V_2 = 0
\]

\[
C = \frac{I_1}{V_2} \quad | \quad I_2 = 0
\]

\[
D = \frac{I_1}{-I_2} \quad | \quad V_2 = 0
\]
Transmission parameters (A,B,C,D):

Example

Given the network below with assumed voltage polarities and current directions compatible with the A,B,C,D parameters.

We can write the following equations.

\[ V_1 = (R_1 + R_2)I_1 + R_2I_2 \]
\[ V_2 = R_2I_1 + R_2I_2 \]

It is not always possible to write 2 equations in terms of the V’s and I’s of the parameter set.
Two Port Networks

Transmission parameters (A,B,C,D):

Example (cont.)

\[ V_1 = (R_1 + R_2)I_1 + R_2I_2 \]
\[ V_2 = R_2I_1 + R_2I_2 \]

From these equations we can directly evaluate the A,B,C,D parameters.

\[ A = \frac{V_1}{V_2} \quad I_2 = 0 \]
\[ B = \frac{V_1}{-I_2} \quad V_2 = 0 \]
\[ C = \frac{I_1}{V_2} \quad I_2 = 0 \]
\[ D = \frac{I_1}{-I_2} \quad V_2 = 0 \]

Later we will see how to interconnect two of these networks together for a final answer.

* notes
Two Port Networks

Hybrid Parameters:
The equations for the hybrid parameters are:

\[
\begin{bmatrix}
V_1 \\
I_2
\end{bmatrix} =
\begin{bmatrix}
h_{11} & h_{12} \\
h_{21} & h_{22}
\end{bmatrix}
\begin{bmatrix}
I_1 \\
V_2
\end{bmatrix}
\]

\[
h_{11} = \frac{V_1}{I_1}, \quad V_2 = 0
\]

\[
h_{12} = \frac{V_1}{V_2}, \quad I_1 = 0
\]

\[
h_{21} = \frac{I_2}{I_1}, \quad V_2 = 0
\]

\[
h_{22} = \frac{I_2}{V_2}, \quad I_1 = 0
\]

* notes
Hybrid Parameters:

The following is a popular model used to represent a particular variety of transistors.

We can write the following equations:

\[ V_1 = AI_1 + BV_2 \]

\[ I_2 = CI_1 + \frac{V_2}{D} \]
Two Port Networks

Hybrid Parameters:

\[ V_1 = AI_1 + BV_2 \]
\[ I_2 = CI_1 + \frac{V_2}{D} \]

We want to evaluate the H parameters from the above set of equations.

\[ h_{11} = \frac{V_1}{I_1} \]
\[ V_2 = 0 \]

\[ h_{21} = \frac{I_2}{I_1} \]
\[ V_2 = 0 \]

\[ h_{12} = \frac{V_1}{V_2} \]
\[ I_1 = 0 \]

\[ h_{22} = \frac{I_2}{V_2} \]
\[ I_1 = 0 \]
Two Port Networks

Hybrid Parameters:

Another example with hybrid parameters.

Given the circuit below.

The equations for the circuit are:

\[ V_1 = (R_1 + R_2)I_1 + R_2 I_2 \]
\[ V_2 = R_2 I_1 + R_2 I_2 \]

The H parameters are as follows.

\[ h_{11} = \frac{V_1}{I_1} \quad V_2=0 \]
\[ h_{21} = \frac{I_2}{I_1} \quad V_2=0 \]
\[ h_{12} = \frac{V_1}{V_2} \quad I_1=0 \]
\[ h_{22} = \frac{I_2}{V_2} \quad I_1=0 \]
Modifying the two port network:

Earlier we found the $z$ parameters of the following network.

\[
\begin{vmatrix}
V_1 \\
V_2 \\
\end{vmatrix} = \begin{bmatrix} 20 & 8 \\ 8 & 12 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}
\]
Two Port Networks

Modifying the two port network:

We modify the network as shown by adding elements outside the two ports.

We now have:

\[ V_1 = 10 - 6I_1 \]

\[ V_2 = -4I_2 \]
Two Port Networks

Modifying the two port network:

We take a look at the original equations and the equations describing the new port conditions.

\[
\begin{bmatrix}
V_1 \\
V_2
\end{bmatrix} = 
\begin{bmatrix} 20 & 8 \\
8 & 12
\end{bmatrix} \begin{bmatrix} I_1 \\
I_2
\end{bmatrix}
\]

\[V_1 = 10 - 6I_1\]
\[V_2 = -4I_2\]

So we have,

\[10 - 6I_1 = 20I_1 + 8I_2\]
\[-4I_2 = 8I_1 + 12I_2\]
Two Port Networks

Modifying the two port network:

Rearranging the equations gives,

\[
\begin{bmatrix}
I_1 \\ I_2
\end{bmatrix} = \begin{bmatrix}
1 \\
0
\end{bmatrix}^{-1}
\begin{bmatrix}
I_1 \\ I_2
\end{bmatrix}
\]
Two Port Networks

Y Parameters and Beyond:

Given the following network.

(a) Find the Y parameters for the network.

(b) From the Y parameters find the z parameters.
Two Port Networks

Y Parameter Example

\[ I_1 = y_{11} V_1 + y_{12} V_2 \]
\[ I_2 = y_{21} V_1 + y_{22} V_2 \]

To find \( y_{11} \)

\[ V_1 = I_1 \left( \frac{2}{s} \right) = I_1 \left[ \frac{2}{2s+1} \right] \]

so

\[ y_{11} = \frac{I_1}{V_1} \quad V_2 = 0 \]

\[ y_{12} = \frac{I_1}{V_2} \quad V_1 = 0 \]

\[ y_{21} = \frac{I_2}{V_1} \quad V_2 = 0 \]

\[ y_{22} = \frac{I_2}{V_2} \quad V_1 = 0 \]

We use the above equations to evaluate the parameters from the network.
Two Port Networks

Y Parameter Example

\[ y_{21} = \frac{I_2}{V_1} \quad | \quad V_2 = 0 \]

We see

\[ V_1 = -2I_2 \]

\[ y_{21} = \frac{I_2}{V_1} = 0.5 \text{ S} \]
To find $y_{12}$ and $y_{21}$ we reverse things and short $V_1$

$$y_{12} = \frac{I_1}{V_2} \mid V_1 = 0$$

We have

$$V_2 = -2I_1$$

$$y_{12} = \frac{I_1}{V_2} = 0.5 \text{ S}$$

$$y_{22} = \frac{I_2}{V_2} \mid V_1 = 0$$

We have

$$V_2 = I_2 \frac{2s}{s + 2}$$

$$y_{22} = 0.5 + \frac{1}{s}$$
Two Port Networks

Y Parameter Example

Summary:

\[
Y = \begin{bmatrix}
y_{11} & y_{12} \\
y_{21} & y_{22}
\end{bmatrix} = \begin{bmatrix}
s + 0.5 & -0.5 \\
-0.5 & 0.5 + 1/s
\end{bmatrix}
\]

Now suppose you want the Z parameters for the same network.
Two Port Networks

Going From Y to Z Parameters

For the Y parameters we have:

\[ I = YV \]

For the Z parameters we have:

\[ V = ZI \]

From above:

\[ V = Y^{-1}I = ZI \]

Therefore

\[ Z = Y^{-1} = \begin{bmatrix} z_{11} & z_{12} \\ z_{21} & z_{22} \end{bmatrix} = \begin{bmatrix} \frac{y_{22}}{\Delta_Y} & -\frac{y_{12}}{\Delta_Y} \\ \frac{\Delta_Y}{\Delta_Y} & \frac{\Delta_Y}{\Delta_Y} \end{bmatrix} \]

where

\[ \Delta_Y = \det(Y) \]
Two Port Parameter Conversions:

\[
\begin{bmatrix}
z_{11} & z_{12} \\
z_{21} & z_{22}
\end{bmatrix}
\begin{bmatrix}
y_{22} & -y_{12} \\
\Delta y & \Delta y \\
-y_{21} & y_{11} \\
\Delta y & \Delta y
\end{bmatrix}
\begin{bmatrix}
A & \Delta_T \\
1 & D \\
C & C
\end{bmatrix}
\begin{bmatrix}
\Delta_H & h_{12} \\
h_{22} & h_{22}
\end{bmatrix}
\begin{bmatrix}
z_{22} & -z_{12} \\
\Delta z & \Delta z \\
-z_{21} & z_{11} \\
\Delta z & \Delta z
\end{bmatrix}
\begin{bmatrix}
y_{11} & y_{12} \\
y_{21} & y_{22}
\end{bmatrix}
\begin{bmatrix}
D & -\Delta_T \\
1 & A \\
B & B
\end{bmatrix}
\begin{bmatrix}
1 & -h_{12} \\
h_{11} & h_{11}
\end{bmatrix}
\begin{bmatrix}
z_{11} & \Delta Z \\
z_{21} & z_{21} \\
1 & z_{22} \\
z_{21} & z_{21}
\end{bmatrix}
\begin{bmatrix}
-y_{22} & -1 \\
y_{21} & y_{21} \\
-\Delta y & -y_{11} \\
y_{21} & y_{21}
\end{bmatrix}
\begin{bmatrix}
A & B \\
C & D
\end{bmatrix}
\begin{bmatrix}
-\Delta_H & -h_{11} \\
h_{21} & h_{21}
\end{bmatrix}
\begin{bmatrix}
\Delta Z & z_{12} \\
z_{22} & z_{22} \\
-z_{21} & 1 \\
z_{22} & z_{22}
\end{bmatrix}
\begin{bmatrix}
1 & -y_{12} \\
y_{11} & y_{11} \\
y_{21} & \Delta y \\
y_{11} & y_{11}
\end{bmatrix}
\begin{bmatrix}
B & \Delta_T \\
1 & C \\
D & D
\end{bmatrix}
\begin{bmatrix}
h_{11} & h_{12} \\
h_{21} & h_{22}
\end{bmatrix}
\]
Two Port Parameter Conversions:

To go from one set of parameters to another, locate the set of parameters you are in, move along the vertical until you are in the row that contains the parameters you want to convert to – then compare element for element.
Three ways that two ports are interconnected:

* **Parallel**

\[ [y] = [y_a] + [y_b] \]

* **Series**

\[ [z] = [z_a] + [z_b] \]

* **Cascade**

\[ [T] = [T_a] \begin{bmatrix} T_b \end{bmatrix} \]
Interconnection Of Two Port Networks

Consider the following network:

Referring to slide 13 we have;

\[
\begin{bmatrix}
V_1 \\
I_1
\end{bmatrix}
= 
\begin{bmatrix}
\frac{R_1 + R_2}{R_2} & R_1 \\
\frac{1}{R_2} & 1
\end{bmatrix}
\begin{bmatrix}
\frac{R_1 + R_2}{R_2} & R_1 \\
\frac{1}{R_2} & 1
\end{bmatrix}
\begin{bmatrix}
V_2 \\
-I_2
\end{bmatrix}
\]
Interconnection Of Two Port Networks

\[
\begin{bmatrix}
V_1 \\
I_1
\end{bmatrix} = \begin{bmatrix}
\frac{R_1 + R_2}{R_2} & R_1 \\
1 & 1
\end{bmatrix} \begin{bmatrix}
\frac{R_1 + R_2}{R_2} & R_1 \\
1 & 1
\end{bmatrix} \begin{bmatrix}
V_2 \\
-I_2
\end{bmatrix}
\]

Multiply out the first row:

\[
V_1 = \left[\begin{bmatrix}
\left(\frac{R_1 + R_2}{R_2}\right)^2 + \frac{R_1}{R_2}
\end{bmatrix} V_2 + \left[\left(\frac{R_1 + R_2}{R_2}\right) R_1 + R_1 \right] (-I_2)\right]
\]

Set \( I_2 = 0 \) (as in the diagram)

\[
\frac{V_2}{V_1} = \frac{R_2^2}{R_1^2 + 3R_1 R_2 R_2^2}
\]

Can be verified directly by solving the circuit
Basic Laws of Circuits

End of Lesson

Two-Port Networks
Transient Analysis
Typical Transient Problems

• What is the voltage as a capacitor discharges to zero?
• What is the voltage as a capacitor charges from one voltage (often zero) to another constant voltage?
• How does the current through an inductor increase from zero to a final value?
• How does the current through an inductor decrease from an initial value to zero?
More Typical Problems

• What are the transient and AC steady-state responses of an RC circuit to a sinusoidal source?
• What are the transient and AC steady-state responses of an RL circuit to a sinusoidal source?
Solutions

• Changes in capacitor voltages and inductor currents from one value to another are easily solved.

• Changes in other voltages or currents in the circuit may or may not be easy to solve directly; they are all easy to solve using Laplace transforms (EEE 302).
More Solutions

• Steady-state responses to sinusoidal sources are easy to find using AC steady-state analysis.

• Transient responses to sinusoidal sources are hard to find directly; they are easier to find using Laplace transforms.
What is the time constant for this circuit?
• What is the initial voltage?
• What is the DC steady state (final) voltage?
• What does the capacitor voltage $v(t)$ look like?
Capacitor Voltage

\[ v(t) = 3V e^{-t/RC} \]
Refresh Rate

Suppose we must refresh before \( v(t) \) drops below 1.5V. How long can we wait before a refresh?

\[ t = 0.693 \text{ms} \]
The 10 Ω resistor models the “on” resistance of Q1.
What is the time constant for this circuit?
Capacitor Voltage

\[ v(t) = 3.3V(1-e^{-t/RC}) \]
Precharge Time

Suppose we must precharge the capacitor to 3V. How long does this take?

\[ t = 24.0\text{ns} \]
Chapter 11 – Inductors
Inductors have a number of response characteristics similar to those of the capacitor.

The inductor exhibits its true characteristics only when a change in voltage or current is made in the network.
11.2 - Magnetic Fields

In the region surrounding a permanent magnet there exists a magnetic field, which can be represented by magnetic flux lines similar to electric flux lines.

Magnetic flux lines differ from electric flux lines in that they don’t have an origin or termination point.

Magnetic flux lines radiate from the north pole to the south pole through the magnetic bar.
Continuous magnetic flux lines will strive to occupy as small an area as possible.

The strength of a magnetic field in a given region is directly related to the density of flux lines in that region.

If unlike poles of two permanent magnets are brought together the magnets will attract, and the flux distribution will be as shown below.
If like poles are brought together, the magnets will repel, and the flux distribution will be as shown.

If a nonmagnetic material, such as glass or copper, is placed in the flux paths surrounding a permanent magnet, there will be an almost unnoticeable change in the flux distribution.
Magnetic Fields

If a magnetic material, such as soft iron, is placed in the flux path, the flux lines will pass through the soft iron rather than the surrounding air because the flux lines pass with greater ease through magnetic materials than through air.

This principle is put to use in the shielding of sensitive electrical elements and instruments that can be affected by stray magnetic fields.
The direction of the magnetic flux lines can be found by placing the thumb of the right hand in the direction of conventional current flow and noting the direction of the fingers (commonly called the right hand rule).
Magnetic Fields

Flux and Flux Density

In the SI system of units, magnetic flux is measured in webers (Wb) and is represented using the symbol \( \Phi \).

The number of flux lines per unit area is called flux density \( (B) \). Flux density is measured in teslas (T).

Its magnitude is determined by the following equation:

\[
B = \frac{\Phi}{A}
\]

- \( B \) = teslas (T)
- \( \Phi \) = webers (Wb)
- \( A \) = square meters (m²)
Magnetic Fields

Permeability

If cores of different materials with the same physical dimensions are used in the electromagnet, the strength of the magnet will vary in accordance with the core used.

The variation in strength is due to the number of flux lines passing through the core.

Magnetic material is material in which flux lines can readily be created and is said to have *high permeability*.

*Permeability* ($\mu$) is a measure of the ease with which magnetic flux lines can be established in the material.
Magnetic Fields

Permeability

Permeability of free space $\mu_0$ (vacuum) is

$$\mu_0 = 4\pi \times 10^{-7} \frac{\text{Wb}}{\text{A} \cdot \text{M}}$$

Materials that have permeability slightly less than that of free space are said to be **diamagnetic** and those with permeability slightly greater than that of free space are said to be **paramagnetic**.
Magnetic Fields

Permeability

Magnetic materials, such as iron, nickel, steel and alloys of these materials, have permeability hundreds and even thousands of times that of free space and are referred to as ferromagnetic.

The ratio of the permeability of a material to that of free space is called relative permeability.

\[ \mu_r = \frac{\mu}{\mu_0} \]
11.3 – Inductance

Inductors are designed to set up a strong magnetic field linking the unit, whereas capacitors are designed to set up a strong electric field between the plates.

Inductance is measure in Henries (H).

One **henry** is the inductance level that will establish a voltage of 1 volt across the coil due to a change in current of 1 A/s through the coil.
Inductance

Inductor construction and inductance

\[ L = \frac{\mu N^2 A}{l} \]

- \( \mu \) = permeability (Wb/A \cdot m)
- \( N \) = number of turns (t)
- \( A \) = area (m\(^2\))
- \( l \) = length (m)
- \( L \) = inductance in henries (H)
If a conductor is moved through a magnetic field so that it cuts magnetic lines of flux, a voltage will be induced across the conductor.
Induced Voltage

Faraday’s law of electromagnetic induction

The greater the number of flux lines cut per unit time (by increasing the speed with which the conductor passes through the field), or the stronger the magnetic field strength (for the same traversing speed), the greater will be the induced voltage across the conductor.

If the conductor is held fixed and the magnetic field is moved so that its flux lines cut the conductor, the same effect will be produced.
Induced Voltage

Faraday’s law of electromagnetic induction

If a coil of $N$ turns is placed in the region of the changing flux, as in the figure below, a voltage will be induced across the coil as determined by Faraday’s Law.

$$e = N \frac{d\phi}{dt} \quad \text{(volts, V)}$$

Changing flux
Induced Voltage

Lenz’s law

An induced effect is always such as to oppose the cause that produced it.
The inductance of a coil is also a measure of the change in flux linking a coil due to a change in current through the coil.

\[ L = N \frac{d\Phi}{di} \]

- \( N \) is the number of turns, \( \Phi \) is the flux in webers, and \( i \) is the current through the coil.
Induced Voltage

The larger the inductance of a coil (with \( N \) fixed), the larger will be the instantaneous change in flux linking the coil due to the instantaneous change in the current through the coil.

\[
v_L = L \frac{di_L}{dt} \quad \text{(volts, V)}
\]

The voltage across an inductor is directly related to the inductance \( L \) and the instantaneous rate of change through the coil. The greater the rate of change of current through the coil, the greater the induced voltage.
11.5 – R-L Transients: The Storage Phase

The changing voltage and current that result during the storing of energy in the form of a magnetic field by an inductor in a dc circuit.

The instant the switch is closed, inductance in the coil will prevent an instantaneous change in the current through the coil.

The potential drop across the coil $V_L$, will equal the impressed voltage $E$ as determined by Kirchhoff's voltage law.
R-L Transients: The Storage Phase

- An ideal inductor \((R_l = 0 \, \Omega)\) assumes a short-circuit equivalent in a dc network once steady-state conditions have been established.

- The storage phase has passed and steady-state conditions have been established once a period of time equal to five time constants has occurred.

- The current cannot change instantaneously in an inductive network.

- The inductor takes on the characteristics of an open circuit at the instant the switch is closed.

- The inductor takes on the characteristics of a short circuit when steady-state conditions have been established.
11.6 – Initial Values

Since the current through a coil cannot change instantaneously, the current through a coil will begin the transient phase at the initial value established by the network before the switch was closed.

The current will then pass through the transient phase until it reaches the steady-state (or final) level after about 5 time constants.

The steady-state level of the inductor current can be found by substituting its short-circuit equivalent (or $R_i$ for the practical equivalent).
The drawing of the waveform for the current $i_L$ from the initial value to a final value.

$$i_L = I_f + (I_i - I_f)e^{-\frac{t}{\tau}}$$
In R-L circuits, the energy is stored in the form of a magnetic field established by the current through the coil.

An isolated inductor cannot continue to store energy since the absence of a closed path would cause the current to drop to zero, releasing the energy stored in the form of a magnetic field.
R-L Transients: The Release Phase

Analyzing the R-L circuit in the same manner as the R-C circuit.

When a switch is closed, the voltage across the resistor $R_2$ is $E$ volts, and the R-L branch will respond in the change in the current $di/dt$ of the equation $v_L = L(di/dt)$ would establish a high voltage $v_L$ across the coil.
11.8 – Thévenin Equivalent: $\tau = L/R_{Th}$

If the circuit does not have the basic series form, it is necessary to find the Thévenin equivalent circuit.
The instantaneous values of any voltage or current can be determined by simply inserting $t$ into the equation and using a calculator or table to determine the magnitude of the exponential term.

Storage cycle:

$$t = \tau \log_e \frac{I_i - I_f}{i_L - I_f} \quad \text{(seconds, s)}$$

Decay cycle:

$$t = \tau \log_e \frac{V_i}{V_L} \quad \text{(seconds, s)}$$
For inductors, the average induced voltage is defined by:

\[ v_{L_{av}} = L \frac{\Delta i_L}{\Delta t} \]  

(volts, V)
11.11 – Inductors in Series and in Parallel

Inductors, like resistors and capacitors, can be placed in series.

Increasing levels of inductance can be obtained by placing inductors in series.

\[ L_T = L_1 + L_2 + L_3 + \cdots + L_N \]
Inductors in Series and in Parallel

Inductors, like resistors and capacitors, can be placed in parallel.

Decreasing levels of inductance can be obtained by placing inductors in parallel.

\[ \frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} + \cdots + \frac{1}{L_N} \]
An inductor can be replaced by a short circuit in a dc circuit after a period of time greater than five time constants have passed.

Assuming that all of the currents and voltages have reached their final values, the current through each inductor can be found by replacing each inductor with a short circuit.
The ideal inductor, like the ideal capacitor, does not dissipate the electrical energy supplied to it. It stores the energy in the form of a magnetic field.

\[ W_{\text{stored}} = \frac{1}{2}LI_m^2 \] (joules, J)
Introduction To Analog Filters
Filters may be classified as either digital or analog.

- **Digital filters** are implemented using a digital computer or special purpose digital hardware.

- **Analog filters** may be classified as either passive or active and are usually implemented with R, L, and C components and operational amplifiers.
Filters

Background:

- An **active filter** is one that, along with R, L, and C components, also contains an energy source, such as that derived from an operational amplifier.

- A **passive filter** is one that contains only R, L, and C components. It is not necessary that all three be present. L is often omitted (on purpose) from passive filter design because of the size and cost of inductors – and they also carry along an R that must be included in the design.
The **analysis** of analog filters is well described in filter text books. The most popular include Butterworth, Chebyshev and elliptic methods.

The **synthesis** (realization) of analog filters, that is, the way one builds (topological layout) the filters, received significant attention during 1940 thru 1960. Leading the work were Cauer and Tuttle. Since that time, very little effort has been directed to analog filter realization.
Generally speaking, digital filters have become the focus of attention in the last 40 years. The interest in digital filters started with the advent of the digital computer, especially the affordable PC and special purpose signal processing boards. People who led the way in the work (the analysis part) were Kaiser, Gold and Radar.

A digital filter is simply the implementation of an equation(s) in computer software. There are no R, L, C components as such. However, digital filters can also be built directly into special purpose computers in hardware form. But the execution is still in software.
In this course we will only be concerned with an introduction to filters. We will look at both passive and active filters.

We will not cover any particular design or realization methods but rather use our understanding of poles and zeros in the s-plane.

All EE and CE undergraduate students should take a course in digital filter design, in my opinion.
Passive Analog Filters

Background: Four types of filters - “Ideal”

- **Lowpass**
- **Highpass**
- **Bandpass**
- **Bandstop**
Passive Analog Filters

Background:  Realistic Filters:

- **lowpass**
- **highpass**
- **bandpass**
- **bandstop**
Passive Analog Filters

Background:

It will be shown later that the ideal filter, sometimes called a “brickwall” filter, can be approached by making the order of the filter higher and higher.

The order here refers to the order of the polynomial(s) that are used to define the filter. Matlab examples will be given later to illustrate this.
Consider the circuit below.

\[ V_o(jw) = \frac{1}{jwC} \cdot \frac{1}{R + \frac{1}{jwC}} = \frac{1}{1 + jwRC} \]
Passive Analog Filters

Low Pass Filter

- 0 dB
- -3 dB
- 1
- 0.707
- 1/RC
- ω

Bode Plot

Passes low frequencies
Attenuates high frequencies

Linear Plot
Consider the circuit below.

\[ \frac{V_o(jw)}{V_i(jw)} = \frac{R}{R + \frac{1}{jwC}} = \frac{jwRC}{1 + jwRC} \]
Passive Analog Filters

High Pass Filter

Bode

0 dB

1/RC

-3 dB

1/RC

ω

Passes high frequencies

Attenuates low frequencies

Linear

1

0.707

0

1/RC

ω
Consider the circuit shown below:

When studying series resonant circuit we showed that:

\[
\frac{V_O(s)}{V_i(s)} = \frac{\frac{R}{L}}{s^2 + \frac{R}{L} s + \frac{1}{LC}}
\]
Passive Analog Filters

Bandpass Pass Filter

We can make a bandpass from the previous equation and select the poles where we like. In a typical case we have the following shapes.
Passive Analog Filters

Bandpass Pass Filter

Example

Suppose we use the previous series RLC circuit with output across R to design a bandpass filter. We will place poles at \(-200\) rad/sec and \(-2000\) rad/sec hoping that our \(-3\) dB points will be located there and hence have a bandwidth of 1800 rad/sec. To match the RLC circuit form we use:

\[
\frac{2200s}{s^2 + 2200s + 400000} = \frac{2200s}{(s+200)(s+2000)} = \frac{2200s}{200\times2000(1+\frac{s}{200})(1+\frac{s}{2000})}
\]

The last term on the right can be finally put in Bode form as:

\[
\frac{0.0055\ jw}{(1+\frac{jw}{200})(1+\frac{jw}{2000})}
\]
From this last expression we notice from the part involving the zero we have in dB form;

\[ 20\log(.0055) + 20\log w \]

Evaluating at \( w = 200 \), the first pole break, we get a 0.828 dB what this means is that our \( -3\text{dB} \) point will not be at 200 because we do not have 0 dB at 200. If we could lower the gain by 0.829 dB we would have \( -3\text{dB} \) at 200 but with the RLC circuit we are stuck with what we have. What this means is that the \( -3 \text{dB} \) point will be at a lower frequency. We can calculate this from

\[
\log \frac{200}{\text{w}_{\text{low}}} \times 20 \frac{\text{dB}}{\text{dec}} = 0.828 \text{dB}
\]
Passive Analog Filters

Bandpass Pass Filter

Example

This gives an \( w_{\text{low}} = 182 \) rad/sec. A similar thing occurs at \( w_{\text{hi}} \) where the new calculated value for \( w_{\text{hi}} \) becomes 2200. These calculations do no take into account a 0.1 dB that one pole induces on the other pole. This will make \( w_{\text{lo}} \) somewhat lower and \( w_{\text{hi}} \) somewhat higher.

One other thing that should have given us a hint that our \( w_1 \) and \( w_2 \) were not going to be correct is the following:

\[
\frac{R}{L} s \left( s^2 + \frac{R}{L} s + \frac{1}{LC} \right) = \frac{(w_1 + w_2)s}{(s^2 + (w_1 + w_2)s + w_1 w_2)}
\]

What is the problem with this?
The problem is that we have

\[ \frac{R}{L} = w_1 + w_2 = BW = (w_2 - w_1) \]

Therein lies the problem. Obviously the above cannot be true and that is why we have a problem at the \(-3\) dB points.

We can write a Matlab program and actually check all of this. We will expect that \(w_1\) will be lower than 200 rad/sec and \(w_2\) will be higher than 2000 rad/sec.
A Bandpass Digital Filter

Perhaps going in the direction to stimulate your interest in taking a course on filtering, a 10 order analog bandpass butterworth filter will be simulated using Matlab. The program is given below.

```matlab
N = 10;           % 10th order butterworth analog prototype

[ZB, PB, KB] = buttap(N);
numzb = poly([ZB]);
denpb = poly([PB]);

wo = 600;        % wo is the center freq
bw = 200;        % bw is the bandwidth

[numbbs,denbbs] = lp2bs(numzb,denpb,wo,bw);

w = 1:1:1200;

Hbbs = freqs(numbbs,denbbs,w);
Hb = abs(Hbbs);

plot(w,Hb)
grid
xlabel('Amplitude')
ylabel('frequency (rad/sec)')
title('10th order Butterworth filter')
```
A Bandpass Filter

10th order Butter bandpass filter

Amplitude

Frequency (rad/sec)
Consider the circuit below:

The transfer function for $V_O/V_i$ can be expressed as follows:

$$G_v(s) = \frac{s^2 + \frac{1}{LC}}{s^2 + \frac{R}{L}s + \frac{1}{LC}}$$
This is of the form of a band stop filter. We see we have complex zeros on the $jw$ axis located

$$\pm j \frac{1}{\sqrt{LC}}$$

From the characteristic equation we see we have two poles. The poles can essentially be placed anywhere in the left half of the s-plane. We see that they will be to the left of the zeros on the $jw$ axis.

We now consider an example on how to use this information.
Example

Design a band stop filter with a center frequency of 632.5 rad/sec and having poles at –100 rad/sec and –3000 rad/sec.

The transfer function is:

\[
\frac{s^2 + 300000}{s^2 + 3100s + 300000}
\]

We now write a Matlab program to simulate this transfer function.
Example

num = [1 0 300000];

den = [1 3100 300000];

w = 1 : 5 : 10000;

Bode(num,den,w)
RLC Band Stop Filter

Example

Bode

Matlab
Basic Active Filters

Low pass filter

![Circuit Diagram]

- $V_{in}$
- $R_{in}$
- $C$
- $R_{fb}$
- $V_{o}$
Basic Active Filters

High pass
Basic Active Filters

Band pass filter

\[ V_{in} \to R_1 \to R_2 \to C_2 \to R_i \to V_O \]
Basic Active Filters

Band stop filter