

COURSE BINDER

ROY G. PERRY COLLEGE OF ENGINEERING

**ELECTRICAL AND COMPUTER ENGINEERING
DEPARTMENT**

PRAIRIE VIEW A&M UNIVERSITY

ASSESSMENT REPORT COVER PAGE

ELEG 2305 Network Theory 1

SPRING 2022 SEMESTER

NAME OF INSTRUCTOR: Dr. John Fuller

Revised: 08/05/2019

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Assignments assessing students' ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately. (outcome "6")

1- Teach students the fundamental concepts of electrical power and electrical machines (DC and AC machines and transformers)

Anticipated Outcome: Student will have an understanding of electrical power systems and the design and operation of electrical machines

2- To teach students how to analyze different type of machines.

Anticipated Outcome: Student will acquire the ability to select the appropriate machine to be used for a specific operation and how to apply this knowledge on a global level.

3- To teach students the use of modern engineering tools such as Matlab and FPGA programming.

Anticipated Outcome: Student will be able to use modern engineering tools and exhibit a competency in the use of simulation tools.

Detailed Course Syllabus
(Distributed to Students at the beginning of the Semester)
ABET Outcomes measured using course should be
explicitly listed in the syllabus

ELEG 2305 Course Description

In ABET Format

Please use the following format for the course syllabi (2 pages maximum in Times New Roman 12 point font)

1.	Course number and name:	ELEG 2305 Section 1 CRN:20107
2.	Credits and contact hours:	3 credit hours; 4 contact hours * Subject Area: Engineering Science
3.	Instructor's or course coordinator's name:	Dr. John Fuller
4.	Text book: Title:	"Fundamentals of Electric Circuits"
	Author:	C.K. Alexander and M.N.O. Sadiku,
	Publisher, Year & Edition:	McGraw Hill, ISBN 978-0-07-352855-4
	a. Other Supplemental material	Electric Circuit Analysis, David Johnson, Johnny Johnson, John Hilburn, Peter Scott, Prentice Hall, ISBN 0-13-252479-1 Introduction to Electrical Engineering, J. David Irwin, Davis V. Kerns, Prentice Hall, ISBN 0-02-359930-8
5.	Specific course information	
	a. Brief description of the content of the course (catalog description)	<i>ELEG 2305 Network Theory I: 3 semester hours.</i> Study of basic circuit laws and theorems. Study of basic circuit analysis techniques, use of controlled sources, and transient and sinusoidal circuit analysis
	b. Prerequisites or Co-requisites	Prerequisites: PHYS 2523 Physics II MATH 2043 Differential Equations(may be taken concurrently).
	c. ** Indicate whether a required, elective, or selected elective (as per definition provided) course in the program	Required
6.	a. Specific goals for the course specific outcomes of instruction (e.g. The student will be able to explain the significance of current research about a particular topic.) <i>Students will be able to :</i>	b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course. <i>The specific goals for the course specific outcomes listed on the left column will address the following student learning outcomes:</i>

	1. Understanding and applying basic circuit laws and theorems to circuit analysis	Outcome 1 An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
	2. Understanding the basic components and configuration of components in circuit theory (Sources, R, L, C, RC, RL, RLC)	
	3. Students will be knowledgeable in the use of modern engineering tools such as Matlab and FPGA programming.	
7	Brief list of topics to be covered	1. Basic Concepts 2. Basic Laws 3. Methods of Analysis 4. Circuit Theorems 5. Operational Amplifiers 6. Capacitors and Inductors 7. First-order Circuits 8. Second-order Circuits

* For all Engineering programs, indicate subject area from the following: **Math, Basic science, Engineering topic or Other**

** **Required** courses are required of all students in the program, **elective** courses (often referred to as open or free electives) are optional for students, and **selected elective** courses are those for which students must take one or more courses from a specified group

Please hide all of the row and column lines when done.

Detailed Course Syllabus

ELEG 2305 Network Theory 1

Spring 2022

Information Item	Information
Instructor:	Dr. John Fuller
Section # and CRN:	ELEG 2305 Section 1 CRN: 20107
Office Location:	Electrical Engineering Building Room 344
Office Phone:	936-261-9923

Email Address:	jhfuller@pvamu.edu
Office Hours:	10:00 – 12:00 MW 11:30 – 1:00 T
Mode of Instruction:	Face to Face
Course Location:	Internet
Class Days & Times:	11:00 am – 12:20 pm TTR 5:30pm – 6:20 pm R
Catalog Description:	<i>ELEG 2305 Network Theory I: 3 semester hours.</i> Study of basic circuit laws and theorems. Study of basic circuit analysis techniques, use of controlled sources, and transient and sinusoidal circuit analysis..

Prerequisites:	Prerequisites: PHYS 2523 and MATH 2043 (Differential Equations may be taken concurrently).
Co-requisites:	Co-requisite: ELEG 2011
Required Text(s):	C.K. Alexander and M.N.O. Sadiku, “Fundamental of Electric Circuits,” 5 th Edition, McGraw Hill
Recommended Text(s):	Electric Circuit Analysis, David Johnson, Johnny Johnson, John Hilburn, Peter Scott, Prentice Hall, ISBN 0-13-252479-1 Introduction to Electrical Engineering, J. David Irwin, Davis V. Kerns, Prentice Hall, ISBN 0-02-359930-8

Student Learning Outcomes:

Upon successful completion of this course, students will be able to:

[NOTE: BEGIN each outcome with a VERB]:

Be able to understand and apply Ohm's law and Kirchhoff's laws in resistive networks.

Be able to understand and apply mesh and nodal analysis methods in networks.

Be able to understand and apply Thevenin and Norton theorems in electrical networks and simplification via source transformation techniques.

Be able to characterize the behavior of resistors, capacitors, and inductors.

Be able to solve electrical engineering circuit problems

Be able to understand and apply RL, RC and RLC transient network analysis.

Be able to use PSPICE, Multisim or MATLAB to solve electric circuit problems.

Major Course Requirements

Method of Determining Final Course Grade

Course Grade Requirement [Name each major requirement]	Value	Total
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First Exam	100	
Midterm Exam	100	
Third Exam	100	
Quizzes, projects, computer usage	100	
Final Exam (Dec 3 – DEC 9)	150	
Total: Note: Large valued exams may be replaced by smaller and more lower valued exams	550	

Grading Criteria and Conversion:

A = (495 points and above)

B = (440 - 494)

C = (385 – 439)

D = (330 – 384)

F = (0 – 329)

From the following table listing of topics to be covered, the above listed exams will be given on subjects of

First Exam – Topics 1 -3

Midterm Exam – Topics 4 -5

Third Exam – Topics 6 -8

Final Exam- All topics

Quizzes will be given as needed throughout the semester

Detailed Description of Major Assignments:

Assignment Title or Grade Requirement	Description
1. Basic Concepts 2. Basic Laws 3. Basic Laws Continued	Introduction and Review Systems of Units Charge and Current Voltage Power and Energy Circuit Elements Ohms Law, Nodes, Branches and Loops, Kirchoff's Law, Series Resistors and Voltage Parallel Resistors, Wye – Delta Transformation
4. Methods of Analysis 5. Circuit Theorems	Nodal Analysis Mesh Analysis Circuit Analysis with Multisim, Pspice and MatLab Linearity Properties Superposition Source Transformation Thevenin's Theorem Norton's Theorem Maximum Power Transfer
6. Operational Amplifiers	Operational amplifiers Ideal Op Amps Non-inverting Amplifier Summing amplifier Difference Amplifier Cascaded Op Amp Circuits
7. Capacitors and Inductors	Capacitors Series and Parallel Capacitors Inductors

8. First-order Circuits	Series and parallel Inductors The source free RC Circuit The source free RL Circuit Step Response Transient Analysis
9. Second-order Circuits	Initial and Final Values Source free series RLC Source free parallel RLC Step Response General Second Order Circuit

DR. MARTIN LUTHER KING HOLIDAY: (Monday, January 17)

University Closed

FIRST CLASS DAY: January 18

TUITION AND FEES PAYMENT DUE DATE: January 18

LATE REGISTRATION/LATE REGISTRATION FEE BEGINS

(\$50.00): January 18-January 24

ATTENDANCE REPORTING PERIOD. STUDENTS WHO DO NOT ATTEND CLASS DURING THIS PERIOD WILL HAVE THEIR COURSES REMOVED AND FINANCIAL AID REDUCED OR CANCELLED: January 18 – January 26

12th CLASS DAY: Tuesday, February 2, Census Date

WITHDRAWAL FROM COURSES WITH ACADEMIC RECORD

("W") BEGINS: February 3

DROP FOR NON-PAYMENT OF TUITION AND FEES@ 5:00 pm,
February 8

FINAL DATE TO APPLY FOR SPRING 2021 GRADUATION (March 30)

FINAL DAY TO DROP/WITHDRAW FROM COURSE WITHOUT ACADEMIC RECORD: February 3 (a financial record will still exist)

LAST DAY TO WITHDRAW FROM COURSE WITH AUTOMATIC "W" (Wednesday: February 3)

MID- SEMESTER EXAMINATION PERIOD: March 14 - 19

GOOD FRIDAY (NO CLASSES): April 15

**FINAL DAY TO WITHDRAWAL FROM COURSES WITH
ACADEMIC RECORD (“W”):** April 6

**FINAL DAY TO WITHDRAW FROM THE UNIVERSITY
(FROM ALL COURSES) FOR THE SEMESTER:** May 2

LAST CLASS DAY FOR SPRING 2021 SEMESTER: May 4

FINAL EXAM PERIOD: May 5-May 12, Thursday- Thursday

COVID-19 Campus Safety Measures [NOTE: Delete this section when the COVID-19 pandemic is over]

To promote public safety and protect students, faculty, and staff during the COVID-19 pandemic, Prairie View A&M University has adopted policies and practices for the Fall 2020 academic term to limit virus transmission. Students must observe the following practices while participating in face-to-face courses and course-related activities (office hours, help sessions, transitioning to and between classes, study spaces, academic services, etc.):

- **Self-monitoring** - Students should follow CDC recommendations for self-monitoring. Students who have a fever or exhibit symptoms of COVID-19 should participate in class remotely and should not participate in face-to-face instruction.
- **Face Coverings** - Face coverings (cloth face covering, surgical mask, etc.) must be properly worn in all nonprivate spaces including classrooms, teaching laboratories, common spaces such as lobbies and hallways, public study spaces, libraries, academic resource and support offices, and outdoor spaces where 6 feet of physical distancing is difficult to reliably maintain.
- **Physical Distancing** - Physical distancing must be maintained between students, instructors, and others in course and course-related activities.

- **Classroom Ingress/Egress** - Students must follow marked pathways for entering and exiting classrooms and other teaching spaces. Students should leave classrooms promptly after course activities have concluded, should not congregate in hallways and should maintain 6-foot physical distancing when waiting to enter classrooms and other instructional spaces.
- **Face-to-face Class** - To attend a face-to-face class, students must wear a face covering (or a face shield if they have an exemption letter). If a student refuses to wear a face covering, the instructor should ask the student to leave and join the class remotely. If the student does not leave the class, the faculty member should report that student to the Office for Student Conduct for adjudication. Additionally, the faculty member may choose to teach that day's class remotely for all students.

Student Support and Success

John B. Coleman Library

The John B. Coleman Library's mission is to enhance the scholarly pursuit of knowledge, to foster intellectual curiosity, and to promote life-long learning and research through our innovative services, resources, and cultural programs, which support the Prairie View A&M University's global mission of teaching, service, and research. It maintains library collections and access both on campus, online, and through local agreements to further the educational goals of students and faculty. Website: <https://www.pvamu.edu/library/>; Phone: 936-261-1500

Academic Advising Services

Academic Advising Services offers students a variety of services that contributes to student success and leads towards graduation. We assist students with understanding university policies and procedures that affect academic progress. We support the early alert program to help students get connected to success early in the semester. We help refer students to the appropriate academic support services when they are unsure of the best resource for their needs. Faculty advisors support some students in their respective colleges. Your faculty advisor can be identified in

PantherTracks. Advisors with Academic Advising Services are available to all students. We are located across campus. Find your advisor's location by academic major at www.pvamu.edu/advising. Phone: 936-261-5911

The University Tutoring Center

The University Tutoring Center (UTC) offers free tutoring and academic support to all registered PVAMU students. The mission of the UTC is to help provide a solid academic foundation that enables students to become confident, capable, independent learners. Competent and caring staff and peer tutors guide students in identifying, acquiring, and enhancing the knowledge, skills, and attitudes needed to reach their desired goals. Tutoring and academic support are offered face-to-face in the UTC, in virtual face-to-face sessions (<https://www.pvamu.edu/student-success/sass/university-tutoring-center/>), and through online sessions (<https://www.pvamu.edu/pvplace/>). Other support services available for students include Supplemental Instruction, Study Break, Academic Success Workshops, and Algebra Study Jam. Location: J. B. Coleman Library, Rm. 307; Phone: 936-261-1561; Email: pvtutoring@pvamu.edu; Website: <https://www.pvamu.edu/student-success/sass/university-tutoring-center/>

Writing Center

The Writing Center provides well-trained peer tutors to assist students with writing assignments at any stage of the writing process. Tutors help students with various writing tasks from understanding assignments, brainstorming, drafting, revising, editing, researching, and integrating sources. Students have free access to Grammarly online writing assistance. Grammarly is an automated proofreading and plagiarism detection tool. Students must register for Grammarly by using their student email address. In addition, students have access to face-to-face and virtual tutoring services either asynchronously via email or synchronously via Zoom. Location: J. B. Coleman Library, Rm. 209; Phone: 936-261-3724; Website: <https://www.pvamu.edu/student-success/writing-center/>; Grammarly Registration: <https://www.grammarly.com/enterprise/signup>

Academic Early Alert

Academic Early Alert is a proactive system of communication and collaboration between faculty, academic advisors, and PVAMU students that is designed to support student success by promptly identifying issues and allowing for intervention. Academic Early Alerts help students by providing a central location to schedule advising appointments, view advisor contact information, and request assistance. Students who recognize that they have a problem that is negatively affecting their

academic performance or ability to continue school may self-refer an Academic Early Alert. To do so, students will log in to PV Place and click on Academic Early Alert on the left sidebar. Phone: 936-261-5902; Website: <https://www.pvamu.edu/student-success/early-alert/>

Student Counseling Services

The Student Counseling Services unit offers a range of services and programs to assist students in maximizing their potential for success: short-term individual, couples, and group counseling, as well as crisis intervention, outreach, consultation, and referral services. The staff is licensed by the State of Texas and assists students who are dealing with academic skills concerns, situational crises, adjustment problems, and emotional difficulties. Information shared with the staff is treated confidentially and in accordance with Texas State Law. Location: Hobart Taylor, 2nd floor; Phone: 936-261-3564; Website: <https://www.pvamu.edu/healthservices/student-counseling-services/>

Office of Testing Services

Testing Services serves to create opportunities by offering a suite of exams that aid in the students' academic and professional success. Currently, we administer entrance (HESI A2), college readiness (TSI assessment), Prior Learning (CLEP, DSST), and proctored exams. Location: Wilhelmina Delco, 3rd Floor, Rm. 305; Phone: 936-261-3627; Email: aetesting@pvamu.edu; Website: www.pvamu.edu/testing

Office of Diagnostic Testing and Disability Services

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, contact the Office of Disability Services. As a federally-mandated educational support unit, the Office of Disability Services serves as the repository for confidential disability files for faculty, staff, and students. For persons with a disability, the Office develops individualized ADA letters of request for accommodations. Other services include learning style inventories, awareness workshops, accessibility pathways, webinars, computer laboratory with adapted hard and software, adapted furniture, proctoring non-standardized test administrations, ASL interpreters, ALDs, digital recorders, Livescribe, and a comprehensive referral network across campus and the broader

community. Location: Hobart Taylor, Rm. 1D128; Phone: 936-261-3583; Website: <https://www.pvamu.edu/disabilityservices/>

Center for Instructional Innovation and Technology Services (CIITS)

Distance Learning, also referred to as Distance Education, is the employment of alternative instructional delivery methods to extend programs and services to persons unable to attend college in the traditional manner. The Center for Instructional Innovation and Technology Services (CIITS) supports student learning through online, hybrid, web-assist, and 2-way video course delivery. For more details and contact information, visit: <https://www.pvamu.edu/dlearning/distance-learning-2-2/students-2/>; Phone: 936-261-3283

Veteran Affairs

Veterans Services works with student veterans, current military and military dependents to support their transition to the college environment and continued persistence to graduation. The Office coordinates and certifies benefits for both the G.I. Bill and the Texas Hazlewood Act. Location: Evans Hall, Rm. 102; Phone: 936-261-3563; Website: <https://www.pvamu.edu/sa/departments/veteranaffairs/>

Office for Student Engagement

The Office for Student Engagement delivers comprehensive programs and services designed to meet the co-curricular needs of students. The Office implements inclusive and accessible programs and services that enhance student development through exposure to and participation in diverse and relevant social, cultural, intellectual, recreational, community service, leadership development, and campus governance. Location: Memorial Student Center, Rm. 221; Phone: 936-261-1340; Website: <https://www.pvamu.edu/studentengagement/>

Career Services

Career Services supports students through professional development, career readiness, and placement and employment assistance. The Office provides one-on-one career coaching, interview preparation, resume and letter writing, and career exploration workshops and seminars. Services are provided for students at the Northwest Houston Center and College of Nursing in the Medical Center twice a month or on a requested basis. Distance Learning students are encouraged to visit the Career Services website for information regarding services provided. Location: Anderson Hall, 2nd floor; Phone: 936-261-3570; Website: <https://www.pvamu.edu/careerservices/>

University Rules and Procedures

Academic Misconduct

Academic dishonesty is defined as any form of cheating or dishonesty that has the effect or intent of interfering with any academic exercise or fair evaluation of a student's performance. The college faculty can provide additional information, particularly related to a specific course, laboratory, or assignment.

You are expected to practice academic honesty in every aspect of this course and all other courses. Make sure you are familiar with the *University Administrative Guidelines on Academic Integrity*, which can be found on the [Academic Integrity webpage](#). Students who engage in academic misconduct are subject to university disciplinary procedures. As listed in the *University Administrative Guidelines on Academic Integrity*, the University Online Catalog, and the Student Code of Conduct, the following are examples of prohibited conduct. This list is not designed to be all-inclusive or exhaustive. In addition to academic sanctions, any student found to have committed academic misconduct that is also a violation of criminal law may also be subject to disciplinary review and action by the Office of Student Conduct (as outlined in the Student Code of Conduct).

Forms of Academic Dishonesty:

1. Cheating: Deception in which a student misrepresents that he/she has mastered information on an academic exercise that he/she has not learned, giving or receiving aid unauthorized by the instructor on assignments or examinations. Examples: unauthorized use of notes for a test; using a "cheat sheet" on a quiz or exam; any alteration made on a graded test or exam which is then resubmitted to the teacher;
2. Plagiarism: Careless or deliberate use of the work or the ideas of another; representation of another's work, words, ideas, or data as your own without permission or appropriate acknowledgment. Examples: copying another's paper or answers, failure to identify information or essays from the internet and submitting or representing it as your own; submitting an assignment which has been partially or wholly done by another and claiming it as yours; not properly acknowledging a source which has been summarized or paraphrased

in your work; failure to acknowledge the use of another's words with quotation marks;

3. Collusion: When more than one student or person contributes to a piece of work that is submitted as the work of an individual;
4. Conspiracy: Agreeing with one or more persons to commit an act of academic/scholastic dishonesty; and
5. Multiple Submission: Submission of work from one course to satisfy a requirement in another course without explicit permission. Example: using a paper prepared and graded for credit in one course to fulfill a requirement and receive credit in a different course.

Nonacademic Misconduct

The university respects the rights of instructors to teach and students to learn. Maintenance of these rights requires campus conditions that do not impede their exercise. Campus behavior that interferes with either (1) the instructor's ability to conduct the class, (2) the inability of other students to profit from the instructional program, or (3) campus behavior that interferes with the rights of others will not be tolerated. An individual engaging in such disruptive behavior may be subject to disciplinary action. The Office of Student Conduct will adjudicate such incidents under nonacademic procedures.

Sexual Misconduct

Sexual harassment of students and employees at Prairie View A&M University is unacceptable and will not be tolerated. Any member of the university community violating the university's sexual harassment policy will be subject to disciplinary action. In accordance with the Texas A&M University System guidelines, your instructor is obligated to report to the Office of Title IX Compliance (titleixteam@pvamu.edu) any instance of sexual misconduct involving a student, which includes sexual assault, stalking, dating violence, domestic violence, and sexual harassment, about which the instructor becomes aware during this course through writing, discussion, or personal disclosure. The faculty and staff of PVAMU actively strive to provide a learning, working, and living environment that promotes respect that is free from sexual misconduct, discrimination, and all forms of violence. If students, faculty, or staff would like assistance or have questions, they may contact the Title IX Coordinator at 936-261-2144 or titleixteam@pvamu.edu. More information can be found at www.pvamu.edu/titleix, including confidential resources available on campus.

Pregnancy, Pregnancy-related, and Parenting Accommodations

Title IX of the Education Amendments of 1972 prohibits sex discrimination, which includes discrimination based on pregnancy, marital status, or parental status. Students seeking accommodations related to pregnancy, pregnancy-related conditions, or parenting (reasonably immediate postpartum period) are encouraged to contact Student Disability Services or the Dean of Students' Office for additional information and to request accommodations.

Non-Discrimination Statement

Prairie View A&M University does not discriminate on the basis of race, color, sex, religion, national origin, age, disability, genetic information, veteran status, sexual orientation, or gender identity in its programs and activities. The University is committed to supporting students and complying with The Texas A&M University System non-discrimination policy. It seeks to establish an environment that is free of bias, discrimination, and harassment. If you experience an incident of discrimination or harassment, we encourage you to report it. If you would like to speak with someone who may be able to afford you privacy or confidentiality, there are individuals who can meet with you. The Director of Equal Opportunity & Diversity has been designated to handle inquiries regarding the non-discrimination policies and can be reached at Harrington Science Building, Suite 109 or by phone at 936-261-1744 or 1792.

Class Attendance Policy (See the University Online Catalog for Full Attendance Policy)

Prairie View A&M University requires regular class attendance. Attending all classes supports the full academic development of each learner, whether classes are taught with the instructor physically present or via distance learning technologies such as interactive video and/or the internet. Excessive absenteeism, whether excused or unexcused, may result in a student's course grade being reduced or in the assignment of a grade of "F." Absences are accumulated beginning with the first day of class during regular semesters and summer terms. Each faculty member will include the University's attendance policy in each course syllabus.

Student Academic Appeals Process

Authority and responsibility for assigning grades to students rest with the faculty. However, in those instances where students believe that miscommunication, errors, or unfairness of any kind may have adversely affected the instructor's assessment of their academic performance, the student has a right to appeal by the procedure listed in the University

Online Catalog and by doing so within thirty days of receiving the grade or experiencing any other problematic academic event that prompted the complaint.

Technical Considerations

Minimum Recommended Hardware and Software:

- Intel PC or Laptop with Windows 10 or later version; Mac with OS High Sierra*
- Smartphone or iPad/Tablet with Wi-Fi*
- High-speed Internet access
- 8 GB Memory
- Hard drive with 320 GB storage space
- 15" monitor, 800x600, color or 16 bit
- Sound card w/speakers
- Microphone and recording software
- Keyboard & mouse
- Most current version of Google Chrome, Safari, or Firefox

Note: Be sure to enable Java & pop-ups in the Web browser preferences

* Smartphones, Google Chrome books, and Android tablets may not be supported. iPads are the only tablets supported.

Participants should have a basic proficiency of the following computer skills:

- Sending and receiving email
- A working knowledge of the Internet
- Microsoft Word (or a program convertible to Word)
- Acrobat PDF Reader
- Windows or Mac OS
- Video conferencing software

Netiquette (online etiquette)

Students are expected to participate in all discussions and virtual classroom chats as directed. Students are to be respectful and courteous to others on discussion boards. Foul or abusive language will not be tolerated. Do not use ALL CAPS for communicating to others AS IT CAN BE INTERPRETED AS YELLING. Avoid slang terms such as "wassup?" and texting abbreviations such as "u" instead of "you." Limit and possibly

avoid the use of emoticons. Be cautious when using humor or sarcasm as tone is sometimes lost in an email or discussion post, and the message might be taken seriously or sound offensive.

Video Conferencing Etiquette

When using Zoom, WebEx, or other video conferencing tools, confirm the visible area is tidy, clear of background clutter, inappropriate or offensive posters, and other distractions. Ensure you dress appropriately and avoid using high traffic or noisy areas. Stay muted when you are not speaking and avoid eating/drinking during the session. Before the class session begins, test audio, video, and lighting to alleviate technology issues.

Technical Support

Students should go to <https://mypassword.pvamu.edu/> if they have password issues. The page will provide instructions for resetting passwords and contact information if login issues persist. For other technical questions regarding eCourses, call the Center for Instructional Innovation and Technology Services at 936-261-3283 or email ciits@pvamu.edu.

Communication Expectations and Standards

Emails or discussion postings will receive a response from the instructor, usually in less than 48 hours. Urgent emails should be marked as such. Check regularly for responses.

Discussion Requirement

Online courses often require minimal to no face-to-face meetings. However, conversations about the readings, lectures, materials, and other aspects of the course can occur in a seminar fashion. The use of the discussion board will accomplish this. The instructor will determine the exact use of discussion boards.

It is strongly suggested that students type their discussion postings in a word processing application such as Word and save it to their PC or a removable drive before posting to the discussion board. This is important for two reasons: 1) If for some reason your discussion responses are lost in your online course, you will have another copy; 2) Grammatical errors can be greatly minimized by the use of the spell-and-grammar check functions in word processing applications. Once the post(s) have been typed and corrected in the word processing application, copy and paste to the discussion board.

COVID-19 Campus Safety Measures [NOTE: Delete this section when the COVID-19 pandemic is over]

To promote public safety and protect students, faculty, and staff during the coronavirus pandemic, PVAMU has adopted policies and practices to limit virus transmission.

- **Self-monitoring** - Students should follow CDC recommendations for self-monitoring. Students who have a fever or exhibit symptoms of COVID-19 should participate in class remotely and should not participate in face-to-face instruction.
- **Face Coverings** - Face coverings (cloth face covering, surgical mask, etc.) are recommended in classrooms, teaching laboratories, common spaces such as lobbies and hallways, public study spaces, libraries, academic resource, and support offices, and outdoor spaces where 6 feet of physical distancing is challenging to maintain reliably.
- **Physical Distancing** - Physical distancing should be maintained between students, instructors, and others in course and course-related activities where possible.

Personal Illness and Quarantine - Students required to quarantine are to participate in courses and course-related activities remotely and must not attend face-to-face course activities. Students should notify their instructors of the quarantine requirement. Students under quarantine are expected to participate in courses and complete graded work unless they have symptoms that are too severe to participate in course activities. Students experiencing personal injury or illness that is too severe for the student to attend class qualify for an excused absence. To receive an excused absence, students must provide appropriate documentation to the Office for Student Conduct, studentcond

CLASS ATTENDANCE POLICY

Effective September 1, 1998

Prairie View A&M University requires regular class attendance. Attending all classes supports full academic development of each learner whether classes are taught with the instructor physically present or via distance learning technologies such as interactive video. Excessive absenteeism, whether EXCUSED or UNEXCUSED, may result in a student's course grade being reduced or in a student's being assigned a grade of "F." Absences are accumulated beginning with the first day of class during regular semesters and summer terms. Each faculty member will include the University's attendance policy in each course syllabus.

Excused Absences

Students are required to attend all class meetings. Absences due to illness, attendance at university approved activities, and family or other emergencies constitute EXCUSED ABSENCES and must be supported by documentation presented to the instructor prior to or immediately upon the student's return to class. Students are responsible for all oral and written examinations as well as all assignments (e.g., projects, papers, reports) whether absence is Excused or Unexcused.

Unexcused Absences

Accumulation of one week of unexcused absences (for the number of clock hours equivalent to the credit for the course) constitutes excessive absenteeism. The instructor is not required to accept assignments as part of the course requirement when the student's absence is unexcused. Each course syllabus will include a clear statement relative to whether late or past due assignments will be accepted toward satisfying the course requirements.

A student who believes that the penalty received following violation of this attendance policy is unjust may first confer with his/her academic advisor. If necessary, the matter may be appealed in writing to the course instructor, the instructor's department head, and finally, to the instructor's dean who must refer the matter to the Chair, Admissions and Academic Standards Committee if it cannot be resolved within the college offering the course.

Absences on Religious Holy Days

In accordance with Texas Education Code, Section 61.003, subdivision (7), a student may be absent from classes for the observance of a religious holy day and

will be permitted to take missed examinations and complete missed assignments provided the student has notified the instructor of the planned absence in writing and receipt of that notice has been acknowledged by the instructor in writing. “A religious holy day means a holy day observed by a religion whose place of worship is exempt from property taxation under the Texas Tax Code, Section 11.20.”

End of Semester Course Assessment Report

This summary contains the following Information

1. Performance Statistics

- Total number of students in class
- The class average performance **(stated as %)** in each course outcome assessed in this class and the **two previous times course was assessed.**
- The acceptable class average for the class in each outcome area as set by your Department. **You cannot use any number of your choice**
- Percentage of students who scored below the expected average in each outcome.

2. Implementation Summary

- Brief summary of plans implemented during the semester based on last assessment report

3. Perceived Problems

- Instructor's **critical evaluation** of perceived problems that affected students' performance. **Realistic problems should be identified throughout the semester and summarized in this section of the report.**

4. New Plans for Addressing Problems

- Instructor's plans for addressing the perceived problems the next time the class is taught. **These should be specific enough for another instructor to implement. Most of these should be things that, you, the instructor can implement to help students to improve. Be creative.**

5. Overall Trend over last three assessment periods

- Instructors summary of overall performance trend for each outcome measured over the last three periods.

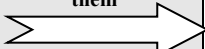
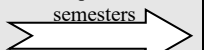
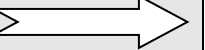
5. Were Expectations Met?

- Answer **YES** if the **class average was above the expected average** and the **stated percentage of students** scored at or above the expected average, else answer **NO**.

END OF SEMESTER COURSE OUTCOME ASSESSMENT REPORT
ELEG 2305-001 Network Theory I
Spring 2022 SEMESTER

Report Prepared by: Dr. John Fuller

Report Date: May 23, 2022

Semester	Analysis Type		Number of Students	Sub-Outcome 1.1 Understanding and applying basic circuit laws and theorems to circuit analysis				Sub-Outcome 1.2 Understanding the basic components and configuration of components in circuit theory (Sources, R, L, C, RC, RL, RLC)				Sub-Outcome 1.3 Knowledge of solving circuits problems using software packages			
				Expected Class Average/	Expected Percent of students at or above average	Class Average	% Students meeting Expected Average	Expected Class Average/	Expected Percent of students at or above average	Class Average	% Students meeting Expected Average	Expected Class Average /	Expected Percent of students at or above average	Class Average	% Students meeting Expected Average
Spring 2022	Direct		8	75	70	48	38	75	70	50	38	75	70	63	63
Fall 2021	Direct		21	75	70	65	33	75	70	55	24	75	70	73	71
Spring 2021	Direct		26	75	70	70	70	75	70	83	84	75	70	82	73
Fall 2020	Direct		12	75	70	61	67	75	70	76	75	75	70	Bonus	
Perceived Problems		Perceived problems are directly related to the PC and the sub items under them 		With a small class size and a number of students not regularly attending class and/or missing exams the average is very low.				Same problem as previously stated, students not regularly attending class or taking exams.				Normally programming is one of the student strengths, but from the record there is a steady decline in computing performance. This is mostly attributable to a number of students not completing and submitting programming assignments.			
Plans for Addressing Problems		Plans for address specific measures to address PC and their sub areas 		This semester and previous semesters have been difficult for the students and with the return to face to face instruction it was expected that there would be a return to normalcy but it will take a little more time.				Attendance at problem sessions was poor during online instruction and still remain low doing face to face instruction. As stated from the previous semester, gave attendance problem solving points during evening problem sessions.				For the previous semester (Fall 2021) the lowered class average was attributed to previous (while meeting expected average) remote online instruction and testing, but the trend is continuing.			
Overall Trend over Periods		Ascertain if there were improvements over previous semesters 		The Students application of circuit laws to problem solving has been at the low level over the past three semesters and is a declining trend.				Again the same as given under outcome 1.1. Students not regularly attending class and some not submitting homework and not taking exams.				Same as previous stated trend. Listing of homework and test scores as given in course assessment table gives evidence of student participation.			
Were Expectations Met?				NO				NO				NO			

**Grade Sheet Showing
Student and Class Performance in Outcomes
The computed semester average in each outcome
as stated in the Assessment report are
highlighted in boldface**

COURSE ASESMENT

ELEG 2305 NETWORK THEORY 1

Fall 2021 Dr. John Fuller Instructor

ELEG 2305-PO1 Fall 2021	First Exam 50 points	HMWK Nodal Analysis 8	HMWK Mesh Analysis 6	Avg % ?/64	Midterm Exam 100	Final Exam 150	Avg % ?/250	MATLAB Program
Student								
1	4	0	0	6	0	0	0	0
2	37	7	6	78	58	82	58	30
3	23	0	6	45	81	113	78	30
4	0	6	5	17	0	10	11	0
5	20	7	0	42	23	71	38	0
6	41	7	6	84	92	90	73	30
7	33	8	6	73	65	138	81	30
8	10	7	6	36	57	90	59	30
Overall Avg. %				48%			50%	63%

COURSE ASESMENT

ELEG 2305 Network Theory 1

**OUTCOME SPECIFIC ASSIGNMENTS
USED TO ASSESS OUTCOMES**

**(Provide at least two assignments used to specifically
measure each outcome and justify the suitability of the
assignments for the outcome being measured)**

ASSIGNMENTS FOR OUTCOME 1.1

Understanding and applying basic circuit laws and theorems to circuit analysis

|

**ELECTRICAL AND COMPUTER ENGINEERING
DEPARTMENT
OUTCOMES SPECIFIC ASSIGNMENT COVER SHEET
NETWORK THEORY 1
Spring 2022
Instructor: Dr. John Fuller**

Title of Assignment

Mesh Analysis Homework

Outcome Measured Using this Assignment

Outcome 1.1

An ability to identify, formulate, and solve **complex engineering problems** by applying principles of engineering, science, and mathematic.

Check the complex engineering problem characteristics related to this assignment

Assignment problem	
	involves wide-ranging or conflicting technical issues,
	has no obvious solution
	Addresses problems not encompassed by current standards and codes
	involves diverse groups of stakeholders
X	includes many component parts or sub-problems
	involves multiple disciplines
X	has significant consequences in a range of contexts
Assignment problem involves the application of the principles of	
X	engineering
	science
X	mathematics

Brief justification of why this assignment is suitable for this outcome

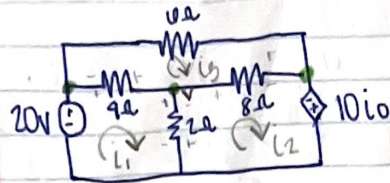
The questions on this homework tests the student's ability to identify relevant laws and equations, formulate the solution methodology, and solve the resulting mathematical equations.

Mesh Analysis Homework

Student Support Material

Above Average

Mesh Method



$$2i_1 - 2i_2 - 20V + 4i_1 - 4i_3 = 0$$

$$\textcircled{1} 6i_1 - 2i_2 - 4i_3 = 20$$

$$2i_2 + 2i_1 + 8i_2 - 8i_1 - 10i_3 = 0$$

$$\textcircled{2} -10i_1 + 10i_2 - 10i_3 = 0$$

$$8i_3 - 8i_2 + 4i_3 - 4i_1 + 0i_3 = 0$$

$$-4i_1 - 8i_2 + 12i_3 = 0$$

$$\begin{bmatrix} 6 & -2 & -4 \\ -10 & 10 & -10 \\ -4 & -8 & 12 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 20 \\ 0 \\ 0 \end{bmatrix}$$

$$\rightarrow \Delta = \begin{bmatrix} 6 & -2 & -4 \\ -10 & 10 & -10 \\ -4 & -8 & 12 \end{bmatrix}$$

$$1080 - 80 - 320 - (1100 + 480 + 360)$$

$$1080 - 1000 = -320$$

$$\Delta = -320$$

$$i_1 = \Delta_1 / \Delta = \left\{ \begin{bmatrix} 20 & 0 & -4 \\ 0 & 10 & -10 \\ 0 & -4 & 12 \end{bmatrix} \begin{bmatrix} 20 \\ 0 \\ 0 \end{bmatrix} \right\} \frac{-2000 + 0 + 0 - (0 + 800 + 0)}{-320} \rightarrow \frac{-4000}{-320}$$

$$i_1 = 12.5$$

$$i_2 = \left\{ \begin{bmatrix} 6 & 20 & -4 \\ -10 & 0 & -10 \\ -4 & 0 & 12 \end{bmatrix} \begin{bmatrix} 0 \\ 20 \\ 0 \end{bmatrix} \right\} \frac{0 + 800 - (0 + 0 - 3600)}{-320} \rightarrow \frac{4400}{-320}$$

$$i_2 = -13.75$$

$$\textcircled{1} 6i_1 - 2i_2 - 4i_3 = 20$$

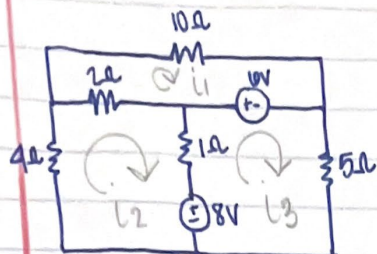
$$6(12.5) - 2(-13.75) - 4i_3 = 20$$

$$75 + 27.5 - 4i_3 = 20$$

$$-4i_3 = 20 - 75 - 27.5$$

$$-4i_3 = -82.5$$

$$i_3 = 20.625$$



$$10i_1 - 10V + 2i_1 - 2i_2 = 0$$

$$12i_1 - 2i_2 = 100$$

$$-2i_1 + 2i_2 + i_2 - i_3 + 8 + 4i_2 = 0$$

$$-2i_1 + 7i_2 - i_3 = -8 \quad (2)$$

$$5i_3 - 8V + i_3 - i_2 + i_1 = 0$$

$$-i_2 + 6i_3 = 2 \quad (3)$$

$$\begin{bmatrix} 12 & -2 & 0 \\ -2 & 7 & -1 \\ 0 & -1 & 6 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 100 \\ -8 \\ 2 \end{bmatrix}$$

$$\Delta = \begin{bmatrix} 12 & -2 & 0 \\ -2 & 7 & -1 \\ 0 & -1 & 6 \end{bmatrix} \begin{bmatrix} 12 & -2 \\ -2 & 7 \\ 0 & -1 \end{bmatrix} \left\{ \begin{array}{l} 504 - (12 \times 24) \\ 408 \end{array} \right.$$

$$i_1 = \Delta_1 / \Delta \rightarrow \begin{bmatrix} 0 & -2 & 0 \\ -8 & 7 & -1 \\ 2 & -1 & 6 \end{bmatrix} \begin{bmatrix} 0 & -2 \\ -8 & 7 \\ 2 & -1 \end{bmatrix} \rightarrow \begin{array}{l} 252 + 4 + 0 - (0 \times 10 \times 90) \\ 250 - 102 = 151 \end{array} \rightarrow \frac{151}{408} = 0.3690$$

$$i_2 = \Delta_2 / \Delta \rightarrow \begin{bmatrix} 12 & 0 & 0 \\ -2 & 8 & -1 \\ 0 & 2 & 6 \end{bmatrix} \begin{bmatrix} 12 & 0 \\ -2 & 8 \\ 0 & 2 \end{bmatrix} \rightarrow \begin{array}{l} -510 + 0 + 0 - (0 \times 24 - 72) \\ -480 \end{array} \rightarrow \frac{-480}{408} = -1.02$$

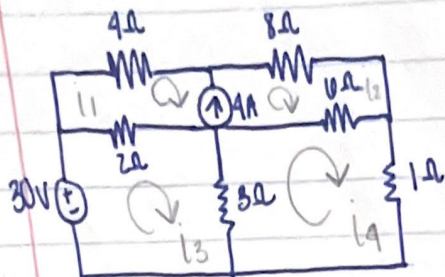
$$(3) -i_2 + 6i_3 = 2$$

$$-1(-1.02) + 6i_3 = 2$$

$$1.02 + 6i_3 = 2$$

$$6i_3 = 2 - 1.02$$

$$i_3 = 0.1633$$



Super Node $\rightarrow$

$$i_1 + i_2 = 4A$$

$$4i_1 + 8i_2 + 10i_2 - 10i_4 + 2i_1 - 2i_3 = 0$$

$$10i_1 + 14i_2 - 2i_3 = 0 \quad (1)$$

$$3i_1 - 3i_3 + 10i_4 - 10i_2 + i_4 = 0$$

$$-10i_2 + 10i_4 - 3i_3 = 0 \quad (2)$$

$$3i_3 - 3i_4 - 30V + 2i_3 - 2i_1 = 0$$

$$-2i_1 + 5i_3 - 3i_4 = 30 \quad (3)$$

$$\begin{bmatrix} 10 & 14 & -2 \\ -10 & 10 & -3 \\ -2 & 5 & -3 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 30 \end{bmatrix}$$

$$\rightarrow \Delta = \begin{bmatrix} 10 & 14 & -2 \\ -10 & 10 & -3 \\ -2 & 5 & -3 \end{bmatrix} \begin{bmatrix} 10 & 14 & -180 \\ -10 & 10 & 120 \\ -2 & -3 & -90 \end{bmatrix}$$

$$i_1 \rightarrow \Delta_1 / -90 \rightarrow \begin{bmatrix} 0 & 14 & -2 \\ 0 & 10 & -3 \\ 30 & 5 & -3 \end{bmatrix} \begin{bmatrix} 10 & 14 & -180 \\ 0 & 10 & -3 \\ 30 & 5 & -3 \end{bmatrix} \rightarrow 0 - 1200 + 0 - (-1000 + 0 + 0) = -200$$

$$i_1 = 1.33$$

$$i_2 \rightarrow \Delta_2 / -90 \rightarrow \begin{bmatrix} 10 & 0 & -2 \\ -10 & 0 & -3 \\ -2 & 30 & -3 \end{bmatrix} \begin{bmatrix} 10 & 0 & -2 \\ -10 & 0 & -3 \\ -2 & 30 & -3 \end{bmatrix} \rightarrow 0 + 0 + 30 - (0 - 540 + 0) = 570$$

$$i_2 = -6.4$$

$$(1) 10i_1 + 14i_2 - 2i_3 = 0$$

$$10(1.33) + 14(-6.4) - 2i_3 = 0$$

$$13.3 - 89.6 - 2i_3 = 0$$

$$-76.3 - 2i_3 = 0$$

$$-2i_3 = 76.3$$

$$i_3 = -38.15$$

Average

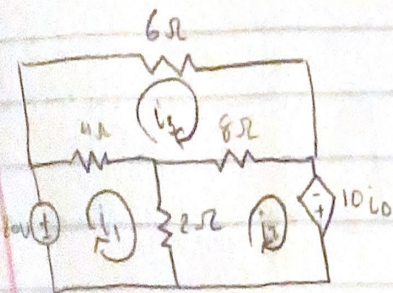
$$4(i_1 - i_2) + 2(i_3 - i_1) + 4(i_3 - i_2)$$

$$4i_1 - 4i_2 + 2i_3 - 2i_1 + 4i_3 - 4i_2$$

$$-8i_1 + 16i_3 - 8i_2$$

HWT#5

Jordan Owens



$$i_0 = i_1 - i_3$$

Mesh 2:

$$-2i_1 + 2i_2 + 8i_2 - 8i_3 - 10i_0 = 0$$

$$-2i_1 + 10i_2 - 8i_3 - 10(i_1 - i_3) = 0$$

$$-2i_1 + 10i_2 - 18i_3 = 0$$

$$6 \cdot 10 = 18$$

$$1,080 - 144 - 64 - (160 + 864 + 72) = -224$$

$$i_3 \begin{bmatrix} 6 & -2 & 20 \\ -2 & 10 & 0 \\ -4 & -8 & 18 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 120 \\ 0 \\ 0 \end{bmatrix}$$

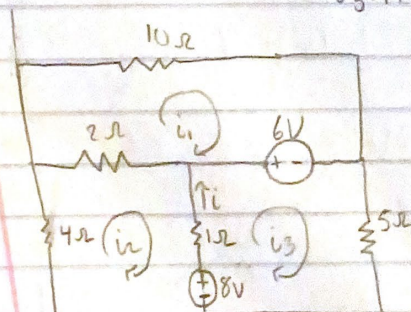
$$\text{Determinant} = -224$$

$$\Delta_3 = 1120$$

$$i_3 = 1120$$

$$\frac{1120}{224} = -5i_3 = i_0$$

$$-5A = i_0$$



Mesh 1:

$$10i_1 - 6 + 2i_1 - 2i_2 = 0$$

$$6 = 12i_1 - 2i_2$$

Mesh 2:

$$4i_2 + 2i_2 - 2i_1 + i_2 = i_3 + 8$$

$$-8 = -i_3 + 7i_2 - 2i_1$$

Mesh 3:

$$i_3 - i_2 + 5i_3 + 6 - 8 = 0$$

$$6i_3 - i_2 = 2$$

$$\begin{bmatrix} 12 & -2 & 0 \\ -2 & 7 & -1 \\ 0 & 1 & 6 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 6 \\ 8 \\ 2 \end{bmatrix}$$

$$\Delta_2 = \begin{bmatrix} 12 & 6 & 0 \\ -2 & 8 & -1 \\ 0 & 2 & 6 \end{bmatrix} = 480$$

$$\Delta_3 = \begin{bmatrix} 12 & -2 & 6 \\ -2 & 7 & 8 \\ 0 & -1 & 2 \end{bmatrix} = 76$$

$$\Delta_2 =$$

$$\Delta_1 = 564 + 2 \cdot (0 + 12 + 21) = 470$$

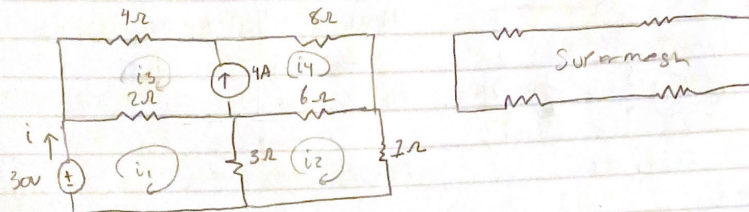
$$\Delta_2 = -576 - (0 - 24 - 72) = 480$$

$$\Delta_2 = \frac{480}{470} = 1.025$$

$$\Delta_3 = \frac{76}{470} = 0.161$$

$$0.161 - (1.025) = 1.187$$

$$1.188A$$



Mesh analysis

loop 1

$$30 = 2i_1 - 2i_3 + 3i_1 - 3i_2 =$$

$$30 = 5i_1 - 3i_2 - 2i_3$$

loop 2

$$0 = 3i_2 - 3i_1 + 6i_2 - 6i_4 + i_2$$

$$0 = 10i_2 - 3i_1 - 6i_4$$

loop 3

$$4 = 4i_3 + 2i_3 - 2i_1$$

$$4 = 6i_3 - 2i_1$$

loop 4

$$4 = 8i_4 + 6i_4 - 6i_2$$

$$4 = 14i_4 - 6i_2$$

$$\begin{bmatrix} 5 & -3 & -2 & 0 \\ -3 & 10 & 0 & -6 \\ -2 & 0 & 6 & 0 \\ 0 & -6 & 0 & 14 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \\ i_4 \end{bmatrix} = \begin{bmatrix} 30 \\ 0 \\ 4 \\ 4 \end{bmatrix}$$

$$\Delta = 1948$$

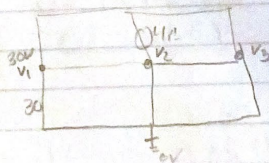
$$\Delta_3 = 7960$$

$$\Delta_4 = 1208$$

$$i = 8.561$$

$$i_4 - i_3 = 4$$

Node Analysis



Node 1

$$30 = \frac{V_1 - V_3}{12} + \frac{V_1 - V_2}{3}$$

$$-V_1 + \frac{1}{5}V_2 + \frac{1}{5}V_3 = -72$$

Cramer's law

$$\Delta = 472$$

$$V_1 = 229$$

$$V_2 = 139$$

$$V_3 = 229$$

Node 2

$$\frac{V_1 - V_2}{3} = \frac{V_2 - V_3}{6} + \frac{V_2 - 4}{3}$$

$$4 = -V_1 + \frac{5}{2}V_2 - \frac{1}{2}V_3$$

$$i = 8.561$$

Node 3

$$\frac{V_1 - V_3}{12} + \frac{V_2 - V_3}{6} = \frac{2(V_1 - V_2)}{2}$$

$$0 = -V_1 + \frac{1}{11}V_2 - \frac{5}{11}V_3$$

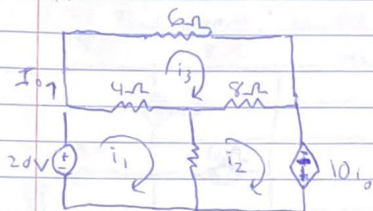
Below Average

Did node instead of mesh on one
problem

Mech Analysis

Joshua
Jones

Problem 3.6



Loop 1:

$$-16 + 4(i_1 - i_3) + 2(i_1 - i_2) = 0$$

$$-16 + 4i_1 - 4i_3 + 2i_1 - 2i_2 = 0$$

$$6i_1 - 2i_2 - 4i_3 = 16$$

$$3i_1 - i_2 - 2i_3 = 8$$

$$4(i_3 - i_1) + 6i_3 + 8(i_3 - i_2) = 0$$

$$4i_3 - 4i_1 + 6i_3 + 8i_3 - 8i_2 = 0$$

$$-4i_1 - 8i_2 + 18i_3 = 0$$

$$-2i_1 - 4i_2 + 9i_3 = 0$$

Loop 2:

$$2i_2 - 2i_1 + 8i_2 - 8i_3 - 10i_1 = 0$$

$$-2i_1 + 10i_2 - 8i_3 - 10i_1 = 0$$

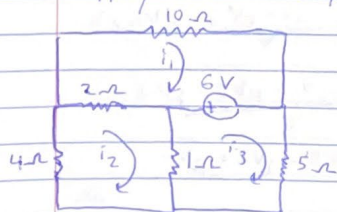
$$-2i_1 + 10i_2 - 18i_3 = 0$$

$$-i_1 + 5i_2 - 9i_3 = 0$$

$$I_0 = -4A$$

$$\begin{bmatrix} 3 & -1 & -2 \\ -1 & 5 & -9 \\ -2 & -4 & 9 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 8 \\ 0 \\ 0 \end{bmatrix}$$

3.41 Apply mesh analysis to find i in Fig 3.87



$$10i_1 - 6 + 2(i_1 - i_2) = 0$$

$$12i_1 - 2i_2 = 6$$

$$2(i_2 - i_1) + 1(i_2 - i_3) + 8 + 4i_2 = 0$$

$$-2i_1 + 7i_2 - i_3 = -8$$

$$6 + 5i_3 + 8 + 1(i_2 - i_3) = 0$$

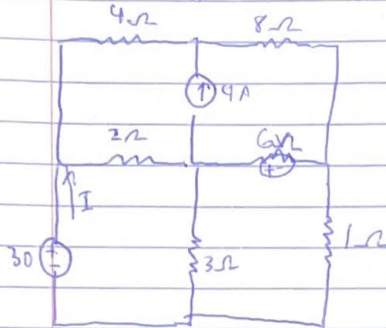
$$i_2 + 6i_3 = -2$$

$$i_1 = 0.33A \quad i_2 = -1.025A \quad i_3 = 0.162A$$

$$i = i_3 - i_2 = 0.162 + 1.025$$

$$i = 1.187A$$

3.45 Find current i in the following circuit using mesh analysis, recheck the problem with node analysis



①

$$\frac{V_1 - V_0}{2} + \frac{V_1}{3} + \frac{V_1 - V_2}{6} + 0 = 0$$

$$3(V_1 - V_0) + 2V_1 + V_1 - V_2 + 2V_0 = 0$$

$$6V_1 - V_2 - 3V_0 = -2V_0$$

②

$$\frac{V_2 - V_1}{6} + \frac{V_2}{1} + \frac{V_2 - V_3}{8} = 0$$

$$\frac{V(V_2 - V_1) + 2V_2 + 3(V_2 - V_3)}{24} = 0$$

$$-4V_1 + 5V_2 - 3V_3 = 0$$

③

$$\frac{V_3 - V_4}{4} + \frac{V_3 - V_2}{8} - 4 = 0$$

$$\frac{2V_3 - 2V_4 + V_3 - V_2 - 32}{8} = 0$$

$$-V_2 + 3V_3 - 2V_4 = 32$$

④

$$V_1 = 11.77 \quad V_2 = 4.6363, \quad V_3 = 32.212$$

$$i = \frac{V_0 - V_1}{2} + \frac{V_0 - V_3}{4} = \frac{30 - 11.77}{2} + \frac{30 - 32.212}{4}$$

$$i = 8.562 \text{ A}$$

**ELECTRICAL AND COMPUTER ENGINEERING
DEPARTMENT
OUTCOMES SPECIFIC ASSIGNMENT COVER SHEET
NETWORK THEORY 1**

Spring 2022

Instructor: Dr. John Fuller

Title of Assignment

**Homework
Nodal Analysis**

Outcome Measured Using this Assignment

Outcome 1.1

An ability to identify, formulate, and solve **complex engineering problems** by applying principles of engineering, science, and mathematic.

Check the complex engineering problem characteristics related to this assignment

Assignment problem	
	involves wide-ranging or conflicting technical issues,
	has no obvious solution
	Addresses problems not encompassed by current standards and codes
	involves diverse groups of stakeholders
X	includes many component parts or sub-problems
	involves multiple disciplines
X	has significant consequences in a range of contexts
Assignment problem involves the application of the principles of	
X	engineering
	science
X	mathematics

Brief justification of why this assignment is suitable for this outcome

This homework gives the student the knowledge of relevant laws and equations, how to formulate the solution methodology, and solve resulting mathematical equations.

Student Support Material

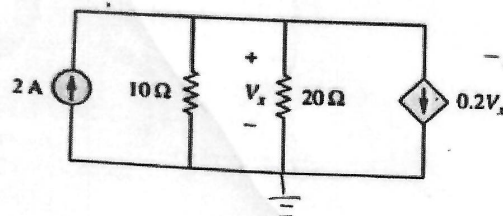
ABOVE AVERAGE



8/8

Homework Nodal Analysis

3.7 Apply nodal analysis to solve for V_x in the circuit of Fig. 3.56.



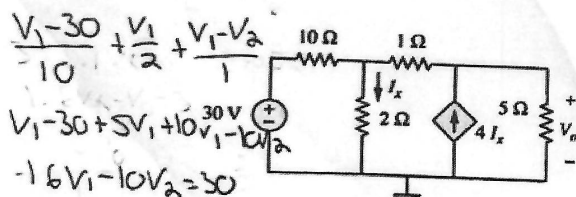
$$-2 + \frac{V_x}{10} + \frac{V_x}{20} + 0.2V_x = 0$$

$$\frac{V_x}{10} + \frac{V_x}{20} + \frac{2}{10}V_x = 2$$

$$\frac{2V_x}{20} + \frac{V_x}{20} + \frac{4V_x}{20} = 2$$

$$7V_x = 40 \quad V_x = 5.71$$

3.12 Using nodal analysis, determine V_o in the circuit in Fig. 3.61.



$$\frac{V_1 - 30}{10} + \frac{V_1}{2} + \frac{V_1 - V_2}{1} = 0$$

$$V_1 - 30 + 5V_1 + 10(V_1 - V_2) = 0$$

$$-16V_1 - 10V_2 = 30$$

$$V_o = V_2$$

$$V_1 = -3.33V$$

$$V_2 = -8.83V$$

$$\frac{V_2 - V_1}{1} + \frac{V_2}{5} - 4I_x = 0$$

$$I_x = \frac{V_1}{2}$$

$$\frac{V_2 - V_1}{1} + \frac{V_2}{5} - 4 \times \frac{V_1}{2} = 0$$

$$V_2 - V_1 + \frac{V_2}{5} - 2V_1 = 0$$

$$5V_2 - 5V_1 + V_2 - 10V_1 = 0$$

$$-15V_1 + 6V_2 = 0$$

3.18 Determine the node voltages in the circuit of Fig. 3.67 using nodal analysis.

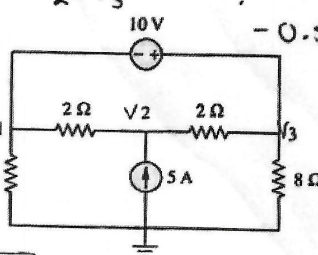
$$-V_1 - 10 + V_3 = 0$$

$$V_3 = V_1 + 10$$

$$2V_1 + V_1 + 10 = 40$$

$$V_3 = 10 + 10 = 20V$$

$$V_2 = 20$$



$$\frac{V_2 - V_1}{2} + \frac{V_2 - V_3}{2} - 5 = 0$$

$$-0.5V_1 + V_2 - 0.5V_3 = 5$$

$$\frac{V_2 - V_1}{2} + \frac{V_2 - V_3}{2} - \frac{V_1}{4} - \frac{V_3}{8} = 0$$

$$\frac{V_1}{4} - 5 + \frac{V_2}{8} = 0$$

$$2V_1 + V_3 = 40$$

$$\boxed{\begin{matrix} V_1 = 10V \\ V_2 = 20V \\ V_3 = 20V \end{matrix}}$$

For following assignments do a more appropriate submission

3.14 Using nodal analysis, find v_o in the circuit of Fig. 3.63.

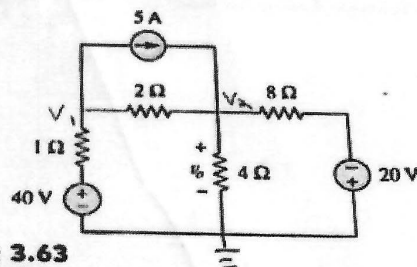


Figure 3.63
For Prob. 3.14.

$$\frac{V_1 - 40}{1} + \frac{V_1 - V_2}{2} + 5 = 0$$

$$2V_1 - 80 + V_1 - V_2 + 10 = 0$$

$$3V_1 - V_2 = 70$$

$$\frac{V_2 - V_1}{2} - 5 + \frac{V_2}{4} + \frac{V_2 + 20}{8} = 0$$

$$\frac{4V_2 - 4V_1 - 40 + 2V_2 + V_2 + 20}{8} = 0$$

$$-4V_1 + 7V_2 = 20$$

$$21V_1 - 7V_2 = 490$$

$$-4V_1 + 7V_2 = 20$$

$$17V_1 = 510$$

$$V_1 = 30V$$

$$3 \cdot 30 - V_2 = 70$$

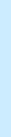
$$90 - V_2 = 70$$

$$V_2 = 20V$$

$$V_2 = V_o$$

$$\boxed{V_o = 20V}$$

AVERAGE



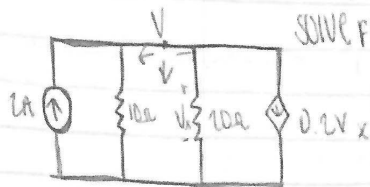
DUE MARCH 1, 2022

7/8

Recheck problem 3.14

HOMEWORK NODE ANALYSIS

3.1



SOVE FOR V_x ?

$$2A = \frac{V}{10} + \frac{V}{10} + 0.2V_x$$

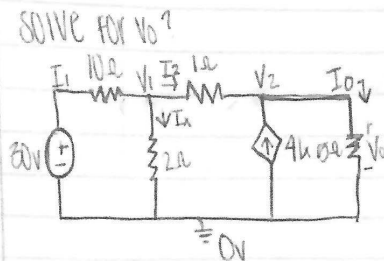
$$2 = \frac{V_x}{10} + \frac{V_x}{10} + 0.2V_x$$

$$2 = 0.1V_x + 0.05V_x + 0.2V_x$$

$$2 = 0.35V_x$$

$$\boxed{5.714V = V_x}$$

3.12



SOVE FOR V_0 ?

$$* I = I_1 + I_2$$

$$\frac{30 - V_1}{10} = \frac{V_1}{2} + \frac{V_1 - V_0}{1}$$

$$\frac{30 - V_1}{10} = \frac{3V_1 - 2V_0}{2}$$

$$30 - V_1 = 15V_1 - 10V_0$$

$$30 = 16V_1 - 10V_0 \quad (1)$$

$$* I_2 + 4I_5 = I_5$$

$$\frac{V_1 - V_0}{2} + 4\left(\frac{V_1}{2}\right) = \frac{V_0}{10}$$

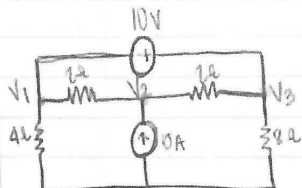
$$15V_1 - 5V_0 = V_0$$

$$15V_1 = 6V_0 \quad (2)$$

$$V_1 = -3.33V$$

$$\boxed{V_0 = -8.33V}$$

3.18 Determine Node Voltage



$$\frac{V_2 - V_1}{2} + \frac{V_2 - V_3}{2} - \frac{V_1}{4} - \frac{V_3}{4} = 0$$

$$V_1/4 - 5 + V_3/8 = 0$$

$$2V_1 + V_3 = 40 \quad (2)$$

$$\frac{V_2 - V_1}{2} + \frac{V_2 - V_3}{2} - 5 = 0$$

$$\textcircled{1} -0.5V_1 + V_2 - 0.5V_3 = 5$$

$$-V_1 - 10 + V_3 = 0 \rightarrow V_3 = V_1 + 10$$

$$2V_1 + V_1 + 10 = 40$$

$$3V_1 = 30$$

$$V_1 = 10V$$

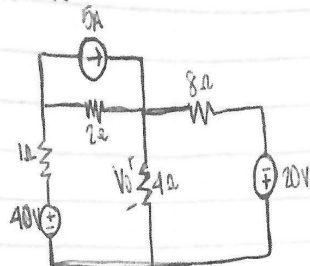
$$V_3 = 10 + 10 = 20V$$

$$V_2 = 20V$$

$$V_1 = 10V$$

$$V_3 = 20V$$

Find V_o ?



$$\frac{V_1 - 40}{1} + \frac{V_1 - V_2}{2} + 5 = 0$$

$$2V_1 - 80 + V_1 - V_2 + 10 = 0$$

$$3V_1 - V_2 = 70 \quad (1)$$

$$\frac{V_2 - V_1 - 5}{2} + \frac{V_2}{4} + \frac{V_2 + 20}{8} = 0$$

$$\frac{4V_2 - 4V_1 - 40 + 2V_2 + V_2 + 20}{8} = 0$$

$$-4V_1 + 7V_2 = 20 \quad (2)$$

$$2V_1 - 7V_2 = 490$$

$$-4V_1 + 7V_2 = 20$$

$$17V_1 = 510$$

$$V_1 = 30V$$

$$30(3) - V_2 = 70$$

$$90 - V_2 = 70$$

$$V_2 = 20V$$

$$V_o = 20V$$

BELOW AVERAGE



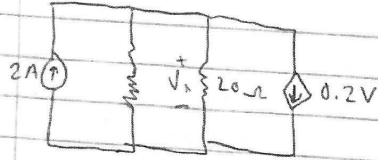
6/8

Recheck problems 3.12 and 3.14

Joshua
June 3

Nodal Analysis

3.7 Apply nodal analysis to solve for V_x in the circuit of Fig 3.56.



$$\frac{2}{10} + \frac{V_x}{10} + \frac{V_x}{20} + 0.2V_x = 0$$

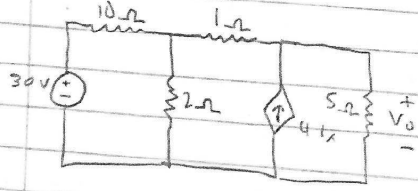
$$\frac{V_x}{10} + \frac{V_x}{20} + \frac{2}{10}V_x = 2$$

$$\frac{2V_x + V_x + 4V_x}{20} = 2$$

$$7V_x = 40$$

$$V_x = 5.71 \text{ volts}$$

3.12 Using nodal analysis, determine V_o in the circuit in Fig 3.61



$$\frac{30 - V_x}{10} = \frac{V_x - V_o}{1} + \frac{V_x}{2}$$

$$3 = 0.1V_x + V_x - V_o + 0.5V_x$$

$$1.6V_x - V_o = 3$$

$$\frac{V_x - V_o}{1} + 4I_x = \frac{V_o}{5}$$

$$I_x = \frac{V_x}{2}$$

$$I_x = 0.5V_x$$

$$V_x - V_o + 4(0.5V_x) = 0.2V_o$$

$$3V_x - 1.2V_o = 0$$

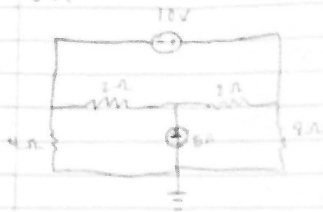
$$V_x = -\frac{10}{3}V$$

$$V_o = -\frac{25}{3}$$

$$\frac{V_x}{2}$$

$$I_x = -\frac{10}{6}A$$

316



$$\frac{V_1}{4} + \frac{V_2}{3} - \frac{V_3}{3} + \frac{V_4}{9} - \frac{V_5}{9} = 0$$

$$2V_1 + 4V_2 - 4V_3 + V_4 + 4V_5 - 4V_6 = 0$$

$$6V_1 - 4V_2 + 5V_3 = 0$$

$$6(V_3 - 10) - 4V_2 + 5V_3 = 0$$

$$6V_3 - 60 - 4V_2 + 5V_3 = 0$$

$$11V_3 - 4V_2 = 60$$

$$-4V_2 + 11V_3 = 60$$

$$5V_3 = 60$$

$$V_3 = 12$$

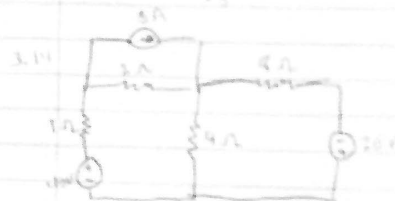
$$V_4 = 20$$

$$V_1 = 20 - 10$$

$$V_1 = 10$$

$$V_2 = 20 - 0$$

$$V_2 = 20$$



$$\frac{V_1}{1} + \frac{V_2 - V_3}{3} + \frac{V_4}{4} = 0$$

$$2V_1 - 4V_2 + V_3 + 10 = 0$$

$$3V_1 - 4V_2 = 70$$

$$\frac{V_2 - V_1}{3} + \frac{5 + V_2}{4} + \frac{V_3 + 10}{4} = 0$$

$$4V_2 - 4V_1 - 40 + 2V_2 + 10 + 10 = 0$$

$$-4V_1 + 7V_2 = 20$$

$$21V_1 - 7V_2 = 490$$

$$-4V_1 + 7V_2 = 20$$

$$17V_1 = 510$$

$$V_1 = 30V$$

$$3(30) - V_2 = 70$$

$$90 - V_2 = 70$$

$$V_2 = 20V$$

$$V_2 V_0 = 21V$$

ASSIGNMENTS FOR OUTCOME 1.2

Understanding the basic electrical components, their configuration in circuit theory and apply the basic circuit laws and theorems to solve for unknown electrical quantities (Sources, R, L, C, RC, RL, RLC)

**ELECTRICAL AND COMPUTER ENGINEERING
DEPARTMENT
OUTCOMES SPECIFIC ASSIGNMENT COVER SHEET
NETWORK THEORY 1
Spring 2022
Instructor: Dr. John Fuller**

Title of Assignment

Midterm Exam

Outcome Measured Using this Assignment

Outcome 1.2

Understanding basic electrical components, their configuration in circuit theory and apply the basic circuit laws and theorems to solve for unknown electrical quantities (Sources, R, L, C, RC, RL, RLC)

Check the complex engineering problem characteristics related to this assignment

Assignment problem	
	involves wide-ranging or conflicting technical issues,
	has no obvious solution
	Addresses problems not encompassed by current standards and codes
	involves diverse groups of stakeholders
X	includes many component parts or sub-problems
	involves multiple disciplines
	has significant consequences in a range of contexts
Assignment problem involves the application of the principles of	
X	engineering
X	science
X	mathematics

Brief justification of why this assignment is suitable for this outcome

The questions on the midterm exam test the students' ability to identify relevant circuit laws, develop applicable equations, formulate a solution methodology, and solve the resulting engineering equations for an electrical circuit.

Student Support Material

Midterm Exam Solution

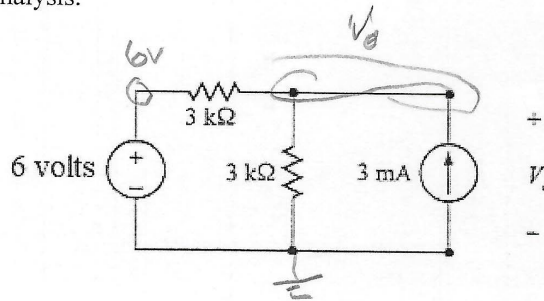
ELEG 2301
NETWORK THEORY I
MIDTERM EXAM

NAME KEY

March 10, 2022

100 Points Closed notes and books, no cell phones are to be visible, show all steps in deriving solution, no sharing calculators, no in and out during exam time.

- (20) I. Solve for the value of the voltage V_o as shown in the following circuit using node voltage analysis.



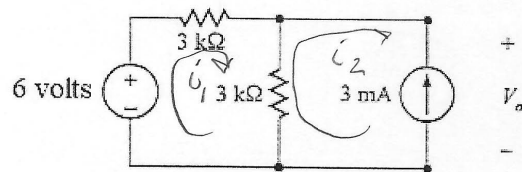
$$\frac{V_o - 6}{3000} + \frac{V_o}{3000} - 3 \times 10^{-3} = 0$$

$$V_o - 6 + V_o - 9 = 0$$

$$2V_o = 15$$

$$V_o = \frac{15}{2} = 7.5 \text{ volts}$$

- 20 II. Solve for the value of the voltage V_o as shown in the following circuit using mesh current method. Same circuit as given in problem 1.



$$-6 + 6000 i_1 - 3000 i_2 = 0$$

$$i_2 = -3 \times 10^{-3}$$

$$-6 + 6000 i_1 - 3000 (-3 \times 10^{-3}) = 0$$

$$-6 + 6000 i_1 + 9 = 0$$

$$6000 i_1 = -3$$

$$i_1 = \frac{-3}{6000} = -0.0005$$

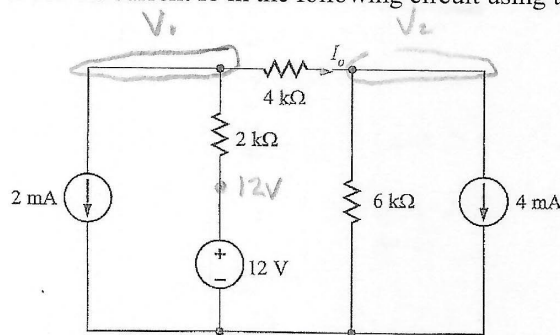
$$V_o = 3000 (i_1 - i_2)$$

$$V_o = 3000 [0.0005 - (-0.003)]$$

$$V_o = 3000 (0.0025)$$

$$V_o = 7.5$$

- (20) III. Solve for the current I_o in the following circuit using the Node voltage Method



$$+2 \times 10^{-3} + \frac{V_1 - 12}{2000} + \frac{V_1 - V_2}{4000} = 0 \quad \text{multiply by 4000}$$

$$8 + 2V_1 - 24 + V_1 - V_2 = 0$$

$$\textcircled{1} \quad 3V_1 - V_2 = 16$$

$$\frac{V_2 - V_1}{4000} + \frac{V_2}{6000} + 4 \times 10^{-3} = 0 \quad \text{mul by 12000}$$

$$3V_2 - 3V_1 + 2V_2 + 48 = 0$$

$$\textcircled{2} \quad -3V_1 + 5V_2 = -48$$

$$\begin{bmatrix} 3 & -1 \\ -3 & 5 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} 16 \\ -48 \end{bmatrix}$$

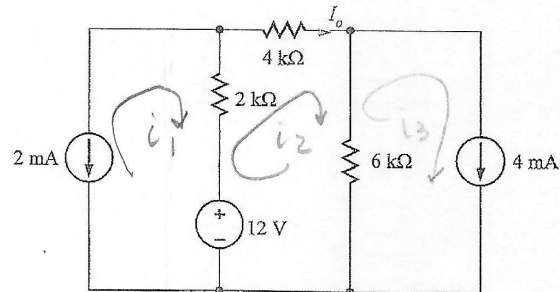
$$\Delta = \begin{vmatrix} 3 & -1 \\ -3 & 5 \end{vmatrix} = 15 - 3 = 12$$

$$V_1 = \frac{\Delta V_1}{\Delta} = \frac{\begin{vmatrix} 16 & -1 \\ -48 & 5 \end{vmatrix}}{12} = \frac{80 - 48}{12} = \frac{32}{12} = 2.667 \text{ volts}$$

$$V_2 = \frac{\begin{vmatrix} 3 & 16 \\ -3 & -48 \end{vmatrix}}{12} = \frac{-144 + 48}{12} = \frac{-96}{12} = -8$$

$$I_o = \frac{V_1 - V_2}{4k} = \frac{2.667 + 8}{4000} = \frac{10.667}{4000} = 2.667 \text{ mA}$$

- 20 IV. Solve for the current I_o in the following circuit using the Mesh Current Method. This is the same circuit as presented in problem III, but using a different analysis method.



$$I_1 = -2 \times 10^{-3}$$

$$I_3 = 4 \times 10^{-3}$$

$$-12 + 12kI_2 - 2kI_1 - 6kI_3 = 0$$

$$-2kI_1 + 12kI_2 - 6kI_3 = 12$$

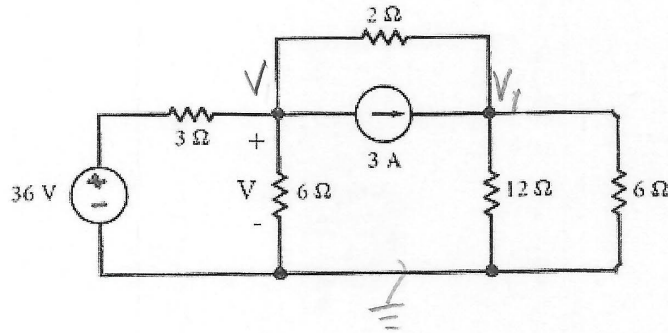
$$-2k(-2 \times 10^{-3}) + 12kI_2 - 6k(4 \times 10^{-3}) = 12$$

$$4 + 12kI_2 - 24 = 12$$

$$12kI_2 = 32$$

$$I_2 = \frac{32}{12,000} = 2.667 \text{ mA}$$

- 10 V. Solve for the voltage V across the $6\ \Omega$ Resistor as shown.



$$\frac{V-36}{3} + \frac{V}{6} + \frac{V-V_1}{2} + 3 = 0 \quad \text{mul by 6}$$

$$2V - 72 + V + 3V - 3V_1 + 18 = 0$$

$$\textcircled{1} \quad -6V_1 - 3V_1 = 54$$

$$\frac{V_1 - V}{2} + \frac{V_1}{12} + \frac{V_1}{6} - 3 = 0$$

$$6V_1 - 6V + V_1 + 2V_1 - 36 = 0$$

$$\textcircled{2} \quad -6V + 9V_1 = 36$$

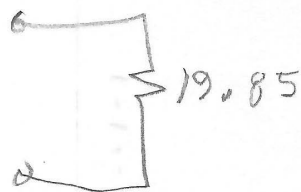
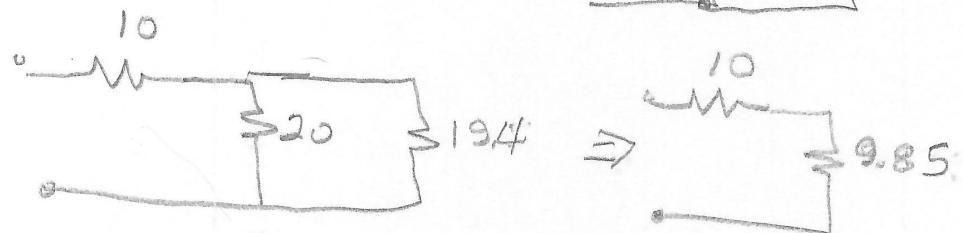
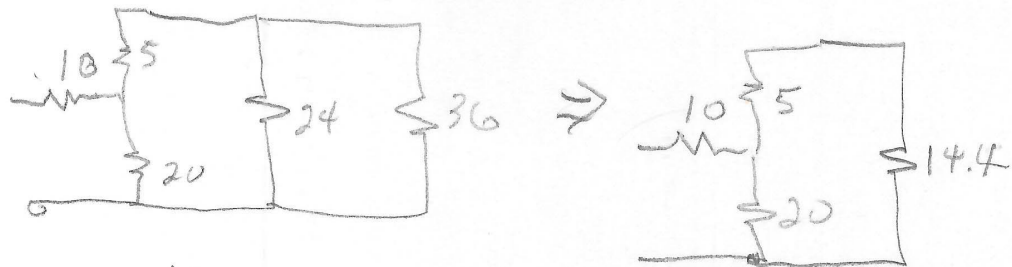
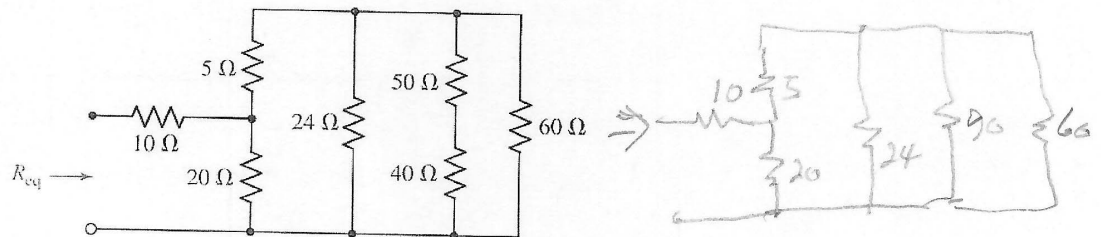
$$\begin{bmatrix} 6 & -3 \\ -6 & 9 \end{bmatrix} \begin{bmatrix} V \\ V_1 \end{bmatrix} = \begin{bmatrix} 54 \\ 36 \end{bmatrix}$$

$$\Delta = \begin{vmatrix} 6 & -3 \\ -6 & 9 \end{vmatrix} = 54 - 18 = 36$$

$$V = \frac{\Delta_{V_1}}{\Delta} = \frac{\begin{vmatrix} 54 & -3 \\ 36 & 9 \end{vmatrix}}{36} = \frac{486 + 108}{36} = \frac{594}{36}$$

$$V = 10,5\text{ V}$$

- 10 VI. Determine the value of the equivalent resistance as seen at the input terminals of the following circuits.



Student Support Material Midterm Exam

Above Average

ELEG 2301
NETWORK THEORY I
MIDTERM EXAM

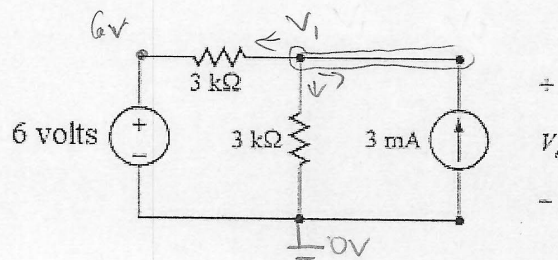
NAME Ayodele Grayson

March 10, 2022

81
100

100 Points Closed notes and books, no cell phones are to be visible, show all steps in deriving solution, no sharing calculators, no in and out during exam time.

- (20) I. Solve for the value of the voltage V_o as shown in the following circuit using node voltage analysis.



$$V_o = \frac{V_1 - 6}{3000}$$

$$\left[\frac{V_1 - 6}{3000} + \frac{V_1}{3000} - 3 \times 10^{-3} \right] = 0 \quad \checkmark$$

$$V_o = \frac{(254.5) - 6}{3000}$$

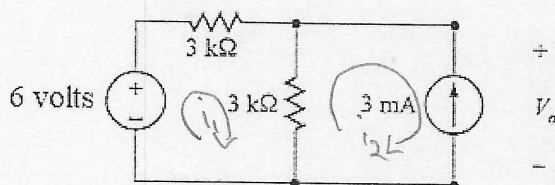
$$2V_1 - 1000 + 2V_1 - 18 = 0$$

$$4V_1 = 1018$$

$$V_1 = 254.5$$

$$V_o = 0.08 \text{ V}$$

- 20 II. Solve for the value of the voltage V_o as shown in the following circuit using mesh current method. Same circuit as given in problem 1.



$$V_o = i_2 - i_1$$

$$-6 + 3000i_1 + 3000i_1 - 3000i_2 = 0 \quad i_2 = 3 \times 10^{-3} \quad -3 \times 10^{-3}$$

$$\textcircled{1} 6000i_1 - 3000i_2 = 6$$

$$6000i_1 - 3000(3 \times 10^{-3}) = 6$$

$$6000i_1 - 9 = 6$$

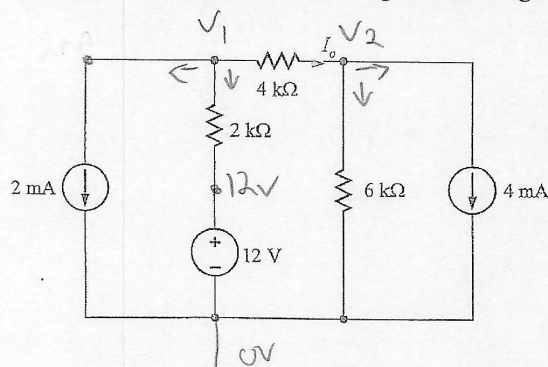
$$6000i_1 = 15$$

$$i_1 = 2.5 \times 10^{-3}$$

$$V_o = (3 \times 10^{-3}) - (2.5 \times 10^{-3})$$

$$V_o = 5 \times 10^{-4} \text{ mA}$$

(20) III. Solve for the current I_0 in the following circuit using the Node voltage Method



$$I_0 = \frac{V_1 - V_2}{4}$$

$$\left[2 + \frac{V_1 - 12}{2000} + \frac{V_1 - V_2}{4000} = 0 \right] \quad 12000 \left[\frac{V_2 - V_1}{4000} + \frac{V_2}{6000} + 4 = 0 \right]$$

$$000 + 6V_1 + 1000 + 3V_1 - 3V_2 = 0 \quad 3V_2 - 3V_1 + 2V_2 + 3000 = 0$$

$$9V_1 - 3V_2 + 7000 = 0$$

$$-3V_1 + 5V_2 = -3000$$

$$9V_1 - 3V_2 = -7000$$

$$\begin{bmatrix} 9 & -3 \\ -3 & 5 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} -7000 \\ -3000 \end{bmatrix} \quad \Delta = \begin{bmatrix} 9 & -3 \\ -3 & 5 \end{bmatrix} = 45 - 9 = 36$$

$$V_1 = \frac{\Delta_1}{\Delta} = \frac{\begin{bmatrix} -7000 & -3 \\ -3000 & 5 \end{bmatrix}}{36} \Rightarrow \frac{-35000 - 9000}{36} = -1222.22$$

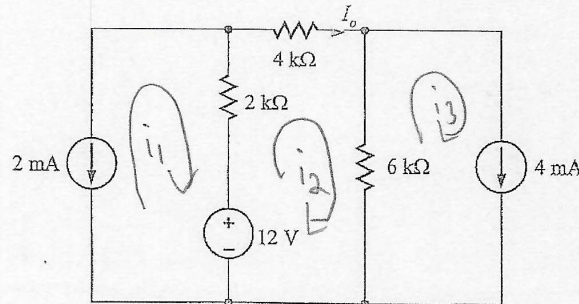
$$V_2 = \frac{\Delta_2}{\Delta} = \frac{\begin{bmatrix} 9 & -7000 \\ -3 & -3000 \end{bmatrix}}{36} \Rightarrow \frac{-27000 - 21000}{36} = -1333.33$$

$$I_0 = \frac{V_1 - V_2}{4}$$

$$I_0 = \frac{(-1222.22) - (-1333.33)}{4000}$$

$$I_0 = 0.03 \text{ A}$$

- (20) IV. Solve for the current I_o in the following circuit using the Mesh Current Method. This is the same circuit as presented in problem III, but using a different analysis method.



$$I_o = i_3 - i_2$$

$$i_1 = -2 \times 10^{-3}$$

$$i_3 = 4 \times 10^{-3}$$

$$2 \times 10^{-3} + 2000i_1 - 2000i_2 + 12 = 0 \quad \times$$

$$\textcircled{1} \quad 2000i_1 - 2000i_2 = -10$$

$$6000i_3 - 6000i_2 + 4 \times 10^{-3} = 0$$

$$\textcircled{3} \quad -6000i_2 + 6000i_3 = 4 \times 10^{-3} \quad \times$$

$$-12 + 2000i_2 - 2000i_1 + 4000i_2 + 6000i_2 - 6000i_3 = 0$$

$$\textcircled{2} \quad -2000i_1 + 12000i_2 - 6000i_3 = 12$$

$$\begin{bmatrix} 2000 & -2000 & 0 \\ -2000 & 12000 & -6000 \\ 0 & -6000 & 6000 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} -10 \\ 12 \\ -4 \end{bmatrix}$$

$$\Delta = \begin{vmatrix} 2000 & -2000 & 0 \\ -2000 & 12000 & -6000 \\ 0 & -6000 & 6000 \end{vmatrix} \begin{vmatrix} 2000 & -2000 \\ -2000 & 12000 \\ 0 & -6000 \end{vmatrix}$$

$$\Delta = (1.44 \times 10^{11} + 0 + 0) - (0 + 7.2 \times 10^{10} + 2.4 \times 10^{10})$$

$$\Delta = 4.8 \times 10^{10}$$

$$i_1 = \frac{\Delta_1}{\Delta} = \frac{\begin{vmatrix} 2000 & -10 & 0 \\ -2000 & 12 & -6000 \\ 0 & -4 & 6000 \end{vmatrix}}{4.8 \times 10^{10}} \begin{vmatrix} 2000 & -2000 \\ -2000 & 12000 \\ 0 & -6000 \end{vmatrix}$$

$$i_3 = \frac{\Delta_3}{\Delta} = \frac{\begin{vmatrix} 2000 & -2000 & -10 \\ -2000 & 12000 & 12 \\ 0 & -6000 & -4 \end{vmatrix}}{4.8 \times 10^{10}} \begin{vmatrix} 2000 & -2000 \\ -2000 & 12000 \\ 0 & -6000 \end{vmatrix}$$

$$i_1 = \frac{(1440000000 + 0 + 0) - (0 + 480000000 + 2.4 \times 10^{10})}{4.8 \times 10^{10}} \quad i_3 = \frac{(-960000000 + 0 - 120000000) - (0 - 144000000 - 160000000)}{4.8 \times 10^{10}}$$

$$i_1 = -0.50$$

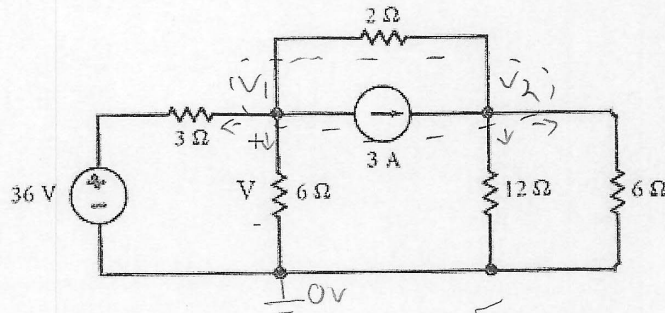
$$I_o = i_3 - i_2$$

$$I_o = (-1.16 \times 10^{-3}) - (-0.5)$$

$$I_o = 0.49 \text{ A}$$

10

- 10) V. Solve for the voltage V across the 6 Ω Resistor as shown.



$$V = IR$$

$$I = \frac{V_1 - V_2}{3}$$

$$\left[\frac{V_1 - 36}{3} + \frac{V_1}{6} + \frac{V_1 - V_2}{2} \right] = 0$$

$$4V_1 - 432 + 2V_1 + 6V_1 - 6V_2 = 0$$

$$\textcircled{1} 10V_1 - 6V_2 = 432$$

$$S = \begin{bmatrix} 10 & -6 \\ -4 & 7 \end{bmatrix} = \begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} 432 \\ 0 \end{bmatrix}$$

$$\Delta = \begin{vmatrix} 10 & -6 \\ -4 & 7 \end{vmatrix} = 70 - 24 = 46$$

$$I = \frac{65.74 - 37.56}{3}$$

$$I = 9.39 \text{ A}$$

$$V = IR$$

$$V = (9.39)(6)$$

$$\boxed{V = 56.34 \text{ V}}$$

$$12 \left[\frac{V_2 - V_1}{3} + \frac{V_2}{12} + \frac{V_2}{6} \right] = 0$$

$$4V_2 - 4V_1 + V_2 + 2V_2 = 0$$

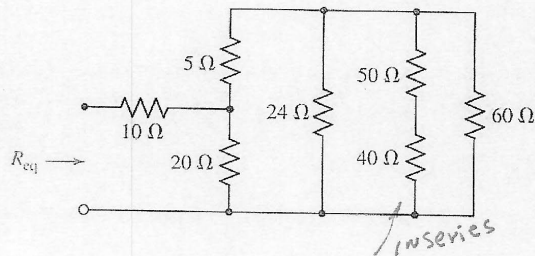
$$\textcircled{2} -4V_1 + 7V_2 = 0$$

$$V_1 = \frac{\Delta_1}{\Delta} = \frac{\begin{vmatrix} 432 & -6 \\ 0 & 7 \end{vmatrix}}{46} = \frac{3024 - 0}{46} = 65.74$$

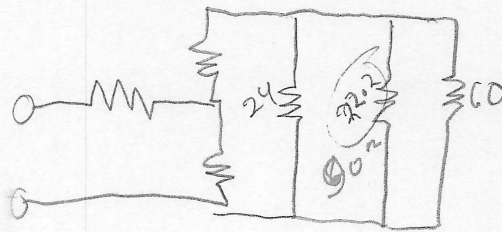
$$V_2 = \frac{\Delta_2}{\Delta} = \frac{\begin{vmatrix} 10 & 432 \\ -4 & 0 \end{vmatrix}}{46} = \frac{-0 - (-1728)}{46} = 37.56$$

- 4

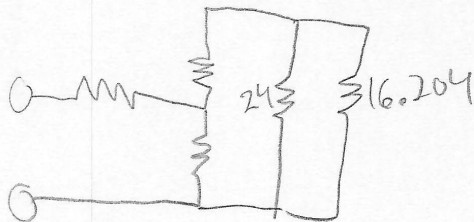
- 10 VI. Determine the value of the equivalent resistance as seen at the input terminals of the following circuits.



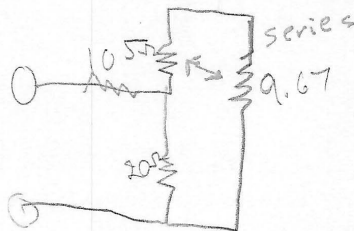
$$\frac{50 \times 40}{50 + 40} = 22.22$$



$$\frac{60 \times 22.2}{60 + 22.2} = 16.204$$



$$\frac{24 \times 16.204}{24 + 16.204} = 9.67$$



→ 2

Average

ELEG 2301
NETWORK THEORY I
MIDTERM EXAM

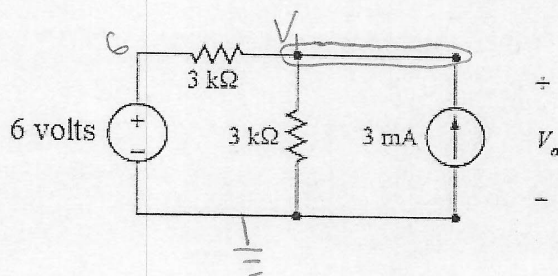
NAME Jaden Simms

March 10, 2022

65
100

100 Points Closed notes and books, no cell phones are to be visible, show all steps in deriving solution, no sharing calculators, no in and out during exam time.

- (20) I. Solve for the value of the voltage V_o as shown in the following circuit using node voltage analysis.



$$V_o = V_1$$

$$V =$$

$$i =$$

$$3 \left(\frac{V_1 - 6}{3k} + \frac{V_1 - 0}{3k} - 0.003 \right) = 0$$

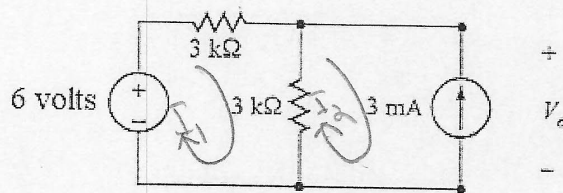
$$1V_1 - 6 + 1V_1 - 9 = 0$$

$$\frac{2V_1}{2} = \frac{15}{2} \quad V_1 = \frac{15}{2}$$

$$V_1 = 7.5 \text{ (V)} ?$$

20 II.

Solve for the value of the voltage V_o as shown in the following circuit using mesh current method. Same circuit as given in problem 1.



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

$$V = IR$$

$$-6 + 3I_1 + 3I_1 - 3I_2 = 0$$

$$\textcircled{1} 6I_1 - 3I_2 = 6$$

$$I_2 = -3I_1 + 3I_2 - 3 \times \text{ooo}$$

$$\textcircled{2} -3I_1 + 3I_2 = .003$$

$$-3(6 - 3I_2 - 6) + 3I_2 = .003$$

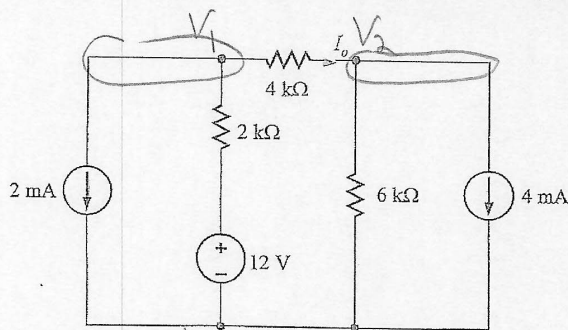
$$+18 - 18 + 9I_2 + 3I_2 = -.003$$

$$\frac{12I_2 = -.003}{12} = -2.5$$

$$2.5 \cdot 3 = 7.5 \text{ k}$$

$$V = IR \quad \boxed{V_o = 7.5 \text{ k}} \times$$

20 III. Solve for the current I_0 in the following circuit using the Node voltage Method



$$I_0 = ?$$

$$2 \times 10^{-3} \left(2 + \frac{V_1 - 12}{2k} + \frac{V_1 - V_2}{4k} \right)$$

$$I_0 = 0.75 \text{ mA}$$

$$12000 \left(4 \times 10^{-3} + \frac{V_2}{6k} + \frac{V_2 - V_1}{4k} \right)$$

$$\frac{-8.25 - 0.125}{4} = -0.75$$

~~$$\begin{bmatrix} 2 & -3 \\ -1 & 5 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} -4 \\ -1 \end{bmatrix}$$~~

$$\begin{bmatrix} i_1 \\ i_2 \end{bmatrix}$$

$$1V_1 - 12 + 1V_1 - V_2 = -4 \quad ?$$

$$\textcircled{1} 2V_1 - V_2 = 8 \quad 2V_1 - (-8.25) = 8$$

$$2V_1 + 8.25 = 8$$

$$\frac{2V_1 = -8.25}{2}$$

$$0.125$$

$$48 + 2V_2 + 3V_2 - 3V_1$$

$$\textcircled{2} -3V_1 + 5V_2 = -48 \quad \checkmark$$

$$-3(2 - V_2 - 8) + 5V_2 = -48$$

$$-6 + 3V_2 + 24 + 5V_2 = -48$$

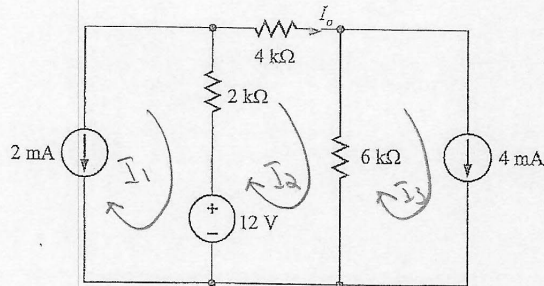
$$\frac{8V_2 = -66}{8}$$

$$I_0 = \frac{V_1 - V_2}{4k}$$

$$V_2 = -8.25$$

-2

- 20 IV. Solve for the current I_o in the following circuit using the Mesh Current Method. This is the same circuit as presented in problem III, but using a different analysis method.



$$I_o = I_2$$

$$I_o = 0.75 \text{ mA}$$

V_2

$$\textcircled{1} \quad -2 + 2I_1 - 2I_2 + 12 \quad I_1 = -2 \text{ mA}$$

$$\times \quad 2I_1 - 2I_2 = -10 \quad I_3 = 4 \text{ mA}$$

$$\textcircled{2} \quad -12 + 2I_2 - 2I_1 + 4I_2 - 6I_3 + 6I_2 = 0$$

$$-2I_1 + 12I_2 - 6I_3 = 12$$

$$\textcircled{3} \quad 6I_3 - 6I_2 - 1 \times$$

$$-6I_2 + 6I_3 = -4$$

-10

$$\begin{array}{ccc|cc} 2 & -2 & 0 & 2 & -2 \\ -2 & 12 & -6 & -2 & 12 \\ 0 & -6 & 6 & 0 & -4 \end{array}$$

$$\begin{array}{ccc|cc} 2 & -10 & 0 & 2 & -2 \\ -2 & 12 & -6 & -2 & 12 \\ 0 & -4 & 6 & 0 & -4 \end{array}$$

$$144 + 0 + 0 - (0 + 72 + 24)$$

$$\Delta = 48$$

$$\frac{36}{48}$$

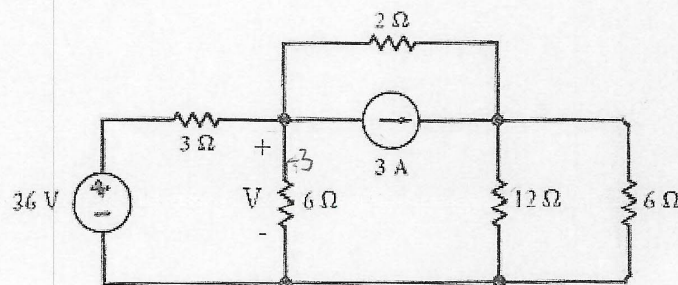
$$0.75$$

$$144 + 60 + 0 - (0 + 48 + 24)$$

$$144 + 60 + 0 - (0 + 48 + 24)$$

$$36$$

- 10 V. Solve for the voltage V across the $6\ \Omega$ Resistor as shown.



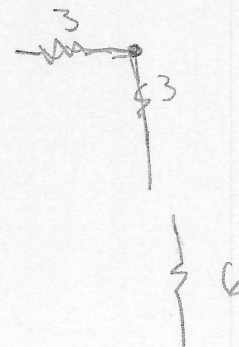
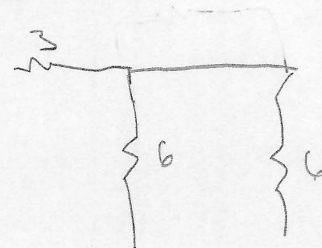
$$V = iR$$

$$i = -3$$

$$\frac{12 \cdot 6}{12 + 6} = 4$$

$$4 + 2 = 6$$

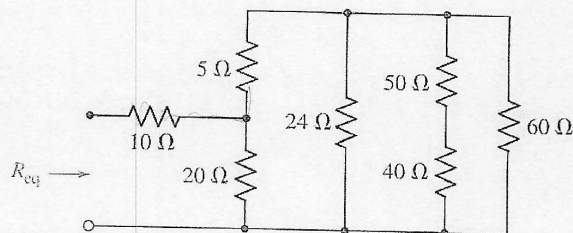
$$\frac{6 \cdot 6}{6 + 6} = 3$$



$$(6 \cdot -3)$$

$$V = -18$$

- 10 VI. Determine the value of the equivalent resistance as seen at the input terminals of the following circuits.



$$\left\{ \begin{array}{l} 90 \\ 60 \end{array} \right\}$$

$$\frac{90 \cdot 60}{90 + 60} =$$

$$\left\{ \begin{array}{l} 24 \\ 36 \end{array} \right\}$$

$$10 + 5 = 15$$

$$15 + 20 = 35$$

$$\frac{24 \cdot 36}{24 + 36}$$

$$\left\{ \begin{array}{l} 5 \\ 10 \\ 20 \end{array} \right\}$$

$$\left\{ \begin{array}{l} 14.4 \end{array} \right\}$$

$$\frac{35 \cdot 14.4}{35 + 14.4} = 10.2$$

$$\left\{ \begin{array}{l} 35 \\ 14.4 \end{array} \right\}$$

$$R_{eq} = 10.2$$

Below Average

ELEG 2301
NETWORK THEORY I
MIDTERM EXAM

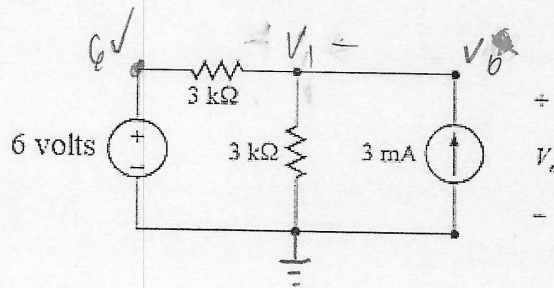
NAME Kyomon Odumoya

March 10, 2022

23
100

100 Points Closed notes and books, no cell phones are to be visible, show all steps in deriving solution, no sharing calculators, no in and out during exam time.

- (20) I. Solve for the value of the voltage V_o as shown in the following circuit using node voltage analysis.



E
 I R

$V_r = V_o$

$$3600 \left(\frac{6 - V_1}{3000} \right) = -\frac{V_1}{3000} + 0.003 \quad \left(\frac{V_1 - 6}{3k} + \frac{V_1}{3k} - 3 \times 10^{-3} = 0 \right)$$

-3

$$184 - 34V_1 = 34V_1 + 9$$

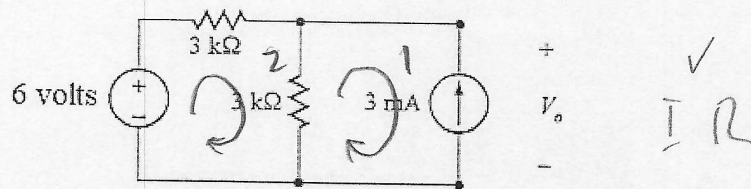
$$\frac{175}{3}$$

$$V_o = 2.9 V$$

20

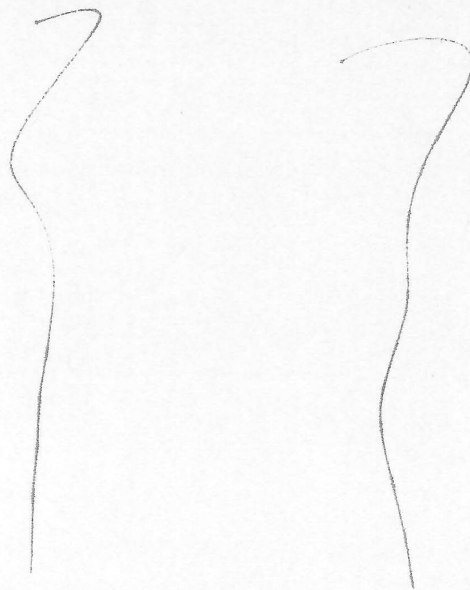
II.

Solve for the value of the voltage V_o as shown in the following circuit using mesh current method. Same circuit as given in problem 1.

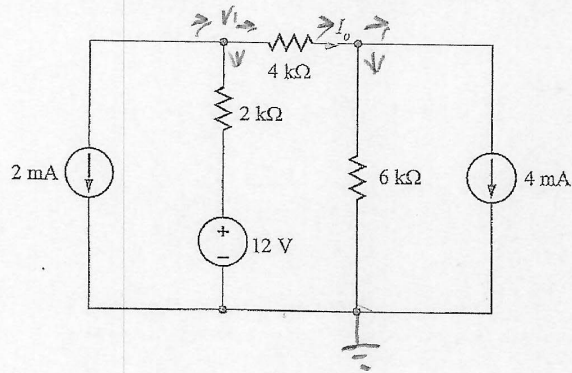


-20

$$-3 + (I_1)(3000) = 0 \quad ?$$



- (20) III. Solve for the current I_o in the following circuit using the Node voltage Method

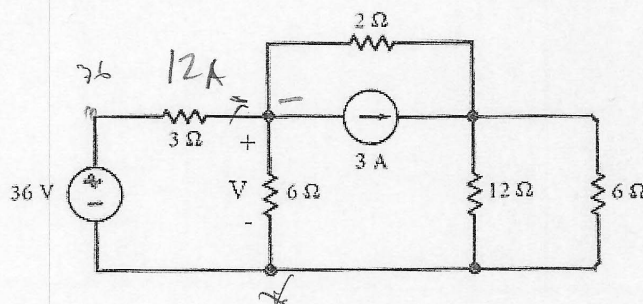


E
 I R

20

166.64

- 10) V. Solve for the voltage V across the 6 Ω Resistor as shown.

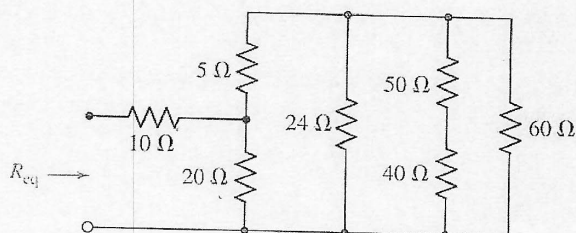


$$\frac{36V}{3\Omega} = 12A$$

$$I_2 = \frac{V_1 - V_2}{2} + 3 + \frac{V_1}{6}$$

$$V_2 = 3 +$$

- 10 VI. Determine the value of the equivalent resistance as seen at the input terminals of the following circuits.



$$50 + 40 = 90 \checkmark$$

$$\frac{10 \cdot 5}{10 + 5} = 3\frac{1}{3}$$

$$\frac{90 \cdot 60}{90 + 60} = 36 \Omega \checkmark$$

$$3\frac{1}{3} + 3 = 6\Omega$$

$$\frac{24 \cdot 36}{24 + 36} = 14.4 \checkmark$$

$$6 + 14.4 = 20.4 \Omega$$

2

Outcome 1.2

Knowledge of solving R,L,C problems and knowledgeable of op-amp and transistor circuits incorporating controlled sources

**ELECTRICAL AND COMPUTER ENGINEERING
DEPARTMENT
OUTCOMES SPECIFIC ASSIGNMENT COVER SHEET**

Network Theory 1

Spring 2022

Instructor: Dr. John Fuller

Title of Assignment

Final Exam

Outcome Measured Using this Assignment

Outcome 1.2

Knowledge of solving R,L,C problems and knowledgeable of op-amp and transistor circuits incorporating controlled sources

Brief justification of why this assignment is suitable for this outcome

The final exam test the students on solving an electrical circuit problem using the concepts learned throughout the semester. Such as parallel and series components, ohms law, mesh and node analysis, dependent and independent sources Thevenin and Norton's Theorems, Superposition, etc..

Final Exam Solution

ELEG 2301
NETWORK THEORY I
FINAL EXAM

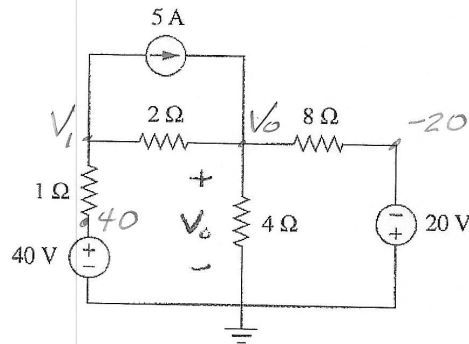
NAME KEY

May 10, 2022

150 Points Closed notes and books, no cell phones are to be visible, show all steps in deriving solution, no sharing calculators, no in and out during test time.

- I. Solve for the voltage V_o across the $4\ \Omega$ resistor in the following circuit using the Node Voltage Method.

(30)



$$\frac{V_1 - V_0}{2} + \frac{V_1 - 40}{1} + 5 = 0$$

$$V_1 - V_0 + 2V_1 - 80 + 10 = 0$$

$$\textcircled{1} -V_0 + 3V_1 = 70$$

$$\frac{V_0 - V_1}{2} + \frac{V_0}{4} + \frac{V_0 - (-20)}{8} - 5 = 0$$

$$4V_0 - 4V_1 + 2V_0 + V_0 + 20 - 40 = 0$$

$$7V_0 - 4V_1 = 20$$

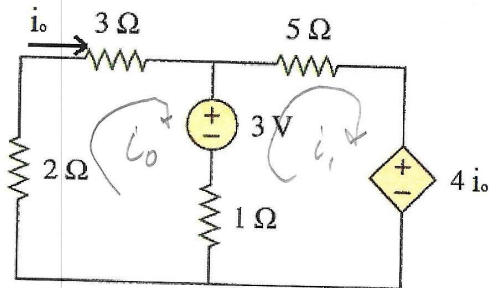
$$\begin{bmatrix} -1 & 3 \\ 7 & -4 \end{bmatrix} \begin{bmatrix} V_0 \\ V_1 \end{bmatrix} = \begin{bmatrix} 70 \\ 20 \end{bmatrix}$$

$$\begin{vmatrix} -1 & 3 \\ 7 & -4 \end{vmatrix} = 4 - 21 = -17$$

$$V_0 = \frac{\begin{vmatrix} 70 & 3 \\ 20 & -4 \end{vmatrix}}{-17} = \frac{-280 - 60}{-17} = \frac{-340}{-17} = 20 \text{ volts}$$

II. Solve for the current i_o in the following circuit using the Mesh Current Method.

(30)



$$\begin{aligned} 6i_0 - i_1 + 3 &= 0 & 6i_1 - i_0 - 3 + 4i_0 &= 0 \\ 6i_0 - i_1 &= -3 & 3i_0 + 6i_1 &= 3 \end{aligned}$$

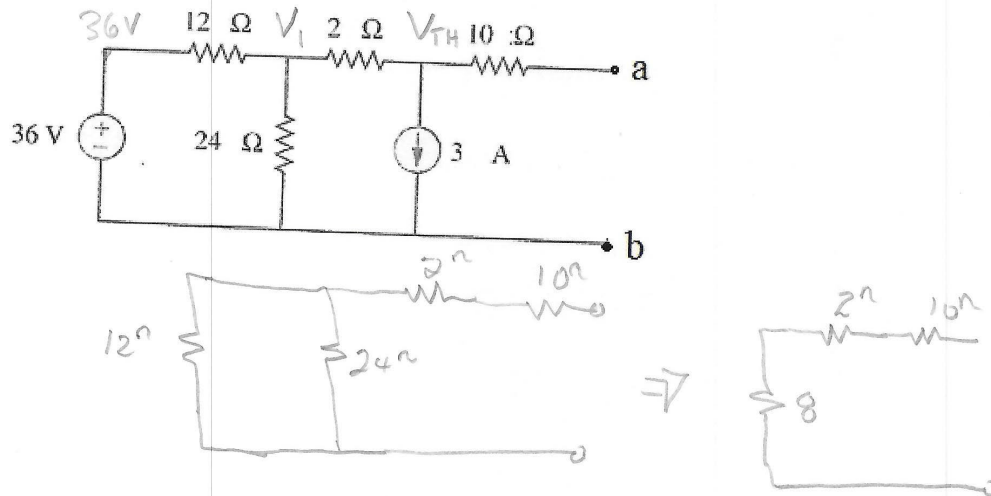
$$\begin{bmatrix} 6 & -1 \\ 3 & 6 \end{bmatrix} \begin{bmatrix} i_0 \\ i_1 \end{bmatrix} = \begin{bmatrix} -3 \\ 3 \end{bmatrix}$$

$$\begin{vmatrix} 6 & -1 \\ 3 & 6 \end{vmatrix} = 36 + 3 = 39$$

$$i_0 = \frac{\begin{vmatrix} -3 & -1 \\ 3 & 6 \end{vmatrix}}{39} = \frac{-18 + 3}{39} = \frac{-15}{39} = -0.38 \text{ A}$$

III. Derive the Thevenin Equivalent Circuit as seen at the a and b terminals.

(20)



$$R_{TH} = 20\Omega$$

$$\frac{V_1 - 36}{12} + \frac{V_1}{24} + \frac{V_1 - V_{TH}}{2} = 0$$

$$\frac{V_{TH} - V_1}{2} + 3 = 0$$

$$2V_1 - 72 + V_1 + 12V_1 - 12V_{TH} = 0$$

$$V_{TH} - V_1 + 6 = 0$$

$$-12V_{TH} + 15V_1 - 72 = 0$$

$$V_1 = V_{TH} + 6$$

$$-12V_{TH} + 15(V_{TH} + 6) - 72 = 0$$

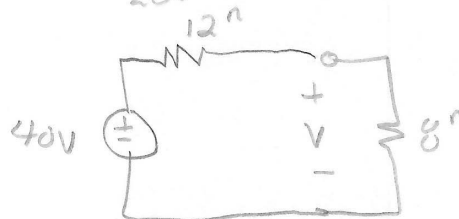
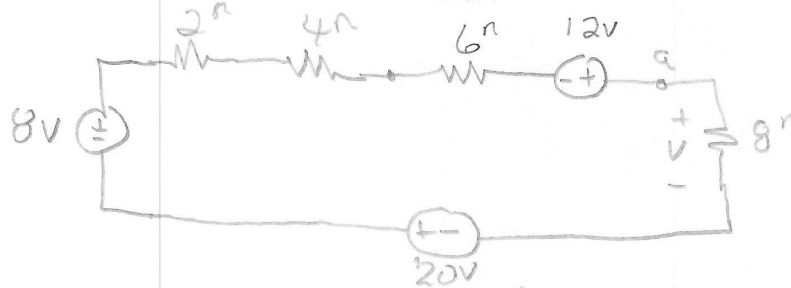
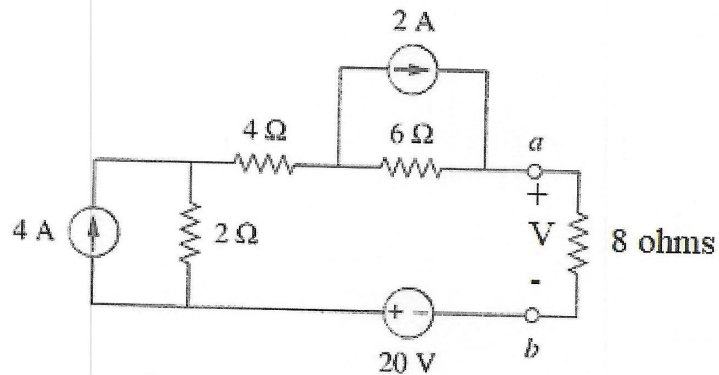
$$-12V_{TH} + 15V_{TH} + 90 - 72 = 0$$

$$3V_{TH} = -18$$

$$V_{TH} = \frac{-18}{3} = -6 \text{ volt}$$

- IV. Solve for the voltage V across the 8 ohm resistor using source transformations.

(20)

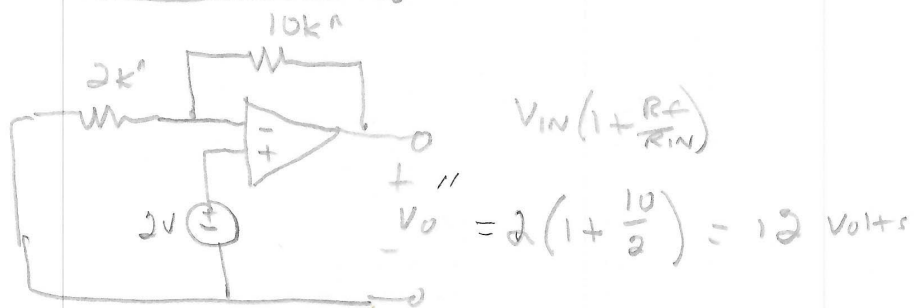
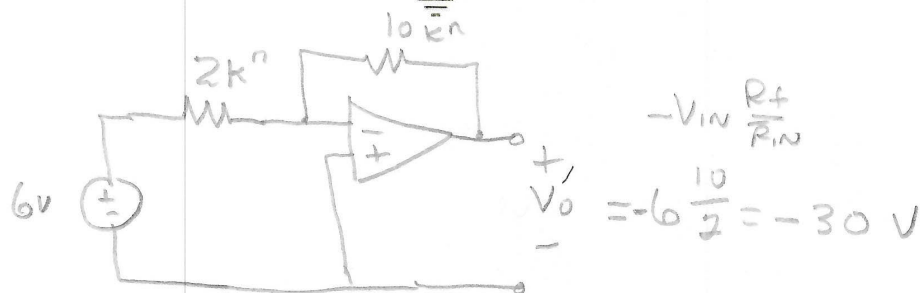
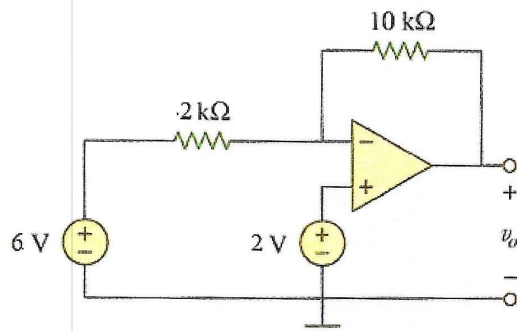


$$V = \frac{40 \times 8}{12 + 8} = \frac{320}{20}$$

$$V = 16 \text{ Volts}$$

- V. Solve for the output voltage V_o in the op amp circuit using superposition.

(20)

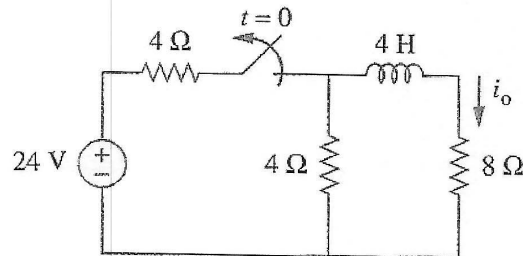


$$V_o = V_o' + V_o''$$

$$V_o = -30 + 12 = -18 \text{ volts}$$

- VI. In the following RL Circuit derive the value of $i(t)$ for $t > 0$. Before $t = 0$ the switch has been in the closed position for a long time.

(15)



$$i_o(0) = \frac{9.6}{8} = 1.2 \text{ A}$$

$$V = \frac{24 \times 2.67}{6.67} = 9.6 \text{ V}$$

SWITCH OPENS



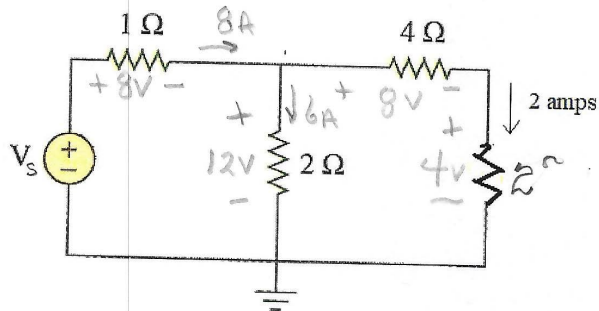
$$i_o = 9.6 e^{-t/\tau} \quad \tau = \frac{L}{R} = \frac{4}{12}$$

$$i_o = 9.6 e^{-t/4/3}$$

$$i_o = 9.6 e^{-3t}$$

- VII. If the current through the 2 ohm resistor is 2 amps what must be the value of the voltage source V_s .

(15)



$$-V + 8 + 12 = 0$$

$$V = 20 \text{ V}$$

Also solve this way

Assume $V_s = 4 \text{ volts}$

$$\therefore \frac{V-4}{1} + \frac{V}{2} + \frac{V}{6} = 0$$

$$6V - 24 + 3V + V = 0$$

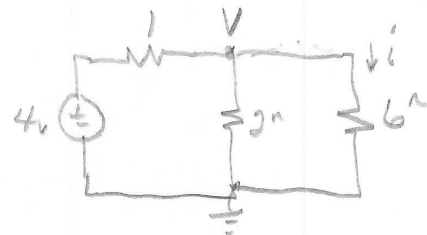
$$10V = 24$$

$$V = 2.4$$

$$i = \frac{2.4}{6} = 0.4$$

$$\frac{0.4 \text{ A}}{4 \text{ V}} = \frac{2 \text{ A}}{V_s}$$

$$V_s = \frac{2 \times 4}{0.4} = \frac{8}{0.4} = 20 \text{ VOLTS}$$



Student Support Material

Above Average

ELEG 2301
NETWORK THEORY I
FINAL EXAM

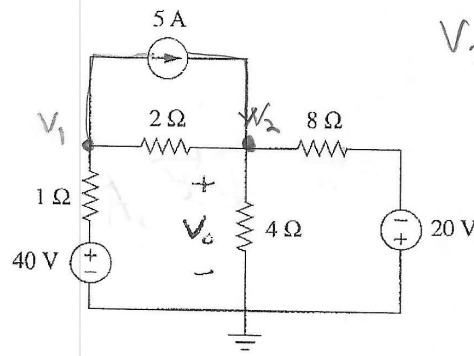
NAME Jaden Simmons

May 10, 2022

150 Points Closed notes and books, no cell phones are to be visible, show all steps in deriving solution, no sharing calculators, no in and out during test time.

- I. Solve for the voltage V_o across the $4\ \Omega$ resistor in the following circuit using the Node Voltage Method.

(30)



$$V_2 = V_o$$

$$V_o = 12.7$$

$$2 \left(\frac{V_1 - 40}{1} + \frac{V_1 - V_2}{2} - 5 \right) = 2V_1 - 80 + 1V_1 - 1V_2 - 10$$

$$3V_1 - 1V_2 = 90$$

$$\left(\frac{V_2 - V_1}{2} + \frac{V_2}{4} + \frac{V_2 + 20}{8} + 5 \right) 8$$

$$4V_2 - 4V_1 + 2V_2 + 1V_2 + 20 + 40$$

$$-4V_1 + 7V_2 = 60$$

$$7(3V_1 - 1V_2 = 90)$$

$$-4V_1 + 7V_2 = 60$$

$$7.23 = V_1$$

$$21V_1 - 7V_2 = 63$$

$$-4V_1 + 7V_2 = 60$$

$$\frac{17V_1 = 123}{17}$$

$$7V_2 = 60 + 28.92$$

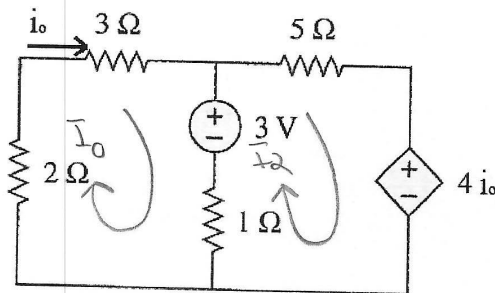
$$7V_2 = 88.92$$

$$-4(7.23) + 7V_2 = 60$$

$$V_2 = 12.7$$

II. Solve for the current i_o in the following circuit using the Mesh Current Method.

(30)



$$2I_0 + 3I_0 + 1I_0 - 1I_2 + 3 \quad \checkmark$$

③ $I_1 = I_0$

① $6I_0 - I_2 = -3$

$$-1I_0 + 1I_2 - 3 + 5I_2 + 4i_o$$

$$6I_0 - \cancel{0.692} = -3$$

② $-1I_0 + 6I_2 + 4i_o = 3 \quad \checkmark$

$$6I_0 = -2.308$$

$$-I_0 + 6I_2 + 4i_o = 3$$

$$I_0 = -0.3846$$

$$(3I_0 + 6I_2 = 3) - 2$$

$$6I_0 - I_2 = -3$$

$$-6I_0 - 12I_2 = -6$$

$$6I_0 - I_2 = -3$$

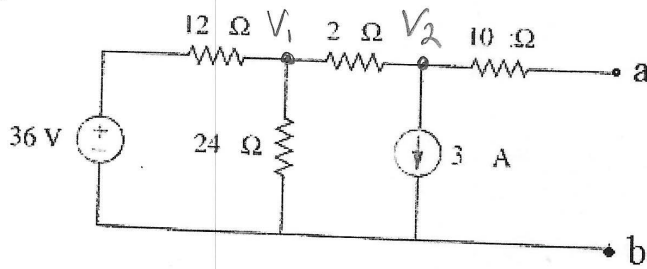
$$-13I_2 = -9$$

$$-13$$

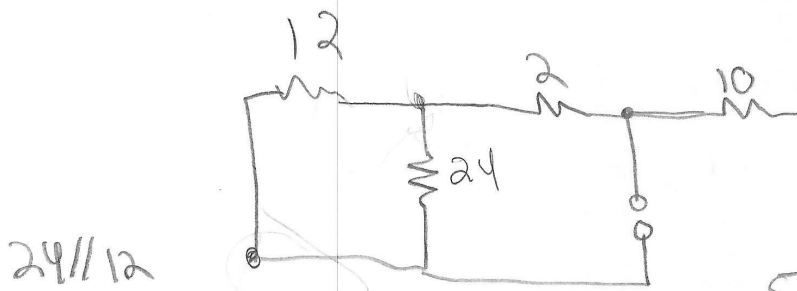
$$I_2 = 0.692$$

III. Derive the Thevenin Equivalent Circuit as seen at the a and b terminals.

(20)

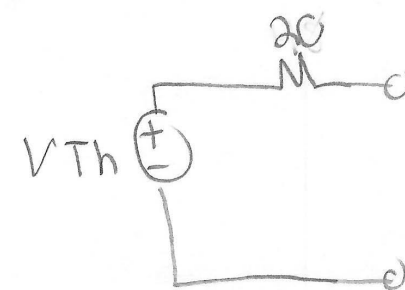
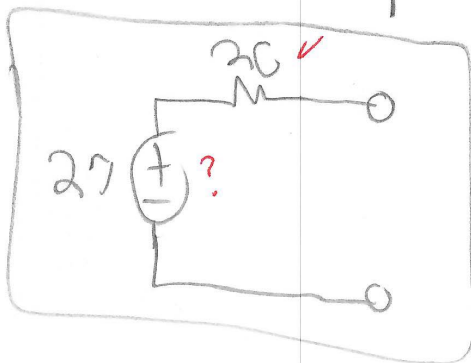
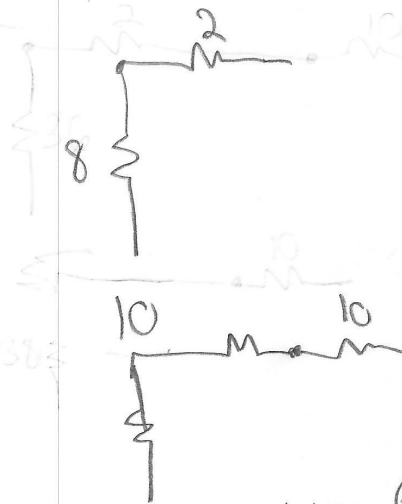


$$\left(\frac{V_1 - 36}{12} + \frac{V_1}{24} + \frac{V_1 - V_2}{2} - 3 \right) 10 = 0$$



$24 \parallel 12$

$\frac{24 \cdot 12}{24 + 12} = 8$



$V_2 = 27$

$2V_1 - 12 + 1V_1 + 12V_1 - 12V_2$

$15V_1 - 12V_2 = 12$

$5V_2 - 5V_1 + 1V_2 - 30$

$2(-5V_1 + 6V_2 - 30)$

$-10V_1 + 12V_2 = 60$

$15V_1 - 12V_2 = 12$

$5V_1 = 132$

$V_1 = 26.4$

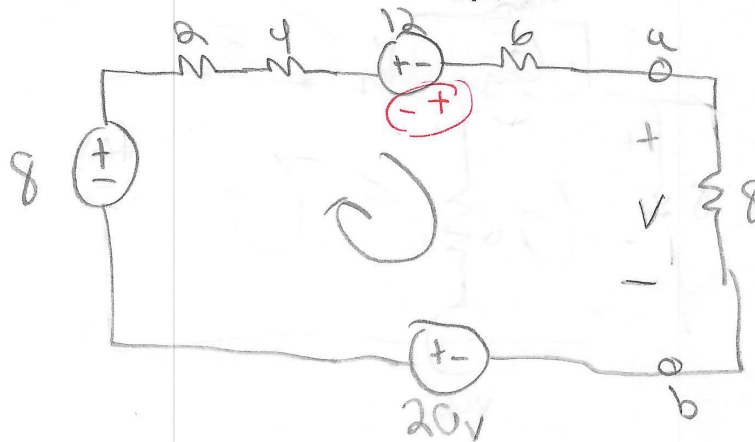
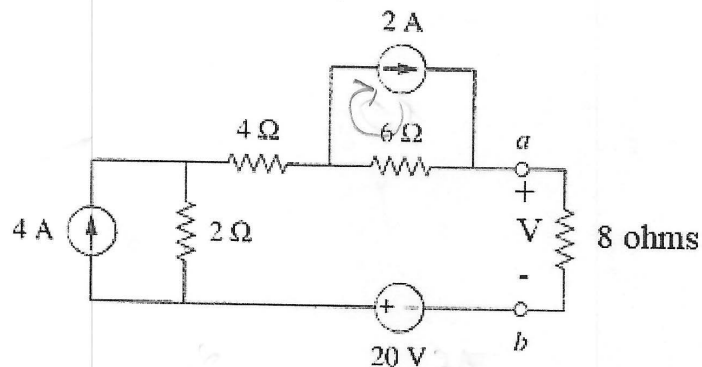
$-5(26.4) + 6V_2 = 30$

$-132 + 6V_2 = 30$
 $+132$

$6V_2 = 162$

- IV. Solve for the voltage V across the 8 ohm resistor using source transformations.

(20)



-2

$$-8 + 2I_1 + 4I_1 + 12 + 6I_1 + 8I_1 - 20$$

$$20I_1 - 16 = 20$$

$$\frac{20I_1 = 36}{20}$$

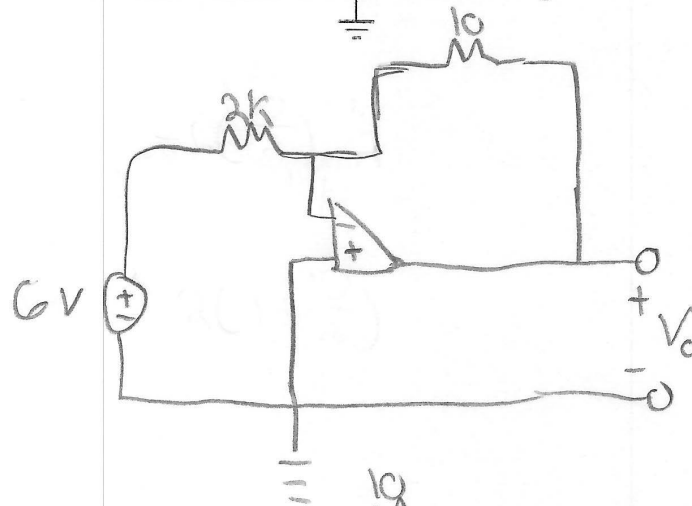
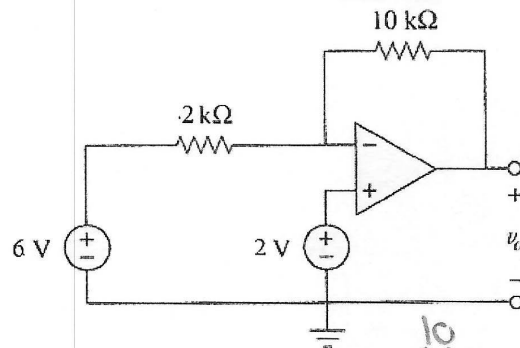
$$I_1 = 0.8$$

$$0.8(8) = 6.4$$

$$\boxed{V = 6.4}$$

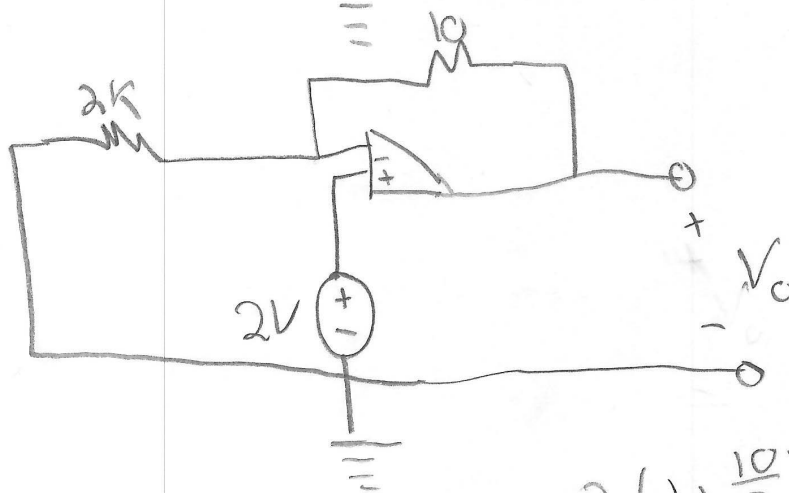
V.
20

Solve for the output voltage V_o in the op amp circuit using superposition.



$$-6\left(\frac{10}{2}\right)$$

$$-30 = V'$$



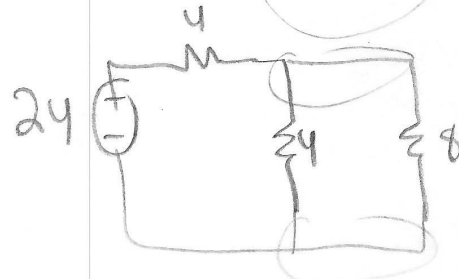
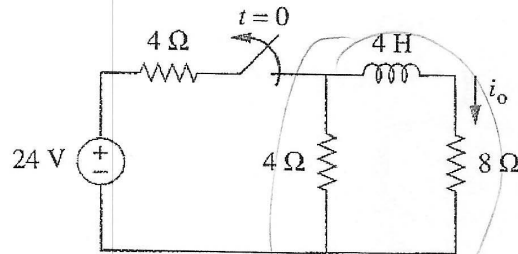
$$2\left(1 + \frac{10}{2}\right) = 12 = V''$$

$$-30 + 12 = -18$$

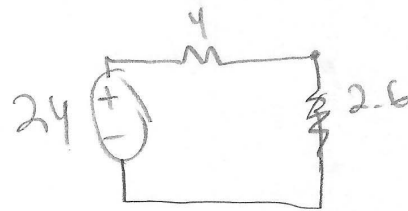
$$\boxed{-18 = V_o}$$

- VI. In the following RL Circuit derive the value of $i(t)$ for $t > 0$. Before $t = 0$ the switch has been in the closed position for a long time.

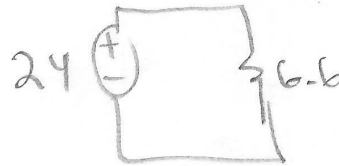
(15)



$$\frac{4 \cdot 8}{4 + 8} = \frac{8}{3}$$



$$4 + 2.6$$

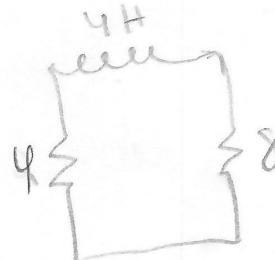


$$\frac{24}{6.6} \quad I(0) = 3.6$$

$$3.6 e^{-t/0.33}$$

$$\frac{1}{0.33}$$

$$i(t) = 3.6 e^{-3.03 t}$$

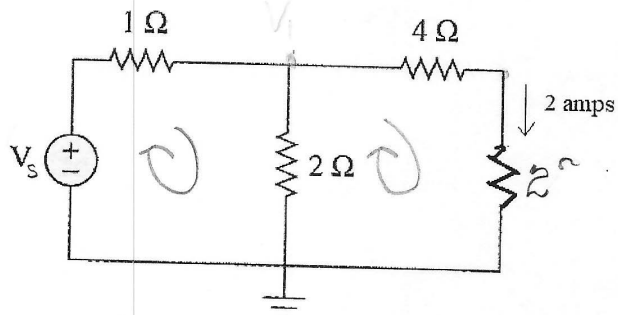


$$\frac{L}{R}$$

$$\frac{4}{12} = 0.33$$

- VII. If the current through the 2 ohm resistor is 2 amps what must be the value of the voltage source V_s .

(15)



$$\begin{aligned} 4 (+3I_1 - 2I_2 &= V_s) \\ -2I_1 + 8I_2 &= 0 \end{aligned}$$

$$\textcircled{1} \quad 3I_1 - 2I_2 = V_s$$

$$\begin{aligned} 12I_1 - 8I_2 &= 4V_s \\ -2I_1 + 8I_2 &= 0 \end{aligned}$$

$$\textcircled{2} \quad -2I_1 + 8I_2 = 0$$

$$4 (3I_1 - 2I_2 = V_s)$$

-2

$$\frac{10I_1 = 4V_s}{4}$$

$$\begin{aligned} -2I_1 + 8I_2 &= 0 \\ 12I_1 - 8I_2 &= 4V_s \end{aligned}$$

2.5

$$\frac{10I_1 = 4V_s}{4V_s}$$

$$V_s = 2.5$$

Below Average

ELEG 2301
NETWORK THEORY I
FINAL EXAM

90
150

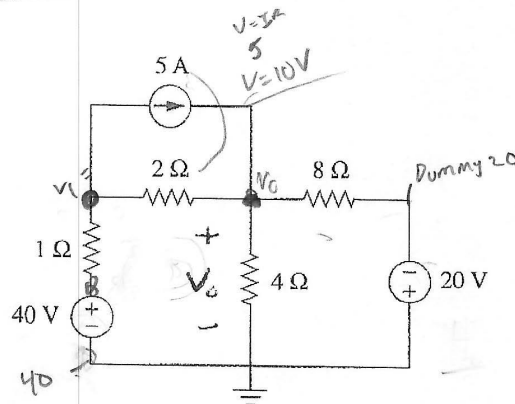
NAME Jordan Owens

May 10, 2022

150 Points Closed notes and books, no cell phones are to be visible, show all steps in deriving solution, no sharing calculators, no in and out during test time.

- I. Solve for the voltage V_o across the $4\ \Omega$ resistor in the following circuit using the Node Voltage Method. Node analysis

(30)



$$\frac{V-0}{2}$$

$$\frac{40-0}{2}$$

-15

2 current
2 equations

$$50 \times 4$$

$$40 + 20 + \frac{5V_0}{2} = ??$$

+

$$17.5V$$

$$? + \frac{V_1 - 40}{1} + 5 = 0$$

$$2 \left(\frac{V_1 - V_0}{2} + 10 \right) = 0$$

$$V_1 - V_0 = -20$$

$$4 \left(\frac{V_0 - V_1}{2} + \frac{V_0}{4} + 20 \right) = 0$$

$$7.68$$

$$2V_0 - 2V_1 + V_0 + 80 = 0$$

$$2V_1 - 3V_0 = -80$$

$$\begin{bmatrix} 1 & -1 \\ 2 & -3 \end{bmatrix}$$

$$\begin{bmatrix} 1 & -1 \\ 2 & -3 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} -80 \\ -80 \end{bmatrix}$$

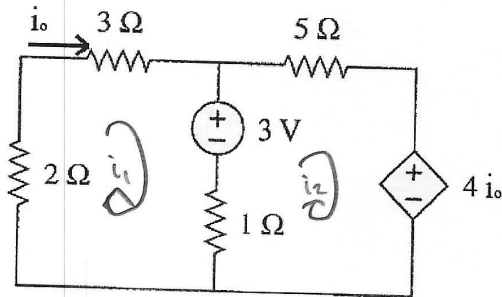
$$\begin{matrix} -160 \\ -80 \end{matrix}$$

$$V_0 = 2.5V$$

$$V_0 = 10V$$

II. Solve for the current i_o in the following circuit using the Mesh Current Method.

(30)



-12

$$\begin{aligned}
 -3 &= 1i_1 - 1i_2 + 2i_1 + 3i_1 \quad \checkmark \quad -3 = 6i_1 - 1i_2 + 4i_o \\
 3 &= 5i_2 - 4i_o + 1i_2 - 1i_1 \rightarrow 3 = 5i_2 - 4i_1 - 4i_2 + 1i_2 - 1i_1 \\
 i_o &= i_1 + i_2 \quad \underline{3 = 2i_2 - 5i_1}
 \end{aligned}$$

or

$$3 = 5i_2 - 4i_2 + 1i_2 - 1i_1$$

$$\underline{3 = 2i_2 - 1i_1}$$

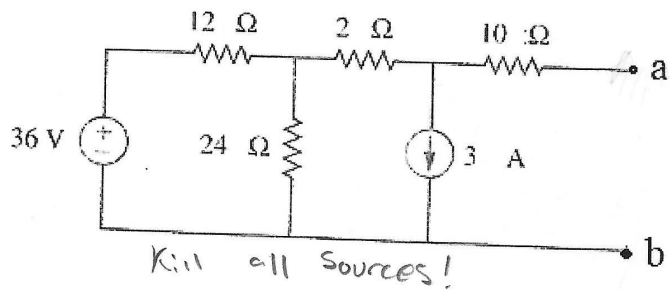
$$\boxed{i_o = 1.36}$$

-4.38?

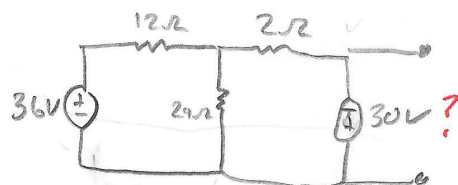
$$\begin{bmatrix} 6 & -1 \\ -5 & 2 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} -3 \\ 3 \end{bmatrix}$$

$$2 + 3 + 1 + 3 - 12 = 0$$

III. Derive the Thevenin Equivalent Circuit as seen at the a and b terminals.
 (20)



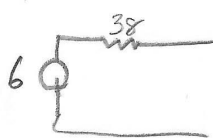
15V



-10

$$12 + 24 = 36 + 2 = 38$$

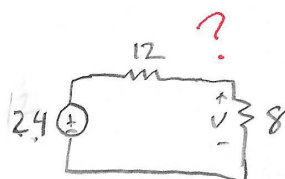
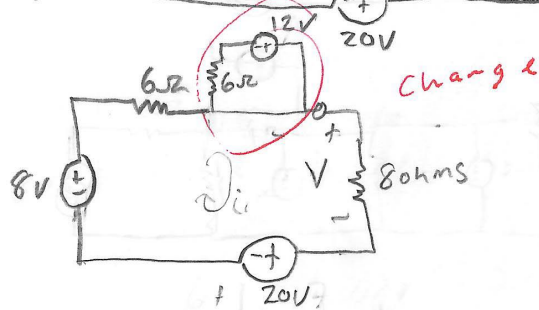
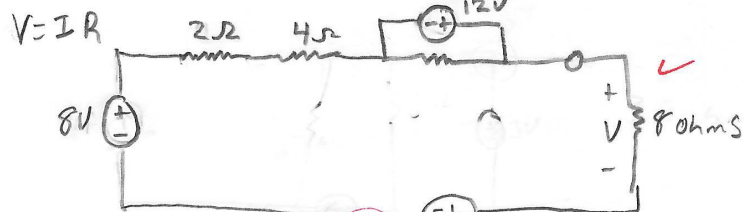
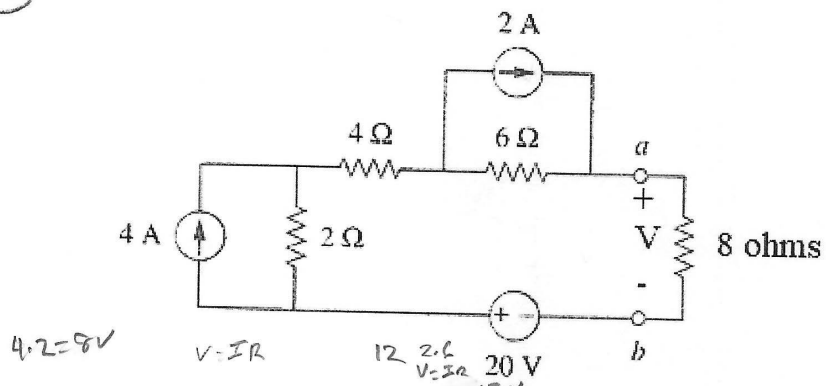
$$36 - 30 = 6$$



or

$$V_{th} = 6.33 \text{ V}$$

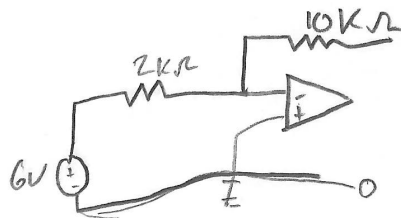
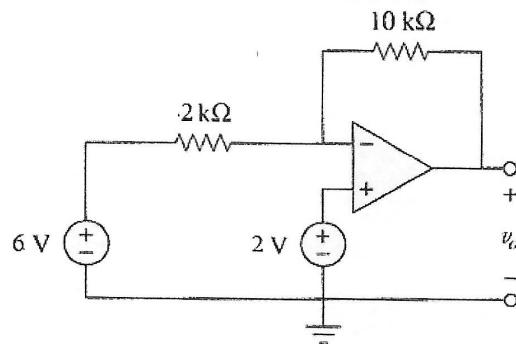
- IV. Solve for the voltage V across the 8 ohm resistor using source transformations.



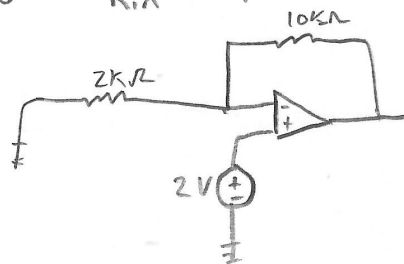
$$\frac{24(12)}{8+12} = 14.4V$$

20 V.

Solve for the output voltage V_o in the op amp circuit using superposition.



$$V_o = -\frac{R_f}{R_{in}} V_{in} = -\frac{10}{2} (6) = -30 \text{ V}$$

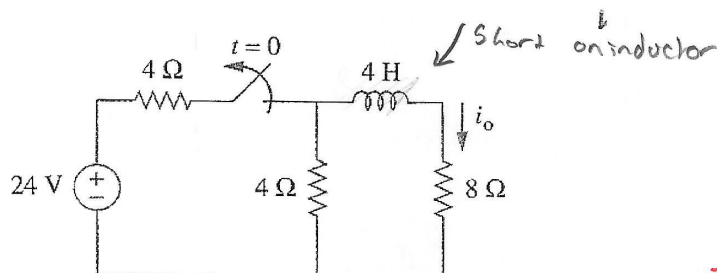


$$V_o = \left(1 + \frac{R_f}{R_{in}}\right) V_{in} = \left(1 + \frac{10}{2}\right) (2) = 12 \text{ V}$$

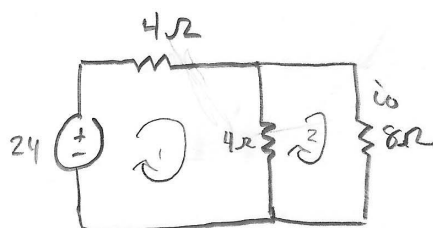
$$-30 + 12 = \boxed{-18 \text{ V}}$$

15

VI. In the following RL Circuit derive the value of $i(t)$ for $t > 0$. Before $t = 0$ the switch has been in the closed position for a long time.

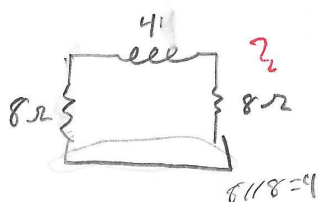


-7



$4+4=8\Omega$ X Not in series

$24/8 = 3 \text{ Amps}$? $i_0 = 3$



$\tau = L/R$ $L=4$ $R=12$

$\tau = 4/4 = 1$?

$I_1 = I_0 (e^{-t/\tau})$

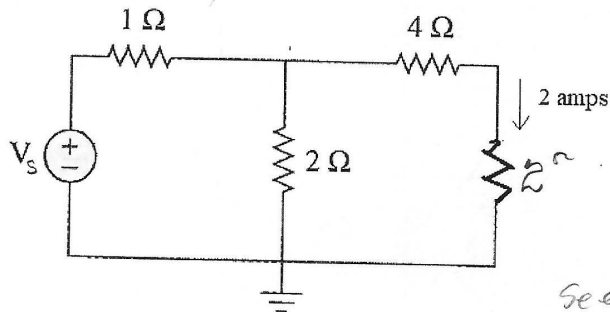
$I_1 = 3 (e^{-t/1})$

$I_L = 3 (e^{-t/1})$ X

$I_L = 3 (e^{-t/1.25})$

$16/4 = 4/16 = .25$

- VII. (15) If the current through the 2 ohm resistor is 2 amps what must be the value of the voltage source V_s .

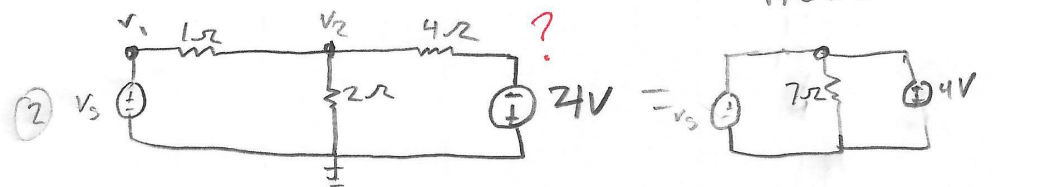


See what source is

1. current creates Voltage

2. V

3. Work right to left



$$4 = \frac{V_0}{7} + 4 + V_s$$

$$V_0 + 32 + 7V_s =$$

$$V_s = 4.5$$

-10

ASSIGNMENTS FOR OUTCOME 1.3

**To teach students the use of modern engineering tools such as Matlab
and FPGA programming**

**ELECTRICAL AND COMPUTER ENGINEERING
DEPARTMENT**

**OUTCOMES SPECIFIC ASSIGNMENT COVER SHEET
NETWORK THEORY 1**

Spring 2022

Instructor: Dr. John Fuller

Title of Assignment

Knowledge of solving electrical circuit problems using software packages

Outcome Measured Using this Assignment

Outcome 1.3

Students will first derive solution to a problem using methods taught in classroom instruction and next program the computer to solve the same problem.

Brief justification of why this assignment is suitable for this outcome

To give the students the knowledge of using software packages to solve electrical circuit problems. In addition to knowing fundamental electrical concepts the student when hired in industry or a government agency will use the computer to solve engineering problems or management planning and/or problems.

MatLab Instructions

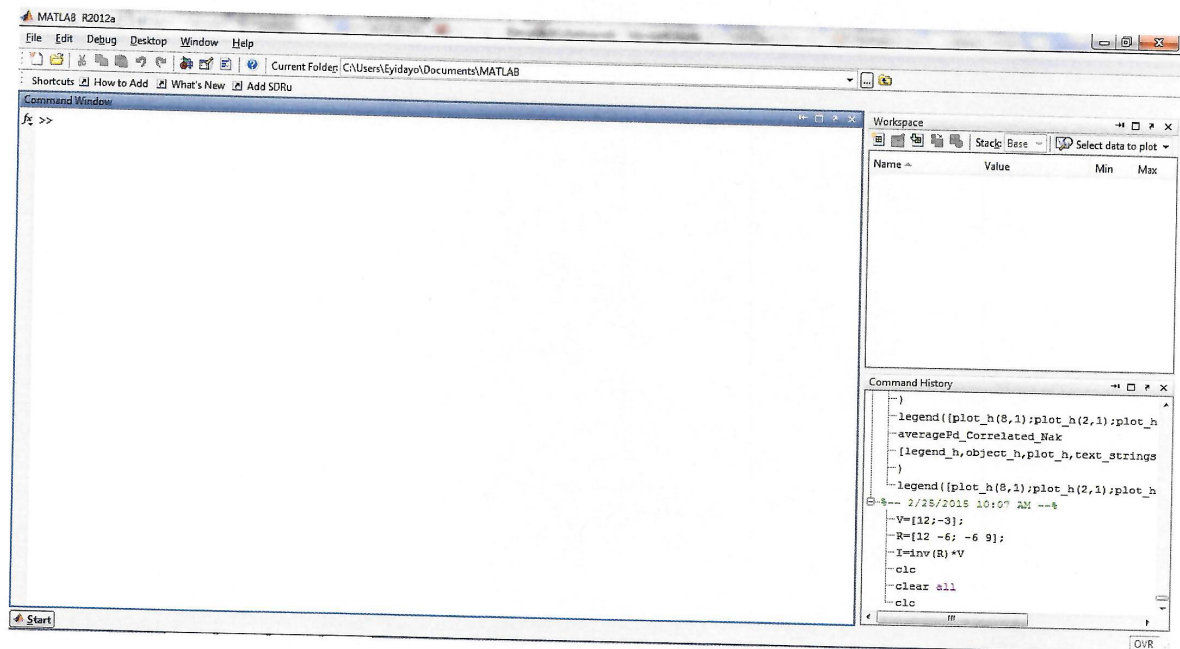
ELEG 2023

NETWORK THEORY I

Circuit Analysis using MATLAB

Procedure for using MATLAB

- Click on the MATLAB icon (Start → All programs → MATLAB → R2014a → MATLAB R2014a) a workspace window should appear with three separate areas titled
 - Workspace
 - Command window
 - Command history
- Click on 'command window'



Nodal Analysis

Objective: To compute the nodal voltages using MATLAB

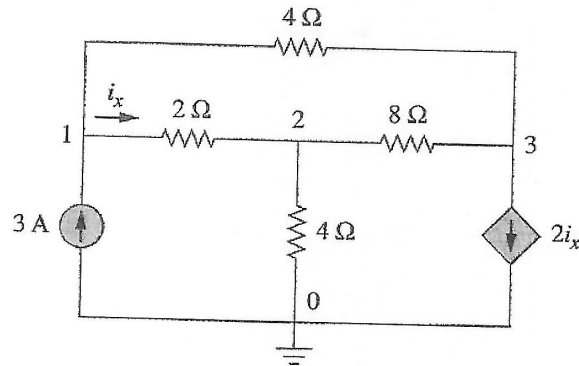


Fig. 1

- Carry out nodal analysis on the circuit and write out the simultaneous equations to obtain the unknown node voltages.

$$3v_1 - 2v_2 - v_3 = 12$$

$$-4v_1 + 7v_2 - v_3 = 0$$

$$2v_1 - 3v_2 + v_3 = 0$$

- The equations above need to be rewritten in matrix form to facilitate the use of MATLAB

$$AV=B$$

where A is a 3X3 matrix and B is a column matrix

$$\begin{bmatrix} 3 & -2 & -1 \\ -4 & 7 & -1 \\ 2 & -3 & 1 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \\ v_3 \end{bmatrix} = \begin{bmatrix} 12 \\ 0 \\ 0 \end{bmatrix}$$

The nodal voltages V will be computed as:

$$AV=B \quad \rightarrow V=A^{-1}B$$

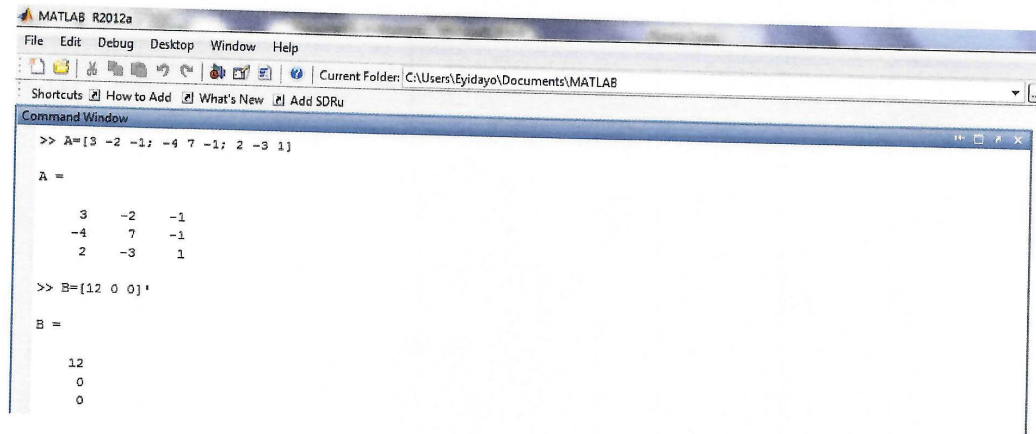
- Go to “command prompt window” as shown below and type in the values of matrix A & B as shown below:

```
>>A=[3 -2 -1; -4 7 -1; 2 -3 1]
```

Then press Enter and it will automatically be put in matrix form as shown below.

```
>>B=[12 0 0]'
```

Then press Enter and it will automatically be put in column matrix form as shown below.



```
MATLAB R2012a
File Edit Debug Desktop Window Help
Current Folder: C:\Users\Eyidayo\Documents\MATLAB
Shortcuts How to Add What's New Add SDRu

Command Window
>> A=[3 -2 -1; -4 7 -1; 2 -3 1]

A =

     3     -2     -1
    -4      7     -1
     2     -3      1

>> B=[12 0 0]';

B =

    12
     0
     0
```

- Use MATLAB to compute node voltages, V by typing in the following:

`>> V=inv(A)*B`

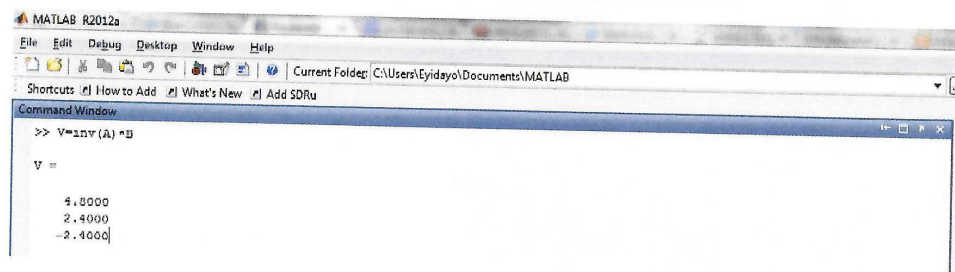
Then press Enter



```
MATLAB R2012a
File Edit Debug Desktop Window Help
Current Folder: C:\Users\Eyidayo\Documents\MATLAB
Shortcuts How to Add What's New Add SDRu

Command Window
>> V=inv(A)*B
```

- The Nodal Voltages are displayed on the screen as shown below



```
MATLAB R2012a
File Edit Debug Desktop Window Help
Current Folder: C:\Users\Eyidayo\Documents\MATLAB
Shortcuts How to Add What's New Add SDRu

Command Window
>> V=inv(A)*B

V =

    4.8000
    2.4000
   -2.4000
```

Thus $v_1 = 4.8V$, $v_2 = 2.4V$ and $v_3 = 2.4V$

Mesh Analysis

Objective: To compute the branch currents using MATLAB

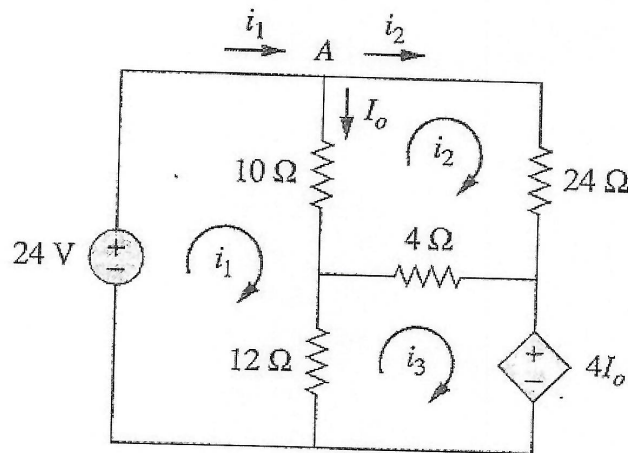


Fig.2

- Carry out mesh analysis on the circuit and write out the simultaneous equations to obtain the unknown branch currents.

$$11i_1 - 5i_2 - 6i_3 = 12$$

$$-5i_1 + 19i_2 - 2i_3 = 0$$

$$-i_1 - i_2 + 2i_3 = 0$$

- The equations above need to be rewritten in matrix form to facilitate the use of MATLAB

$$CI=D$$

where C is a 3X3 matrix and D is a column matrix

$$\begin{bmatrix} 11 & -5 & -6 \\ -5 & 19 & -2 \\ -1 & -1 & 2 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 12 \\ 0 \\ 0 \end{bmatrix}$$

The branch currents I will be computed as:

$$CI=D \longrightarrow I=C^{-1}D$$

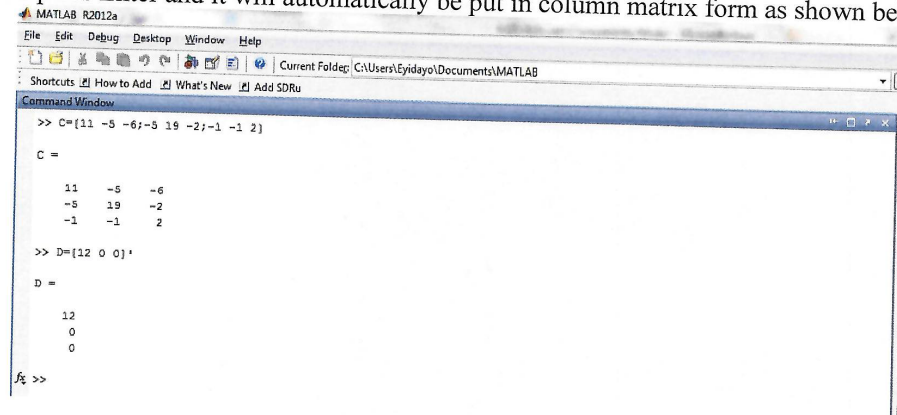
- Go to "command prompt window" in MATLAB as shown below and type in the values of matrix C & D as shown below:

```
>>C=[11 -5 -6; -5 19 -2; -1 -1 2]
```

Then press Enter and it will automatically be put in matrix form as shown below.

```
>>D=[12 0 0]'
```

Then press Enter and it will automatically be put in column matrix form as shown below.



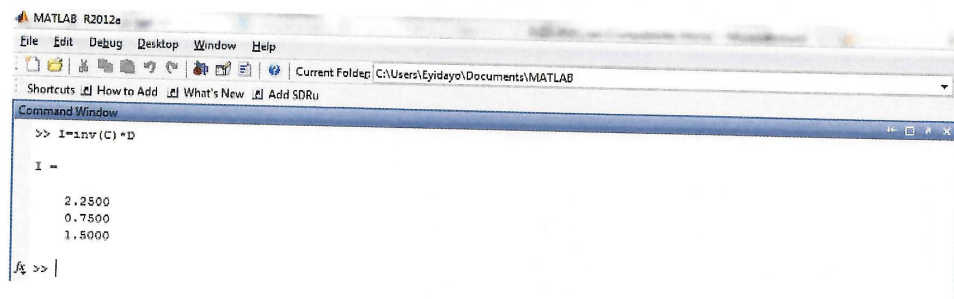
```
MATLAB R2012a
File Edit Desktop Window Help
Current Folder: C:\Users\Eyidayo\Documents\MATLAB
Shortcuts How to Add What's New Add SDRu
Command Window
>> C=[11 -5 -6; -5 19 -2; -1 -1 2]
C =
    11    -5    -6
    -5    19    -2
     -1     -1     2
>> D=[12 0 0]';
D =
    12
     0
     0
fx >>
```

- Use MATLAB to compute the branch currents, I by typing in the following:

```
>> I=inv(C)*D
```

Then press Enter

The branch currents are displayed on the screen as shown below



```
MATLAB R2012a
File Edit Desktop Window Help
Current Folder: C:\Users\Eyidayo\Documents\MATLAB
Shortcuts How to Add What's New Add SDRu
Command Window
>> I=inv(C)*D
I =
    2.2500
    0.7500
    1.5000
fx >>
```

Thus $i_1 = 2.25A$ $i_2 = 0.75A$ and $i_3 = 1.5A$

Student Support Material

Above Average

30/30

Network Theory

ELEG 2305

MATLAB assignment

Jordan Owens

Performed: 5/01/2022

Submitted: 5/10/2022

Department of Electrical and Computer Engineering

Prairie View A&M University

Introductory:

Network Theory I is the basic foundation for an electrical engineer's success, thus it would be expected for said engineer to have basic knowledge of the virtual tools available. The overall purpose of the lab is to become familiar with Matlab and gain experience in solving circuit solutions with the software source available. The objective is to compute the nodal voltage using MATLAB and to compute the branch currents using MATLAB.

Procedures:

- The objective is to compute the nodal voltage using MATLAB
- The objective is to compute the branch currents using MATLAB.

Equipment:

MATLAB

Data and Results:

```
>> A=[3 -2 -1; -4 7 -1; 2 -3 1]
```

```
A =
```

```
     3     -2     -1
    -4      7     -1
     2     -3      1
```

```
>> B=[12 0 0]'
```

```
B =
```

```
    12
     0
     0
```

Figure 1: Shown above is the typed in values for matrix A and B.

```
>> V=inv(A)*B
```

```
V =
```

```
    4.8000
    2.4000
   -2.4000
```

Figure 2: Above are the Nodal voltage Values

```

C =

    11    -5    -6
    -5    19    -2
    -1    -1     2

>> D=[12 0 0]'

D =

    12
     0
     0

```

Figure 3: Shown above is the typed in values for matrix C and D .

```

>> I=inv(C)*D

I =

    2.2500
    0.7500
    1.5000

```

Figure 4: Above are the currents for the branches 1, 2, 3.

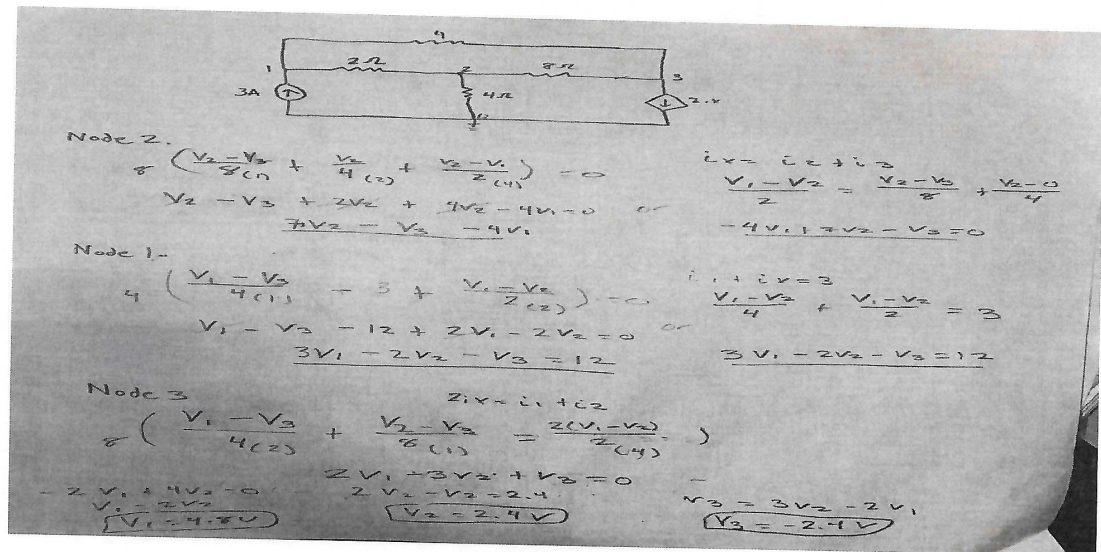


Figure 7: Above is the physical work done for example 1: Nodal Analysis

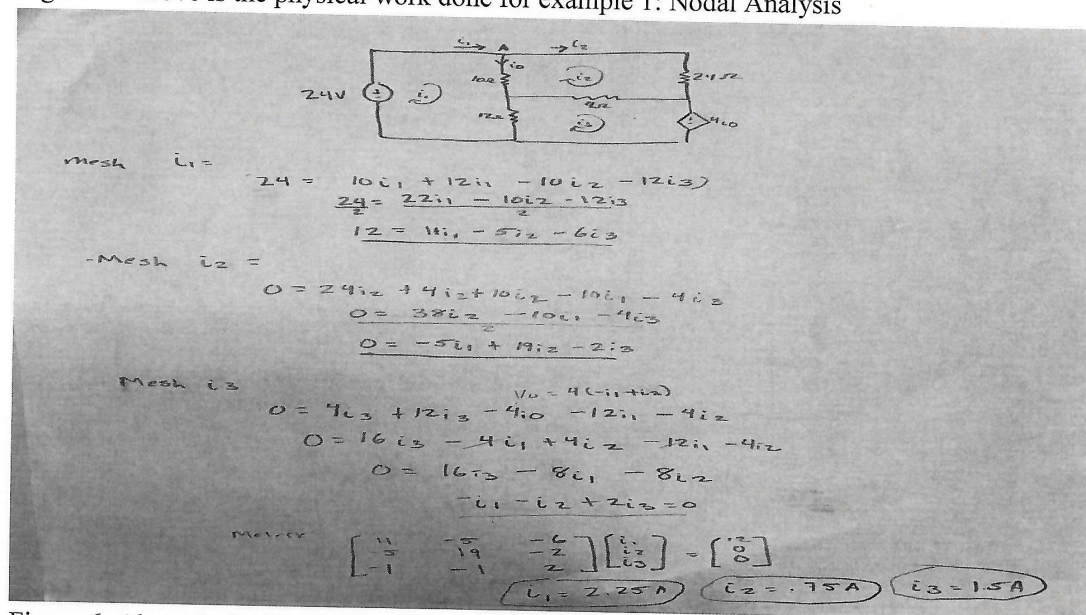


Figure 6: Above is the physical work done for example 2: Mesh analysis

Discussion:

Overall, I met very few issues operating MATLAB and followed the instructions thoroughly. In the first example, Nodal analysis, I learned to write out the simultaneous equations to obtain the unknown node voltages. I rewritten those values in a 3 by 3 matrix equation. Using the Command prompt window I then inputted those values in for A & B as shown in figure 1. I then executed the program which gave me the values as shown in figure 2. Unlike figure 1, it is shown in figure 2 that to find the value for either current or voltage require the code $V = \text{inv}(A) * B$. For the second example, I did the same process with a different circuit, but solved the equation using mesh analysis. I wrote out the simultaneous equations to solve the unknown branch currents and retten the equation into a 3 by 3 matrix and a column for D. I then Used the command prompt window in MATLAB as shown in figure 3. I successfully retrieved the branch current as displayed in figure 4. This Website in my belief can become a great asset in the future if more practice is done.

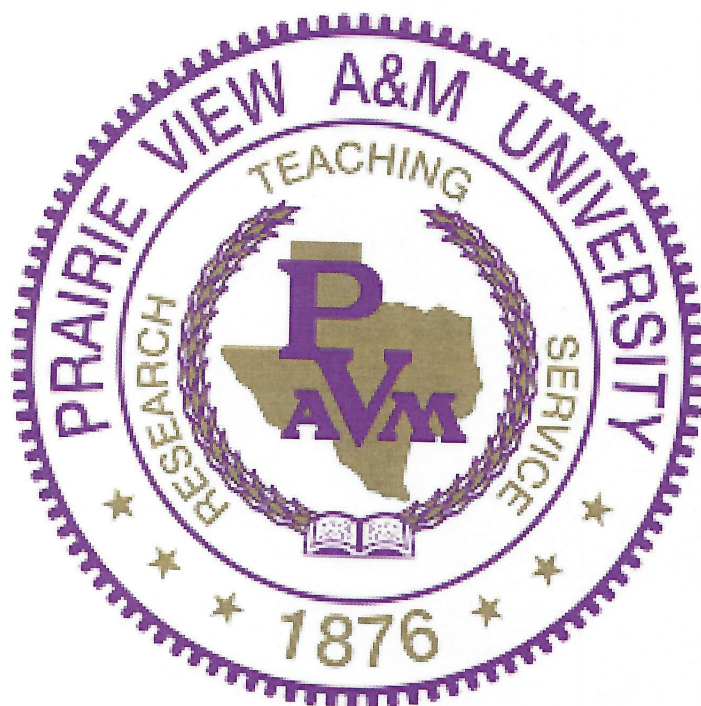
Conclusions:

For this experiment I successfully learned how to use MATLAB to solve for branch currents and node voltages. I learned how to analyze the circuit given, make a simultaneous equation and convert the equation to a matrix in order to input the values in MATLAB. This experiment gave me the opportunity to learn about new types of tools that engineers can use to be more accurate in the workplace. This experiment gave me the opportunity to have a basic introduction to MATLAB and I now possess basic control over the software.

Average

30/30

Network Theory
ELEG 2305
MatLab Homework



Julian Claiborne

MatLab Homework

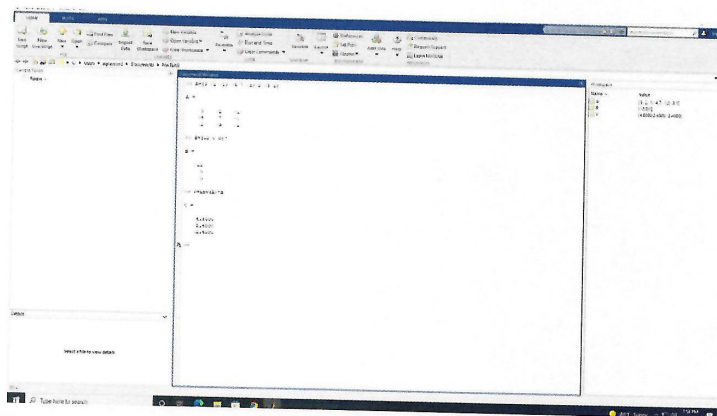
Objective: Is to run a nodal Analysis and a Mesh Analysis in MatLab.

Tools:
MatLab

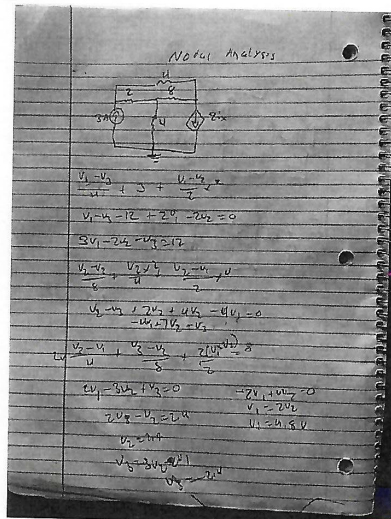
Procedure:

Nodal Analysis

MatLab

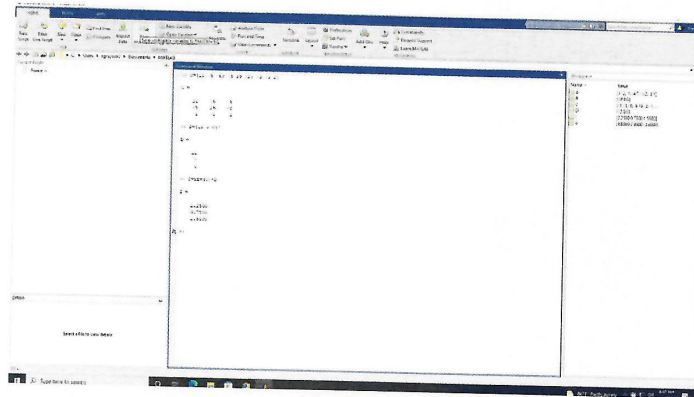


Work

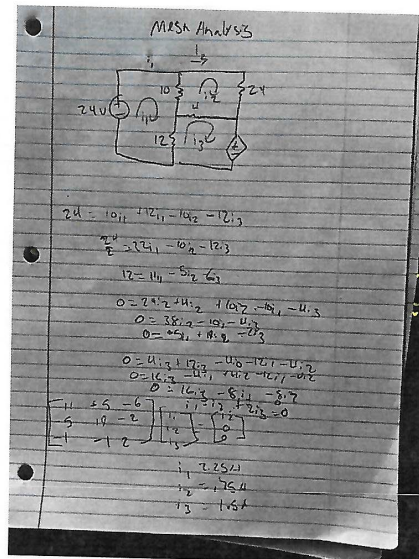


Mesh Analysis

MatLab



Work



Conclusion:

This Homework was to help us learn and practice how to run nodal and mesh analysis in MatLab. This also helped getting some practice in on how to complete this circuits and finding voltages.

Average
Below are '0'

30/30

Ayodele Grayson

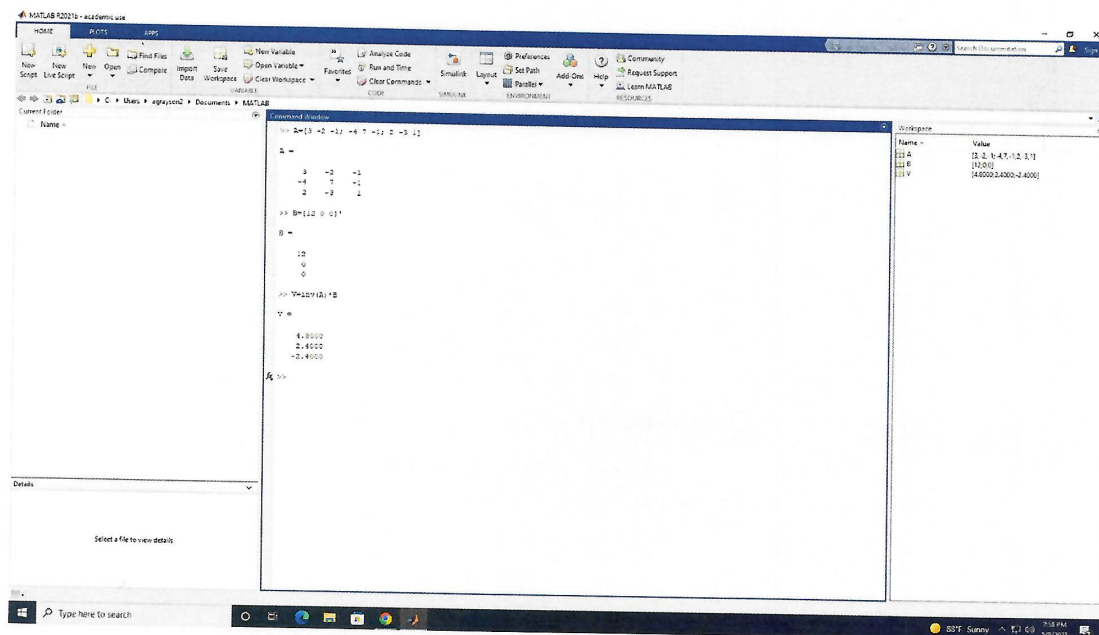
Professor John Fuller

05/10/2022

Network theory 1

Mesh and Nodal analysis using MATLAB

Nodal Analysis



The image shows a MATLAB R2021a Command Window and Workspace. The Command Window contains the following code and output:

```
>> A=[3 -2 -1; -4 5 -1; 2 -2 2]
A =
     3     -2     -1
    -4     5     -1
     2     -2     2

>> B=[12 0 0]'
B =
    12
     0
     0

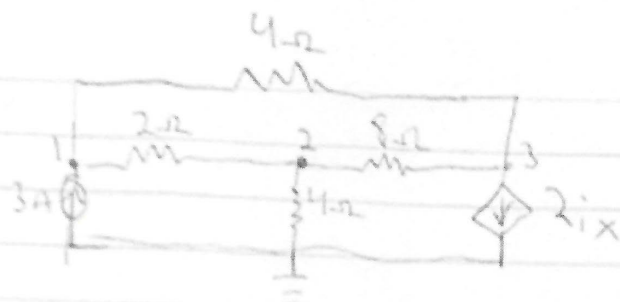
>> V=inv(A)*B
V =
    1.8000
    2.4000
   -2.4000
```

The Workspace shows the following variables:

Name	Value
A	3x3 double
B	3x1 double
V	3x1 double

Using MATLAB, we inputted the simulation equation into the window command and produced our answer. And to solve the problem we used nodal analysis on the circuit diagram which is shown below.

Nodal Analysis



$$\text{Node 1} \quad 4 \left(\frac{v_1 - v_3}{4\Omega} + 3 + \frac{v_1 - v_2}{2\Omega} \right) = 3$$

$$v_1 - v_3 - 12 + 2v_1 - 2v_2 = 0$$

$$3v_1 - 2v_2 - v_3 = 12$$

$$i_x = i_3$$

$$\text{Node 2} \quad 8 \left(\frac{v_2 - v_3}{8\Omega} + \frac{v_2}{4\Omega} + \frac{v_2 - v_1}{2\Omega} \right) = 0$$

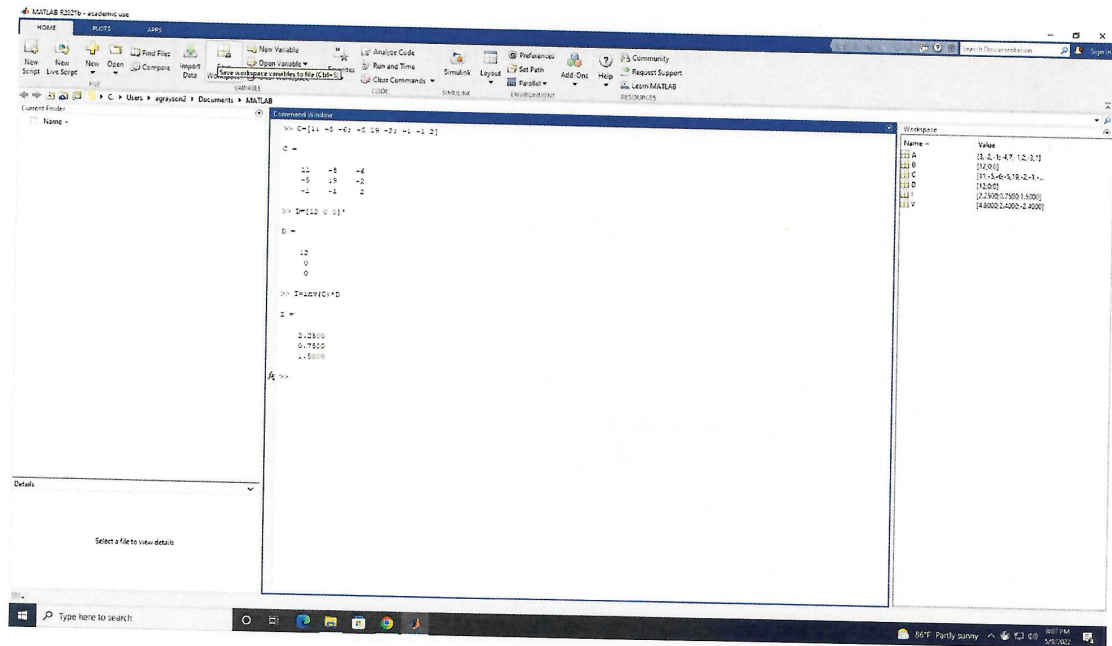
$$v_2 - v_3 + 2v_2 + 4v_2 - 4v_1 = 0$$

$$-4v_1 - v_3 + 7v_2 = 0$$

$$\text{Node 3} \quad 8 \left(\frac{v_3 - v_1}{4\Omega} + \frac{v_3 - v_2}{8\Omega} + 2i_x \right) = 0$$

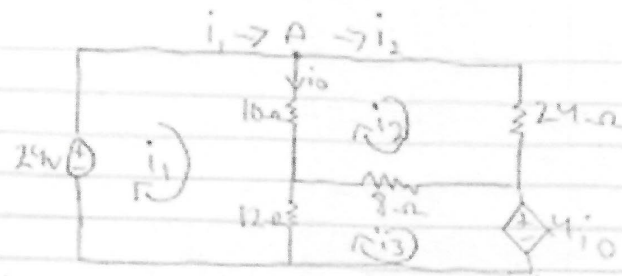
$$2v_3 - 2v_1 + v_3 - v_2 + 2$$

Mesh Analysis



Using MATLAB, we inputted the simulation equation into the window command and produced our answer. And to solve the problem we used Mesh analysis on the circuit diagram which is shown below.

Mesh Analysis



Mesh 1 i_1

$$24 = 10i_1 + 12i_1 - 10i_2 - 12i_3$$

$$\frac{24}{2} = \frac{22i_1 - 10i_2 - 12i_3}{2}$$

$$12 = 11i_1 - 5i_2 - 6i_3$$

Mesh 2 i_2

$$0 = 24i_2 + 4i_2 + 10i_2 - 10i_1 - 4i_3$$

$$0 = 38i_2 - 10i_1 - 4i_3$$

$$0 = -5i_1 + 19i_2 - 2i_3$$

Mesh 3 i_3

$$0 = 4i_3 + 12i_3 - 4i_1 - 12i_2 - 4i_3$$

$$0 = 16i_3 - 4i_1 - 12i_2 - 4i_3$$

$$0 = 12i_3 - 8i_1 - 8i_2$$

$$-i_1 - i_2 + 2i_3 = 0$$

$$\text{Matrix} \begin{bmatrix} 11 & -5 & -6 \\ -5 & 19 & -2 \\ -1 & -1 & 2 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 12 \\ 0 \\ 0 \end{bmatrix}$$

$$i_1 = 2.25A \quad i_2 = -1.75A \quad i_3 = 1.5A$$

Conclusion

In conclusion the whole point of this lab report is for us to familiarize ourselves with MATLAB so that in our future engineer classes we take, we'll be prepared to use the program. We also used it to help solve and compute simply node and mesh analysis problems that otherwise would take some time to do.

BELOW AVERAGE

ELEG 2305
Network Theory I
Midterm Exam

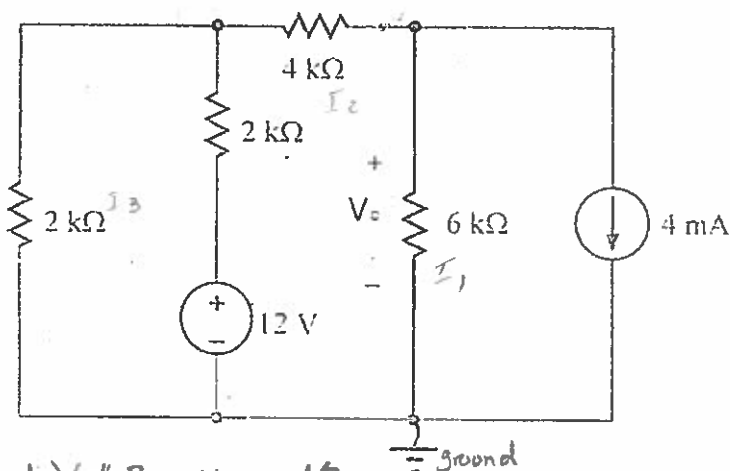
0/100

Name Jaylen Brown

Date 10-14-21

100 points

- (20) 1. Solve for the voltage V_o across the 6 kohm resistor in the following circuit using the node voltage method. Show all steps in deriving equations and solution.



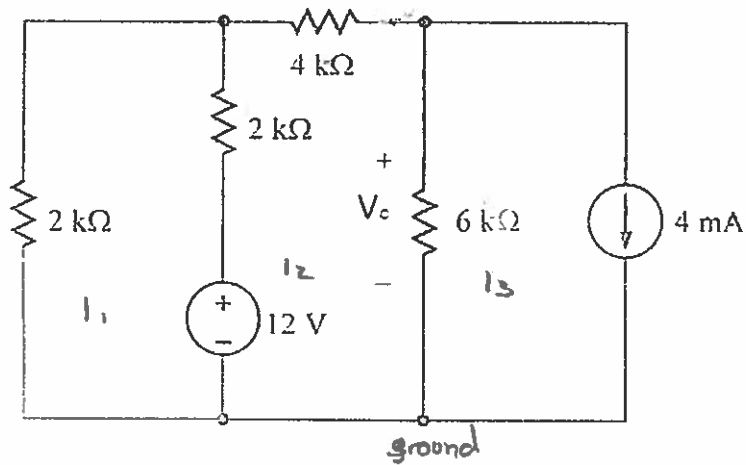
1.) $6k\Omega + 4 = 10$ ground

2.) $6k\Omega + 4k\Omega + 2k\Omega \cdot 12 = 10.24$ NOT IN SERIES

3.) $12V \cdot 2k\Omega + 2k\Omega = 12$?

-20

- 20 2. Solve for the Voltage V_o across the $6\text{ k}\Omega$ resistor in the following circuit using the Mesh Current method. Show all steps in deriving a solution.



$$I_1: 2\text{ k}\Omega + 6\text{ k}\Omega \cdot I_2 = 26$$

$$I_2: \cancel{2\text{ k}\Omega} + \cancel{4\text{ k}\Omega} + 6\text{ k}\Omega \cdot I_2 = 1$$

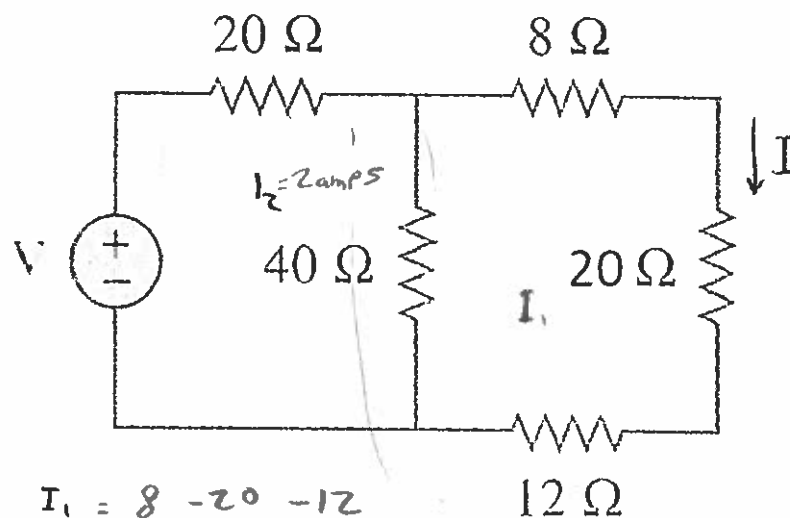
$$6 - 2 + 4 \cdot I_2 = 52$$

$$I_3: 4 - 6 \cdot I_2 = 24$$

} ??

-20

3. If the value of the current I in the following circuit is 2 Amps, what must be the value of the supply voltage V . Show all steps in deriving a solution.



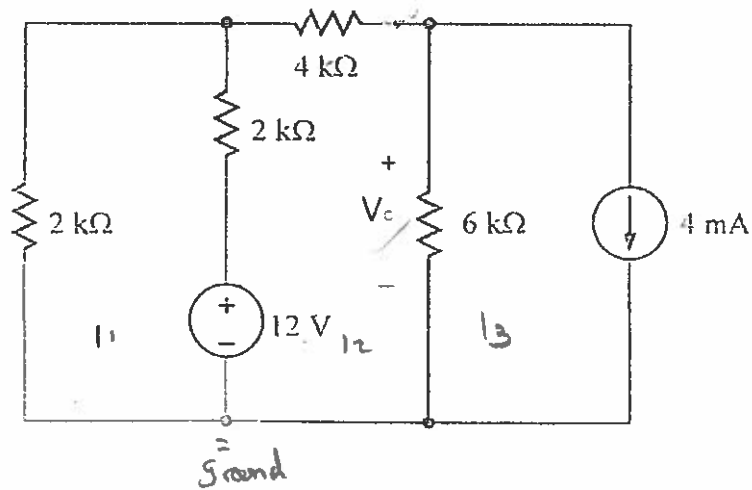
$$I_1 = 8 - 20 - 12 = -24$$

$$\frac{-24}{2} = -12 = 12\text{ volts}$$

$$I_2 = 20 - 40 = -10$$

-20

4. What is the value of the voltage V_o in the following circuit due to the 12 V voltage source.



$$1, 2 - 2 = 0$$

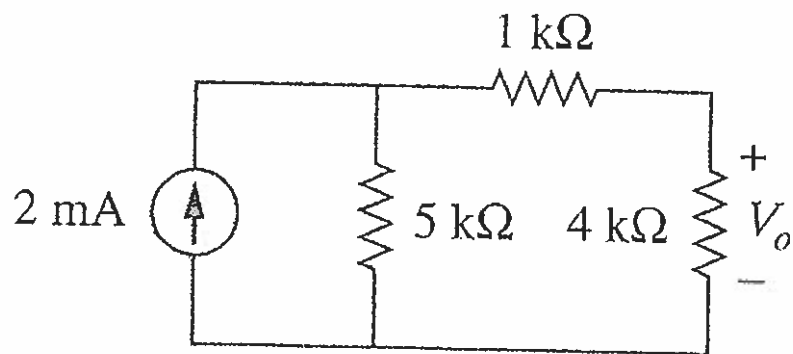
$$V_o = 1$$

$$12, 2 + 4 - 6 = 0$$

$$13, 2 + 4 - 6 = 0$$

-20

5. Solve for the value of the voltage V_o in the following circuit.



$$1 + 2 - 5 - 4 = -6 = \boxed{6 \text{ V}}$$

-20

**ELECTRICAL AND COMPUTER ENGINEERING
DEPARTMENT
OUTCOMES SPECIFIC ASSIGNMENT COVER SHEET
ELEG 2305 Network Theory 1
Fall 2021
Instructor: Dr. John Fuller**

Title of Assignment

Final Exam

Outcome Measured Using this Assignment

Outcome 1.2

Understanding the basic components and configuration of
components in circuit theory (Sources, R, L, C, RC, RL, RLC)

Check the complex engineering problem characteristics related to this assignment

Assignment problem	
	involves wide-ranging or conflicting technical issues,
	has no obvious solution
	Addresses problems not encompassed by current standards and codes
	involves diverse groups of stakeholders
X	includes many component parts or sub-problems
	involves multiple disciplines
	has significant consequences in a range of contexts
Assignment problem involves the application of the principles of	
X	engineering
X	science
X	mathematics

Briefly justification of why this assignment is suitable for this outcome

EXAM SOLUTION

ELEG 2305
NETWORK THEORY I
FINAL EXAM

NAME: KEY

Date: December 7, 2021 - 9:30 to 11:30am

Number of Problems: 8 problems

Score _____ (150 points maximum)

Closed notes and books, no cell phones should be visible, show all steps in deriving a solution, no in and out during test.

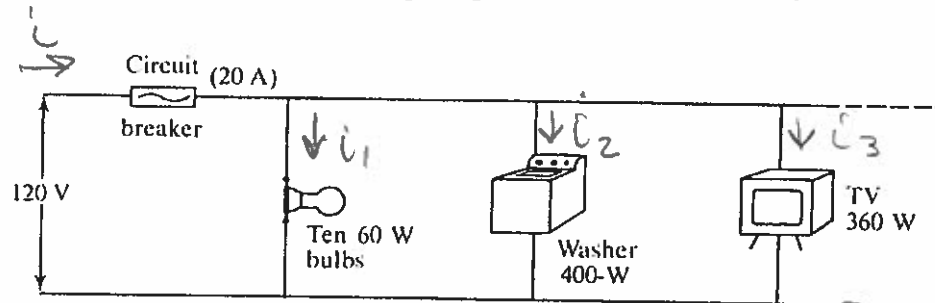
DEPARTMENT OF ELECTRICAL AND COMPUTER
ENGINEERING

ROY G. PERRY COLLEGE OF ENGINEERING

PRAIRIE VIEW A&M UNIVERSITY

NETWORK THEORY I

- (10) 1. Determine if the circuit breaker (20 amps max) is activated in the following circuit, when the light bulb draws $P_1 = 60$ watts, washer with $P_2 = 400$ watts and TV drawing $P_3 = 360$ watts. All receive voltage in parallel as shown. Show your work.



Note: circuit breaker has zero resistance

$$i = i_1 + i_2 + i_3$$

$$P = V i$$

$$i = \frac{P}{V}$$

All in Parallel
with 120V across

$$i_1 = \frac{600}{120} = 5A, \quad i_2 = \frac{400}{120} = 3.33A, \quad i_3 = \frac{360}{120} = 3A$$

$$i = i_1 + i_2 + i_3$$

$$i = 5 + 3.33 + 3$$

$$i = 11.33A$$

Breaker will not activate

- 20 2. Determine the value of the voltage V in the circuit of figure P-2.

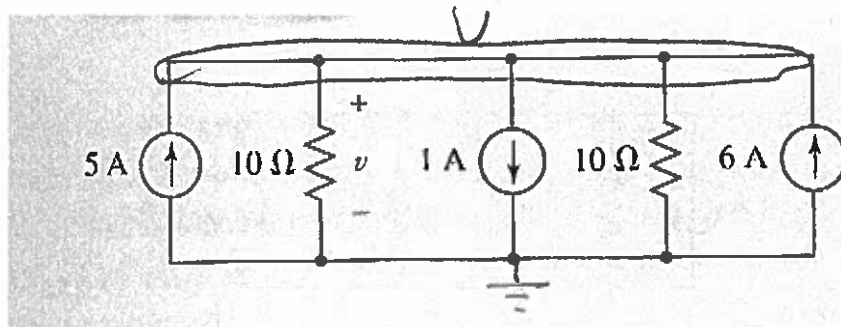


Figure P-2

$$\frac{V}{10} + \frac{V}{10} - 5 + 1 - 6 = 0$$

$$V + V - 50 + 10 - 60 = 0$$

$$2V = 100$$

$$V = 50V$$

- 20 3. Use superposition to find the value of the current i_2 due to the 0.5 amp source in the circuit of figure P-3

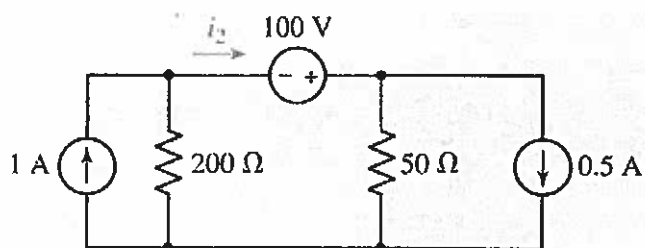
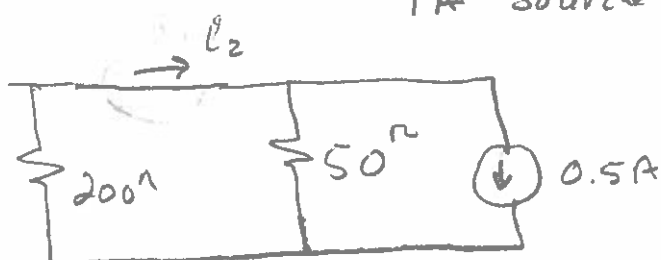


Figure P-3

100V source shorted
1A source opened

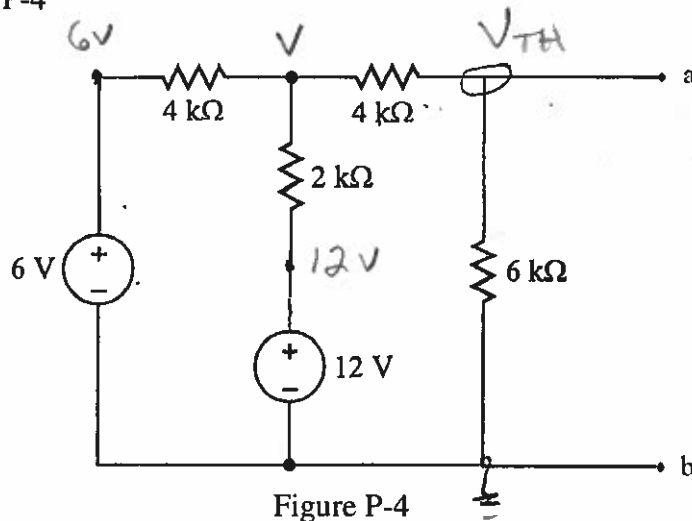


$$i_2' = \frac{0.5 \times 50}{200 + 50}$$

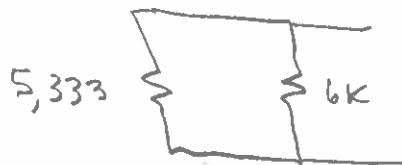
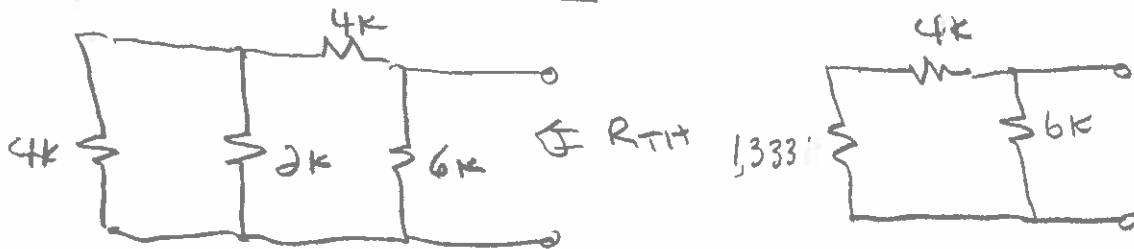
$$i_2' = \frac{25}{250}$$

$$i_2' = 0.1 \text{ A}$$

- 20 4. Find the Thevenin's equivalent circuit as seen at the a and b terminals for the circuit of figure P-4



THEVENIN'S RESISTANCE



$$R_{TH} = 2823 \Omega$$

THEVENIN VOLTAGE

$$\frac{V-6}{4k} + \frac{V-12}{2k} + \frac{V-V_{TH}}{4k} = 0$$

$$V-6 + 2V-24 + V-V_{TH} = 0$$

$$-V_{TH} + 4V = 30$$

$$-V_{TH} + 4\left(\frac{5}{3}V_{TH}\right) = 30$$

$$-V_{TH} + 6.67V_{TH} = 30$$

$$5.67V_{TH} = 30$$

$$V_{TH} = \frac{30}{5.67} = 5.29V$$

$$\frac{V_{TH}}{6k} + \frac{V_{TH}-V}{4k} = 0$$

$$2V_{TH} + 3V_{TH} - 3V = 0$$

$$5V_{TH} - 3V = 0$$

$$3V = 5V_{TH}$$

$$V = \frac{5}{3}V_{TH}$$

5. a) Determine the value of the output voltage V_{out} in the Op-Amp circuit of figure P-5.

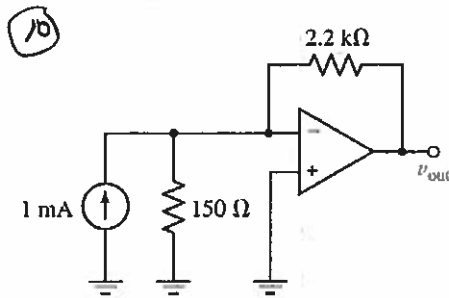
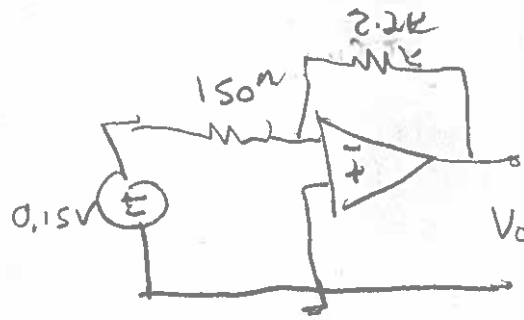


Figure P-5



$$V_O = -V_{IN} \frac{R_F}{R_{IN}}$$

$$V_O = 0.15 \left(\frac{2,200}{150} \right)$$

$$V_O = -2.2 \text{ V}$$

- 10 b) Find the load voltage V_L in the cascaded Op Amp circuit of Figure P-6,

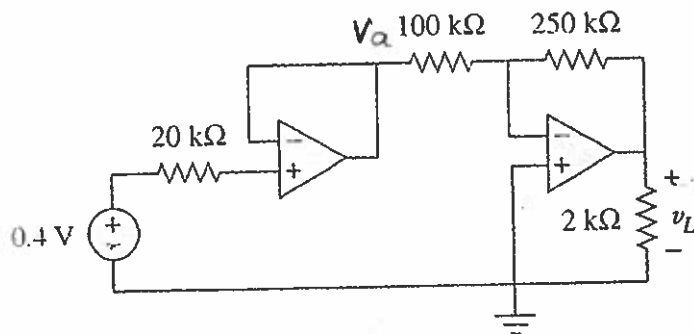


Figure P-6

$$V_a = 0.4 \left(\frac{100 \text{ k}\Omega}{20 \text{ k}\Omega} \right) = 2 \text{ V} \quad V_a = 0.4$$

$$V_L = 0.4 \left(\frac{250 \text{ k}\Omega}{100 \text{ k}\Omega} \right) = -1 \text{ V}$$

6. a) Solve for the equivalent capacitance of the circuit of figure P-7:

(10)

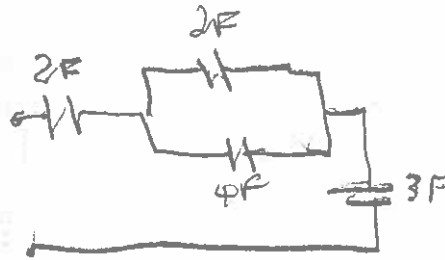
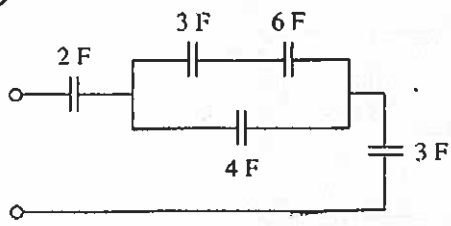
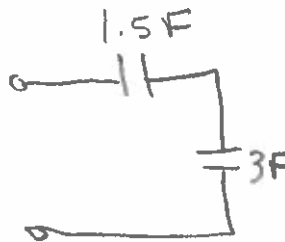
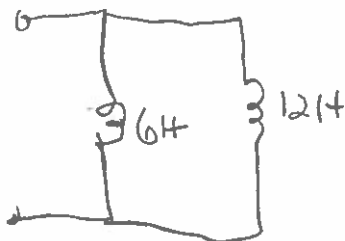
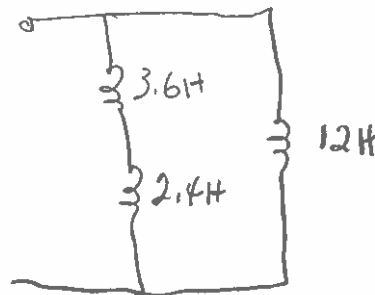
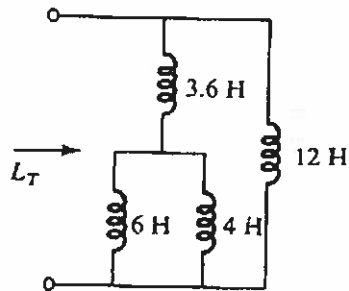


Figure P-7



b) Solve for the equivalent inductance L_T for the following circuit as seen at the input terminals

(10)



- 20 7. The voltage V_o of figure P-8 is 6 volts. What is the value of the supply voltage V_s .

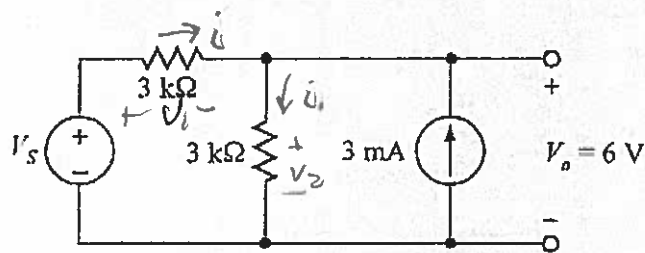


Figure P-8

$$i_1 = \frac{6}{3k} = 2\text{mA}$$

$$i + 3\text{mA} - i_2 = 0 \quad i = 2\text{mA} - 3\text{mA} = -1\text{mA}$$

$$V_s = V_1 + V_2$$

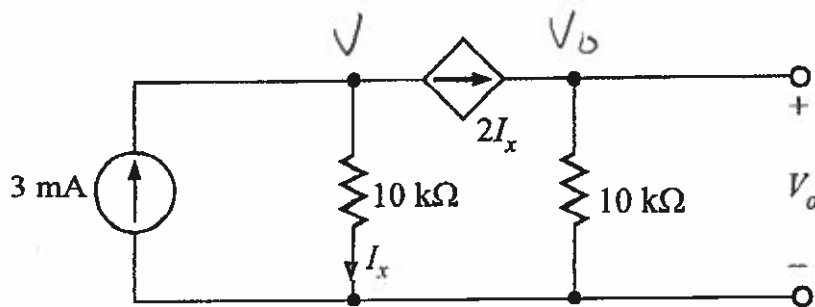
$$V_1 = 1\text{mA} \times 3k = 3\text{V}$$

$$V_2 = 2\text{mA} \times 3k = 6\text{V}$$

$$V_s = 3\text{V} + 6\text{V}$$

$$V_s = 9\text{V}$$

20. 8. Solve for the value of the output voltage V_o in the following circuit.



$$\frac{V}{10k} - 3mA + 2I_x = 0$$

$$\frac{V_o}{10k} - 2I_x = 0$$

$$I_x = \frac{V}{10k}$$

$$\frac{V}{10k} - 3mA + 2\left(\frac{V}{10k}\right) = 0$$

$$\frac{V_o}{10k} - 2\left(\frac{V}{10k}\right) = 0$$

$$V - 30 + 2V = 0$$

$$V_o - 2V = 0$$

$$3V = 30$$

$$V = 10$$

$$V_o - 2(10) = 0$$

$$V_o = 20$$



Sample of Student Work

ABOVE AVERAGE

ELEG 2305
NETWORK THEORY I
FINAL EXAM

131
150

NAME: Faisal Ahmed

Date: December 7, 2021 - 9:30 to 11:30am

Number of Problems: 8 problems

Score _____ (150 points maximum)

Closed notes and books, no cell phones should be visible, show all steps in deriving a solution, no in and out during test.

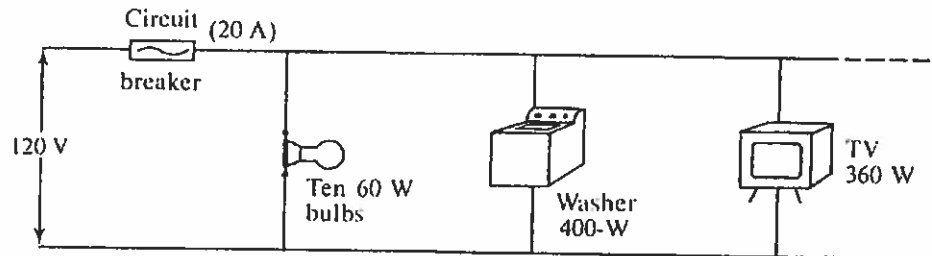
DEPARTMENT OF ELECTRICAL AND COMPUTER
ENGINEERING

ROY G. PERRY COLLEGE OF ENGINEERING

PRAIRIE VIEW A&M UNIVERSITY

NETWORK THEORY I

- (10) 1. Determine if the circuit breaker (20 amps max) is activated in the following circuit, when the light bulb draws $P_1 = 60$ watts, washer with $P_2 = 400$ watts and TV drawing $P_3 = 360$ watts. All receive voltage in parallel as shown. Show your work.



Note: circuit breaker has zero resistance

for $P_1 = 60W$

$$I_1 = \frac{P_1}{V} = \frac{60}{120} = 0.5A$$

for P_2

$$I_2 = \frac{P_2}{V} = \frac{400}{120} = 3.33A$$

for P_3

$$I_3 = \frac{P_3}{V} = \frac{360}{120} = 3A$$

Now

$$I_1 + I_2 + I_3 = 6.83A$$

$$I > I_1 + I_2 + I_3$$

therefore 20A is a circuit breaker

- 20 2. Determine the value of the voltage V in the circuit of figure P-2.

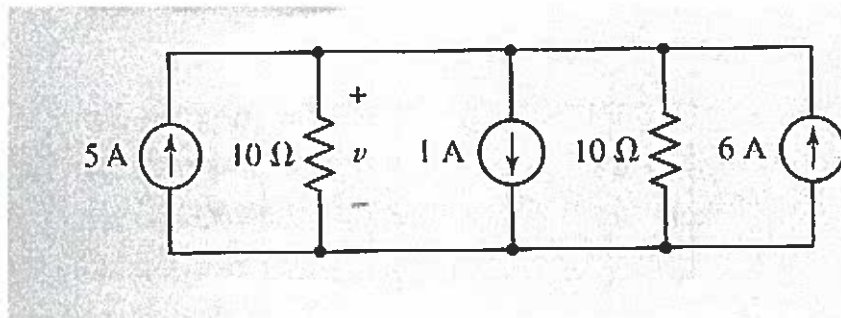
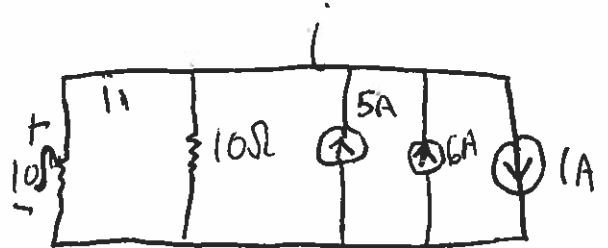


Figure P-2



Current $i = 5 + 6 - 1 = 10A$

$$I_1 = \frac{10 \times 10}{10 + 10} = 5A$$

So $V = (5)(10) = \boxed{50V}$ ~~$V = iR$~~ $V = iR$ ✓

- 20 3. Use superposition to find the value of the current i_2 due to the 0.5 amp source in the circuit of figure P-3

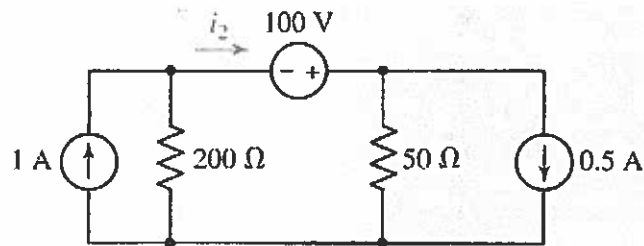
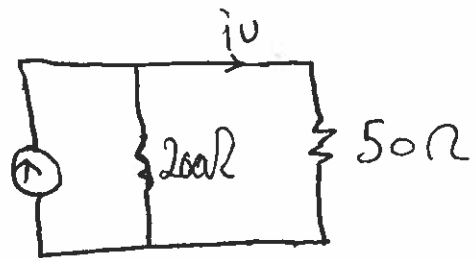
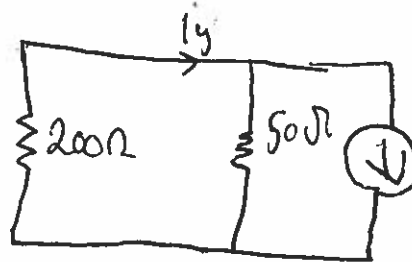


Figure P-3



$$i_X = \frac{200 \times 1}{200 + 50} = 0.8 \text{ A}$$

For source 0.5



$$i_Y = \frac{(0.5)(50)}{50 + 200} = 0.1 \text{ A}$$

For source 100

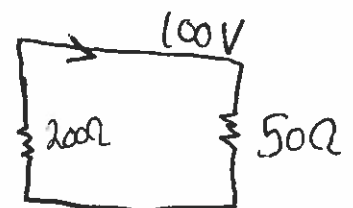
$$i = \frac{100 \text{ V}}{(250 + 50 \Omega)}$$

$$i = 0.333 \text{ A}$$

$$i_2 = i_X + i_Y + i_2$$

$$i_2 = 0.8 + 0.1 + 0.33$$

$$i_2 = 1.233 \text{ A}$$



- 20 4. Find the Thevenin's equivalent circuit as seen at the a and b terminals for the circuit of figure P-4

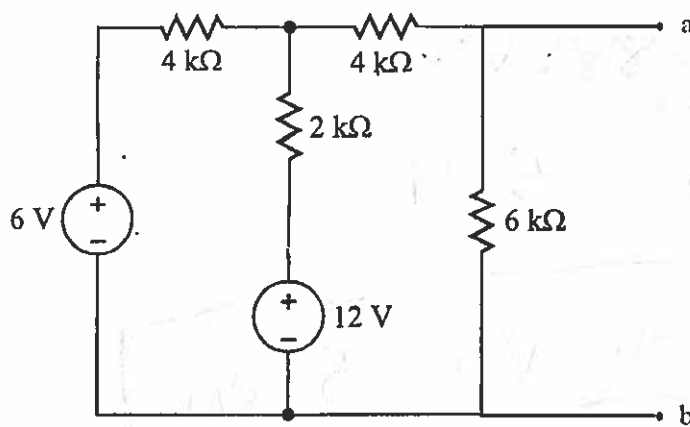
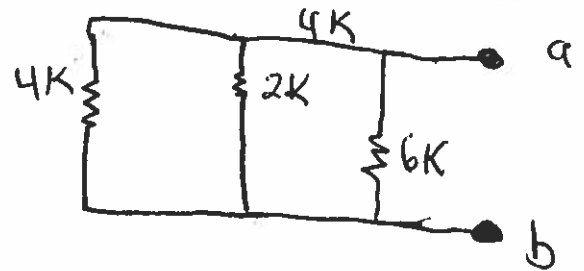


Figure P-4



$$R_{th} = \frac{\left[\left(\frac{4 \times 2}{4+2} \right) + 4 \right] \times 6}{\frac{4 \times 2 + 4 \times 6}{4+2}}$$

$$R_{th} = \boxed{6.004 \text{ K}\Omega} \times -2$$

for V_{th}

$$\frac{6 - V_A}{4} + \frac{12 - V_A}{2} = \frac{V_A}{4}$$

$$6 - V_A + 24 - 2V_A = V_A - V_{ob}$$

$$30 = 4V_A - V_{ob} \quad (1)$$

for Node

$$\frac{V_A - V_{ob}}{4} = \frac{V_{ob}}{6}$$

$$3V_A - 3V_{ob} = 2V_{ob}$$

$$3V_A = 5V_{ob}$$

Test on back

5. a) Determine the value of the output voltage V_{out} in the Op-Amp circuit of figure P-5.

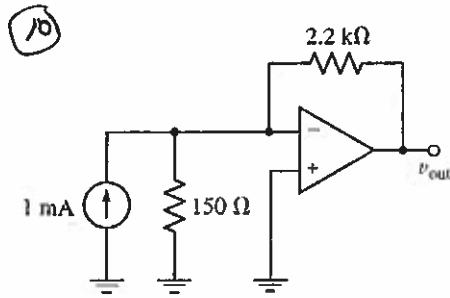


Figure P-5

$$V = 1 \times 10^{-3} \times 150$$

$$V = 0.15V$$

By Node theorem at 1

$$\frac{0.15 - 0}{150} = \frac{0 - V_{out}}{2.2 \times 10^3}$$

$$V_{out} = -2.2V$$

- b) Find the load voltage V_L in the cascaded Op Amp circuit of Figure P-6,

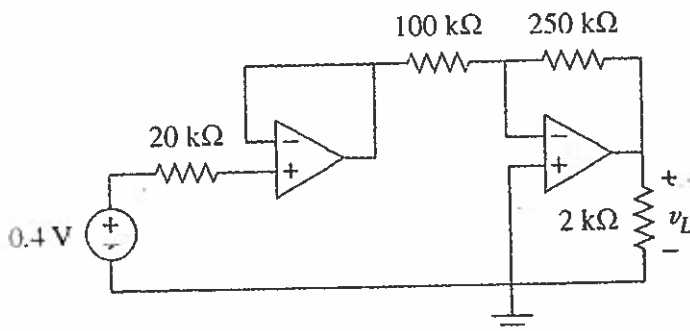
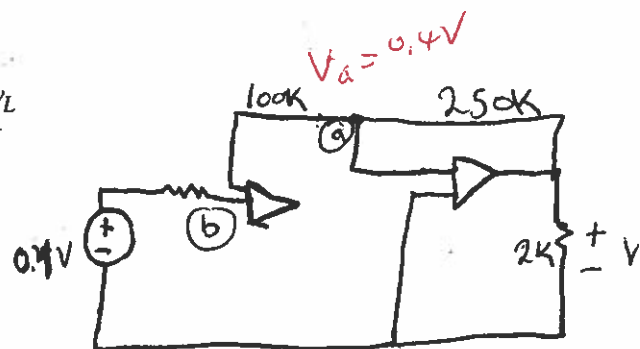


Figure P-6



$$\frac{V_b - 0.4}{20k\Omega} = 0$$

Node theorem

$$\frac{0 - 0.4}{100k} + \frac{0 - V_L}{250k} = 0$$

$$V_L = \frac{0.4}{100} \times 250$$

$$V_L = -1V$$

6. a) Solve for the equivalent capacitance of the circuit of figure P-7:

(10)

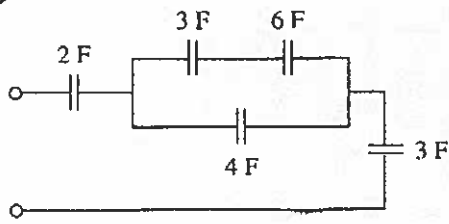
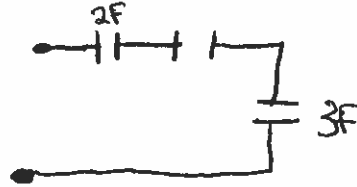


Figure P-7

$$C_x = \frac{3 \times 6}{3 + 6} + 4 = 6 \text{ F}$$

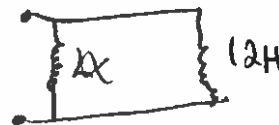
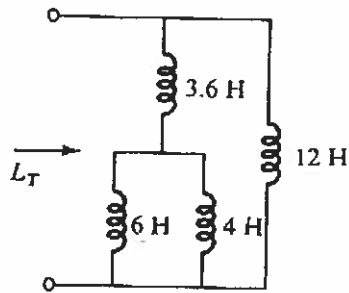


$$\frac{1}{C_{eq}} = \frac{1}{2} + \frac{1}{6} + \frac{1}{3}$$

$$C_{eq} = \frac{6}{3 + 1 + 2} = \boxed{1 \text{ F}}$$

b) Solve for the equivalent inductance L_T for the following circuit as seen at the input terminals

(10)



$$L_x = \frac{6 \times 4}{6 + 4} + 3.6 = 6 \text{ H}$$

So

$$L_{eq} = \frac{6 \times 12}{6 + 12} = \boxed{4 \text{ H}}$$

7. The voltage V_o of figure P-8 is 6 volts. What is the value of the supply voltage V_s .

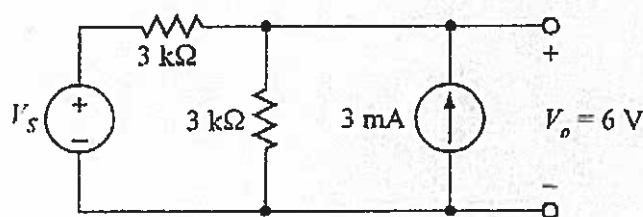


Figure P-8

~~scribbled out text~~

6

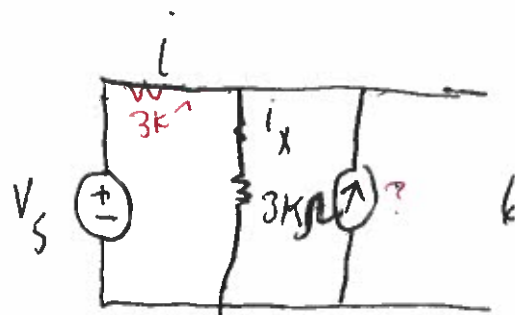
$$i_x = \frac{6V}{3k\Omega} = 2mA$$

So,

$$i + i_x = 3mA$$

$$i = 3 - 2$$

$$i = 1mA$$

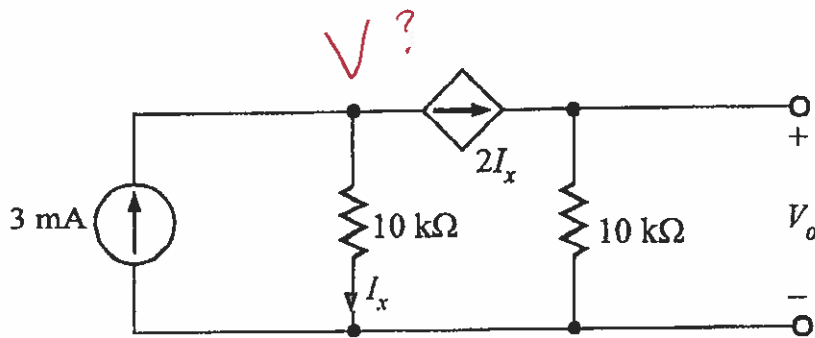


So

$$V_s = (-1mA)(3k\Omega) \quad \times \quad ?$$

$$V_s = 3V \quad \times$$

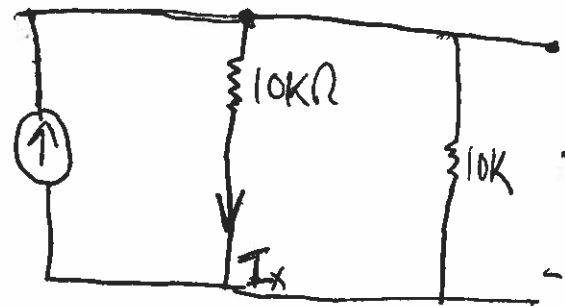
20. 8. Solve for the value of the output voltage V_o in the following circuit.



$$3 = \frac{V}{10} + 2I_x \quad \checkmark$$

$$\text{or } 3 = I_x + 2I_x$$

$$I_x = 1 \text{ mA}$$



Now

$$V_o = 10(2I_x) \quad \text{by KVL}$$

$$V_o = 10(2)(1)$$

$$\boxed{V_o = 20 \text{ V}}$$

$$\frac{V_o}{10K} - 2I_x = 0$$

- 4



10

4



AVERAGE

ELEG 2305
NETWORK THEORY I
FINAL EXAM

114
150

NAME: Kerln Medenwald

Date: December 7, 2021 - 9:30 to 11:30am

Number of Problems: 8 problems

Score _____ (150 points maximum)

Closed notes and books, no cell phones should be visible, show all steps in deriving a solution, no in and out during test.

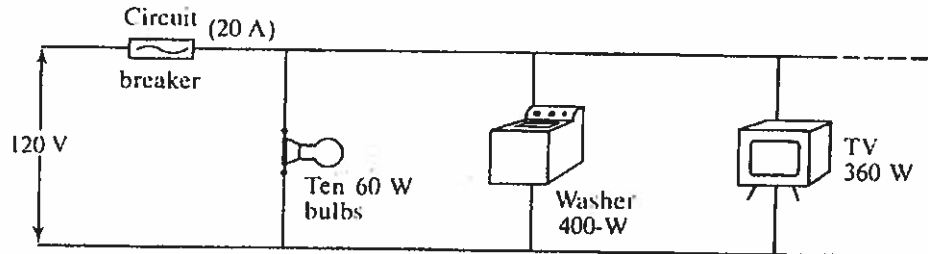
DEPARTMENT OF ELECTRICAL AND COMPUTER
ENGINEERING

ROY G. PERRY COLLEGE OF ENGINEERING

PRAIRIE VIEW A&M UNIVERSITY

NETWORK THEORY I

- (10) 1. Determine if the circuit breaker (20 amps max) is activated in the following circuit, when the light bulb draws $P_1 = 60$ watts, washer with $P_2 = 400$ watts and TV drawing $P_3 = 360$ watts. All receive voltage in parallel as shown. Show your work.



Note: circuit breaker has zero resistance

$$P = VI$$

$$600 = 120 \cdot I_1$$

$$I_1 = 5 \text{ A}$$

$$5 \text{ A} + 3 \text{ A} + 3 \text{ A} = 11.33 \text{ A} < 20 \text{ A}$$

$$400 = 120 \cdot I_2$$

$$I_2 = 3.33 \text{ A}$$

$$360 = 120 \cdot I_3$$

$$I_3 = 3 \text{ A}$$

circuit breaker not activated
✓

- 20 2. Determine the value of the voltage V in the circuit of figure P-2.

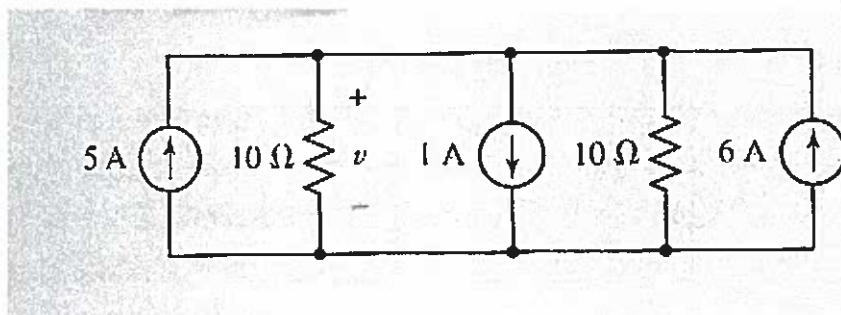
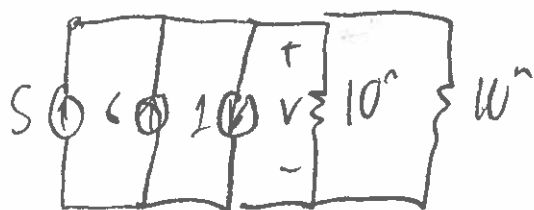


Figure P-2

$$5/6 - 1 = 0$$



$$\frac{10A \cdot 10\Omega}{20\Omega} = 5A$$

$$I \cdot R = V$$

$$5A \cdot 10\Omega = 50V$$



3. Use superposition to find the value of the current i_2 due to the 0.5 amp source in the circuit of figure P-3

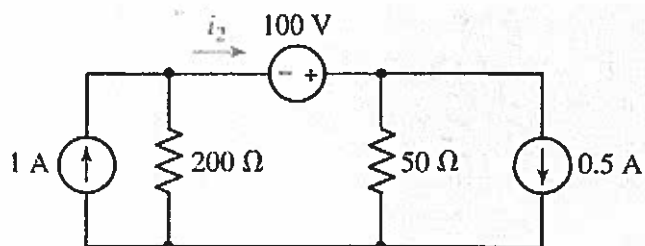
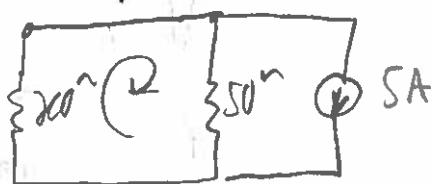


Figure P-3



$$200i_2 + 50i_2 - 50i_0 = 0$$

$$i_0 = 0.5A$$

$$250i_2 - 25 = 0$$

$$250i_2 = 25$$

$$i_2 = \frac{25}{250}$$

$$i_2 = 10A$$

- 20 4. Find the Thevenin's equivalent circuit as seen at the a and b terminals for the circuit of figure P-4

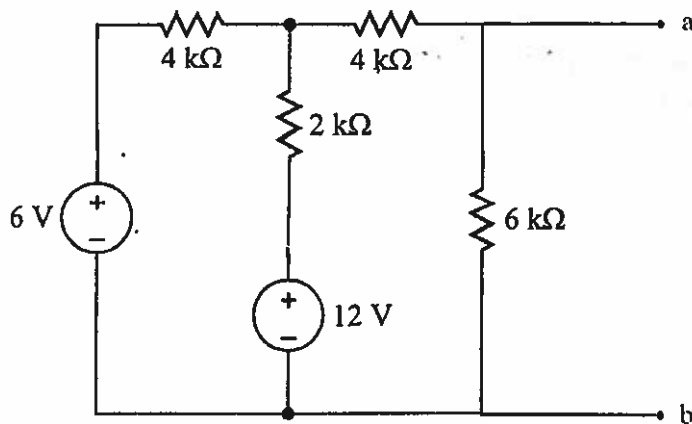
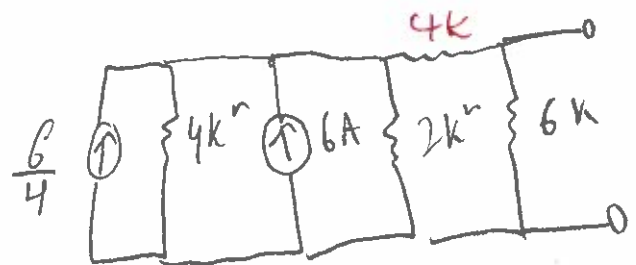
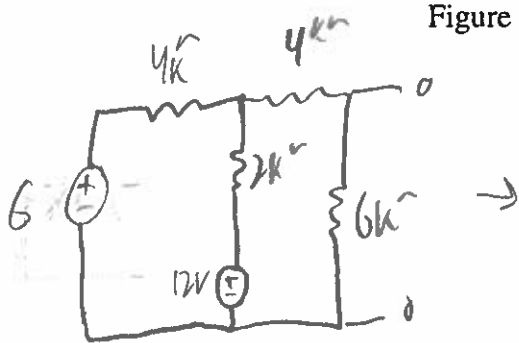
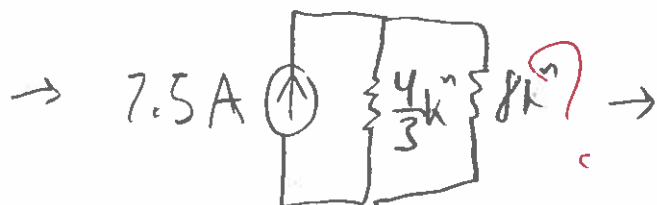


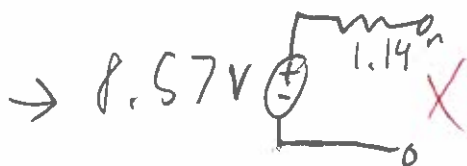
Figure P-4



$$\frac{6}{4} \text{ A} = 1.5 \quad \frac{4 \cdot 2}{6} = \frac{4}{3} \quad \frac{6+2}{3}$$



$$7.5 \times \left(\frac{8 \cdot \frac{4}{3}}{8 + \frac{4}{3}} \right) = 7.5 \cdot \frac{10.6}{9.33} = 8.57$$



— 10

5. a) Determine the value of the output voltage V_{out} in the Op-Amp circuit of figure P-5.

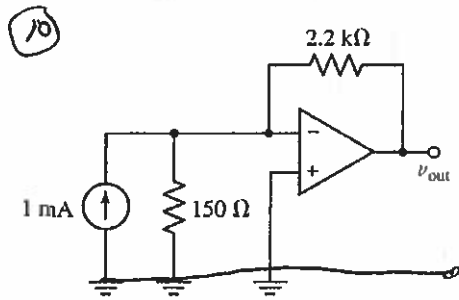
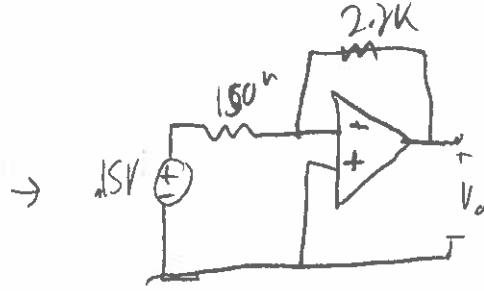


Figure P-5



$$V_o = -V_i \cdot \left(\frac{R_f}{R_i} \right) = -15 \cdot \left(\frac{2.2}{.15} \right) = -2.2$$

- 10 b) Find the load voltage V_L in the cascaded Op Amp circuit of Figure P-6,

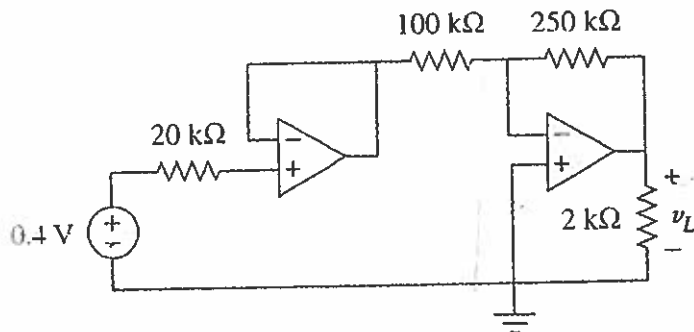


Figure P-6

$$\frac{.4 \cdot 100}{120} = .33V \quad \text{X} \quad 10$$

6. a) Solve for the equivalent capacitance of the circuit of figure P-7:

(10)

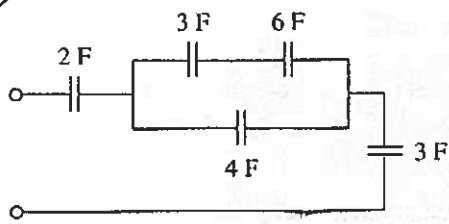


Figure P-7

Should show
reduced circuit?

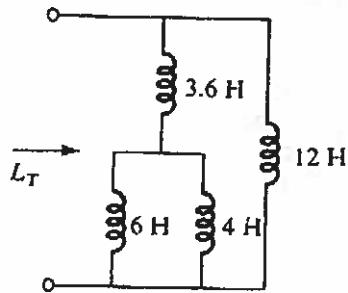
$$\left(\frac{3 \cdot 6}{9} = 2 + 4 = \frac{6 \cdot 2}{8} = \frac{3 \cdot 3}{2} = \right)$$

$$\frac{9}{2} \div \frac{9}{2} = 1 = C_{eq}$$

3

b) Solve for the equivalent inductance L_T for the following circuit as seen at the input terminals

(10)



$$\frac{6 \cdot 4}{10} = 2.4 + 3.6 = \frac{6 \cdot 12}{18} = 4 = L_T$$

SHOW IN STEPS

20) 7. The voltage V_o of figure P-8 is 6 volts. What is the value of the supply voltage V_s .

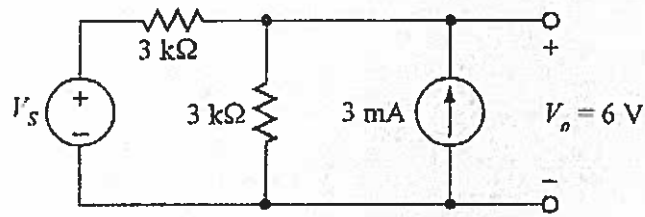
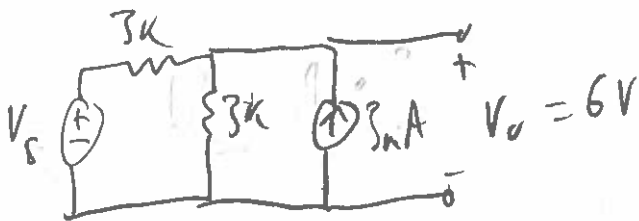
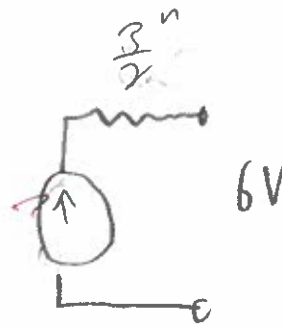


Figure P-8



$$\frac{V_s + 9}{3}$$



$$\frac{5.3}{6} = \frac{3}{2}$$

$$\frac{V_s + 9}{3} \cdot \frac{3}{2} = 6$$

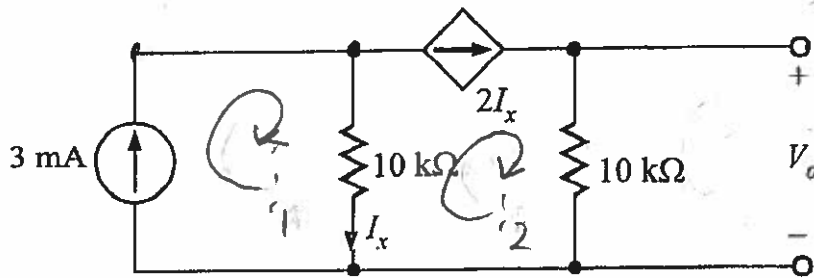
$$V_s + 9 = 12$$

$$V_s = 3V$$

$$V_s = 3V$$

-7

20. 8. Solve for the value of the output voltage V_o in the following circuit.



$$I_x = i_1 - i_2$$

$$i_1 = 3 \text{ mA}$$

$$i_2 = 10k i_2 - 10k i_1 - 2i_x + 10k i_2 = 0$$

$$20k i_2 - 10k i_1 - 2(i_1 - i_2) = 0$$

$$(20k + 2) i_2 - (10k + 2) i_1 = 0$$

$$i_2 = \left(\frac{10k + 2}{20k + 2} \right) \cdot 3 \text{ mA}$$

$$i_2 = 1.5 \text{ mA}$$

$$I_1 - I_2$$

$$3 - 1.5 = 1.5 \text{ A}$$

$$10k \times 1.5 \text{ A} = 15 \text{ V}$$

$$15 \text{ V} = V_o$$



BELOW AVERAGE

ELEG 2305
NETWORK THEORY I
FINAL EXAM

47
150

NAME: Nicholas Gregoire

Date: December 7, 2021 - 9:30 to 11:30am

Number of Problems: 8 problems

Score _____ (150 points maximum)

Closed notes and books, no cell phones should be visible, show all steps in deriving a solution, no in and out during test.

DEPARTMENT OF ELECTRICAL AND COMPUTER
ENGINEERING

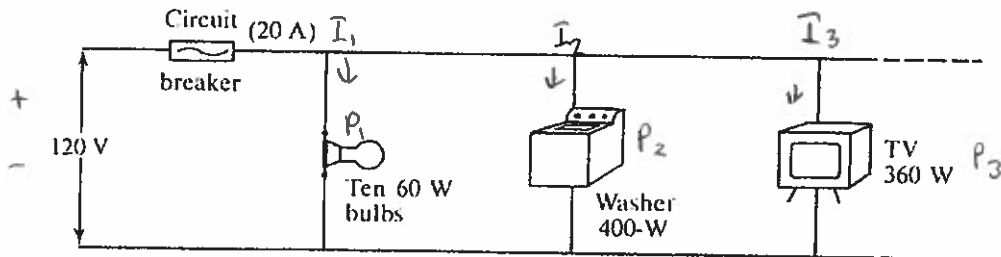
ROY G. PERRY COLLEGE OF ENGINEERING

PRAIRIE VIEW A&M UNIVERSITY

$$P = \frac{V^2}{R} \quad P = I^2 R$$

NETWORK THEORY I

- (10) 1. Determine if the circuit breaker (20 amps max) is activated in the following circuit, when the light bulb draws $P_1 = 60$ watts, washer with $P_2 = 400$ watts and TV drawing $P_3 = 360$ watts. All receive voltage in parallel as shown. Show your work.



Note: circuit breaker has zero resistance

$$P_1 = 600 = \frac{120^2}{R} = 60R = 120^2 \quad R = 24\Omega$$

$$400 = \frac{120^2}{R} = 400 = 120^2 \quad R = 36\Omega$$

$$R = 40\Omega$$

$$CB. \leq 20A \quad I_S = I_1 + I_2 + I_3$$

$$5 + 3.33 + 3$$

$$I_S = 11.83$$

Circuit Breaker will be activated since the total Amperage doesn't exceed the 20A max. Limit.

just the opposite

2

- 20 2. Determine the value of the voltage V in the circuit of figure P-2.

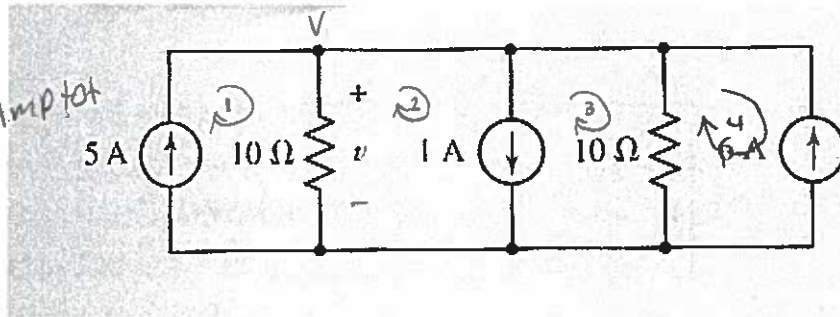
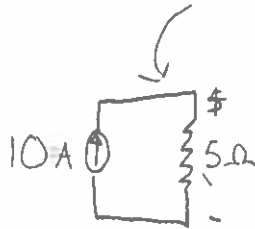
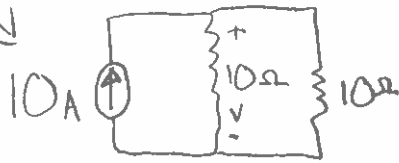


Figure P-2

$$5 - 1 + 6A = 10A \text{ total}$$



$$V = 50V$$

$$5 + 10i_1 - 10i_2 = 0$$

$$10i_2 - 10i_3 + 1 = 0$$

$$-1 + 10i_3 + 10i_4 = 0$$

$$10i_4 - 10i_3 - 4 = 0$$

$$i_3 - i_4 = \frac{1}{10}$$

$$\textcircled{A} 60$$

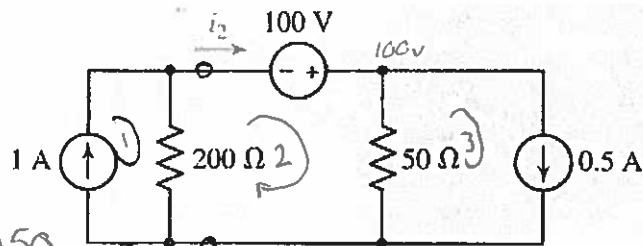
$$\frac{1}{2} + 1R_1 = 1R_2$$

$$10R_2 - 10R_1 = -1$$

$$10R_2 = 5 + 10R_1$$

3. Use superposition to find the value of the current i_2 due to the 0.5 amp source in the circuit of figure P-3

$$I_1 = 1A$$



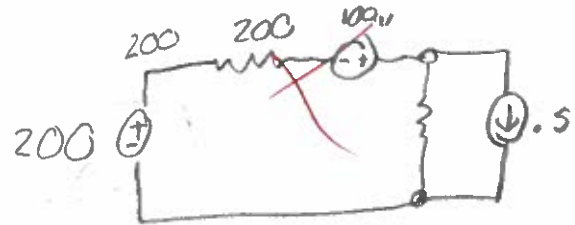
$$200I_2 - 200I_1 + 100V + 50I_2 - 50I_3 = 0$$

$$250I_2 - 200A + 100V \quad \text{Figure P-3}$$

$$250I_2 - 300A + 100V$$

$$I_3 = -0.5A + 50I_3 - 50I_2$$

$$= -100A - 50I_2 + 50I_3$$



$$\frac{100}{200} + \frac{V - 100}{50} = 0$$

$$100 + 4V - 400 = 0$$

$$4V = 300$$

$$\frac{200}{200} + \frac{200 - 100}{200} + \frac{100 - V}{50} = 0$$

$$200 + 200 - 100 + 400 - 4V = 0$$

$$\frac{V - 100}{50} = 0$$

$$700 - 4V = 0$$

$$\frac{4V}{4} = \frac{700}{4}$$

$$V = 175$$

$$\frac{V - 100}{50}$$

$$\frac{175 - 100}{50} = I = 1.5$$

$$1.5 = I_1 + I_2 + I_3$$

$$1 + I_2 + 0.5$$

$$I_2 = 0A$$

- 20 4. Find the Thevenin's equivalent circuit as seen at the a and b terminals for the circuit of figure P-4

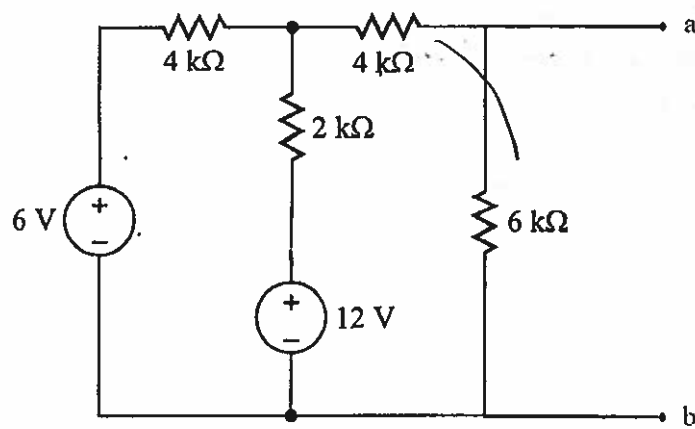
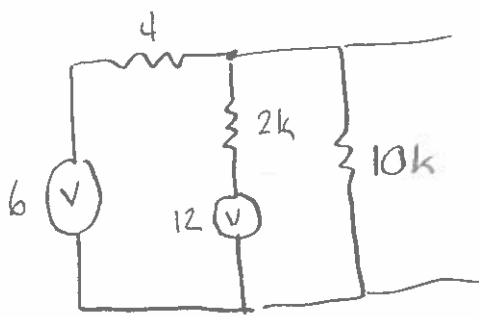


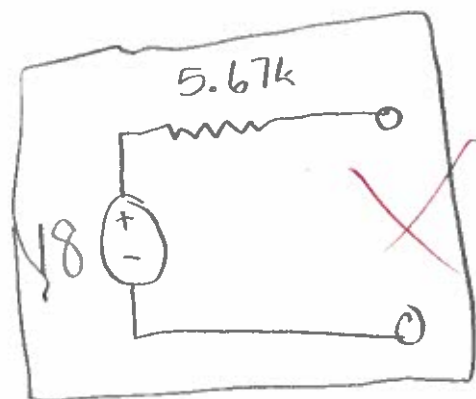
Figure P-4



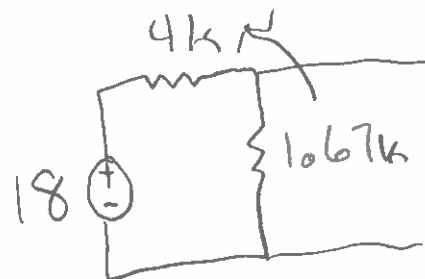
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- 20

5. a) Determine the value of the output voltage V_{out} in the Op-Amp circuit of figure P-5.

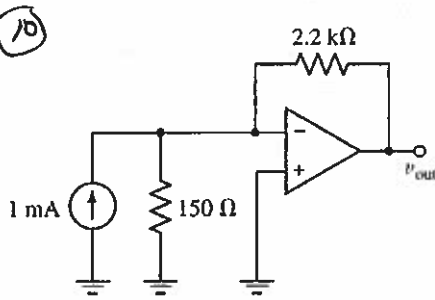


Figure P-5

~~$-0.15 \times \frac{2.2k}{150}$~~

~~$(1 \times 10^{-3})(2.2 \times 10^3) ???$~~

$V_{out} = 2.2V$

???

6

- b) Find the load voltage V_L in the cascaded Op Amp circuit of Figure P-6,

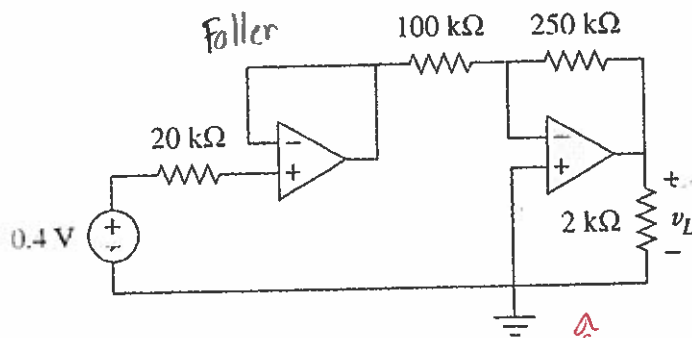


Figure P-6

↑ inverting op amp

10

$-0.4 + \left(1 + \frac{1}{100k}\right)$

$-0.4 + 1.001 = V_L = 0.6001$

6. a) Solve for the equivalent capacitance of the circuit of figure P-7:

(10)

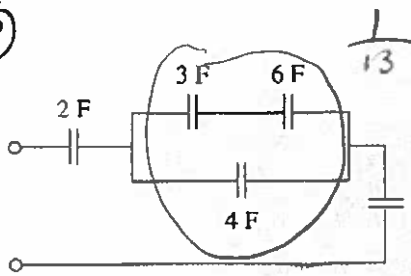


Figure P-7

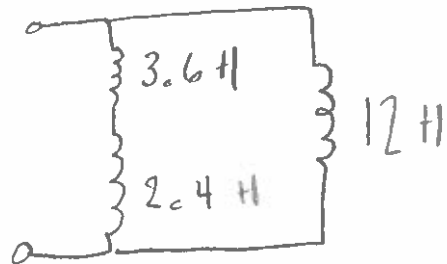
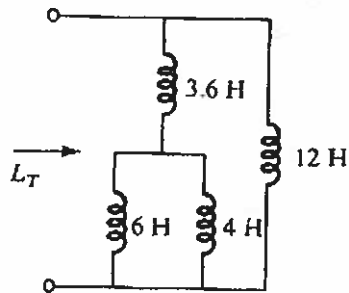
$$= 2F \cdot \frac{1}{13} = \frac{27}{13} + \frac{39}{13}$$

$$C_{eq} = \frac{66}{13}$$

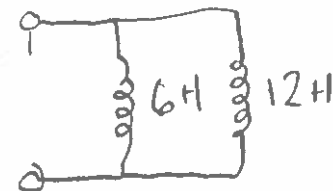
10

b) Solve for the equivalent inductance L_T for the following circuit as seen at the input terminals

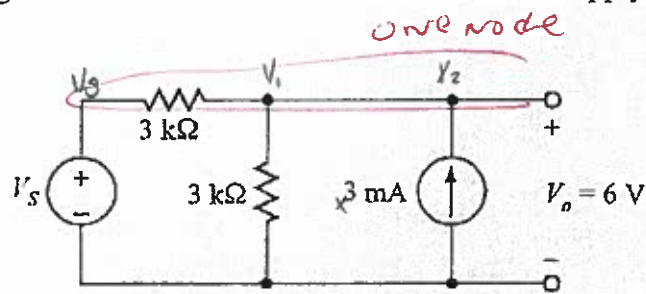
(10)



$$L_T = 4H$$



20) 7. The voltage V_o of figure P-8 is 6 volts. What is the value of the supply voltage V_s .



$$V_s = \cancel{4000\text{V}}$$

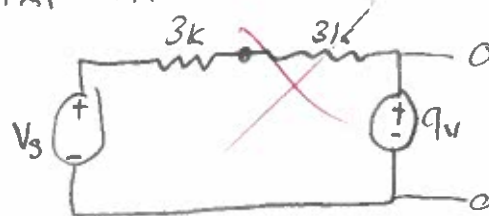
Figure P-8

$$V_o + 3k_1 + 3k_1 - 3k_2 = 0$$

$$3k_2 - 3k_1 - 3\text{mA} = 0$$

$$3k_2 = +3k_1 + 3\text{mA}$$

$$V_s + 9k_1 + 3\text{mA} = 0$$



$$V_o = 6\text{V}$$

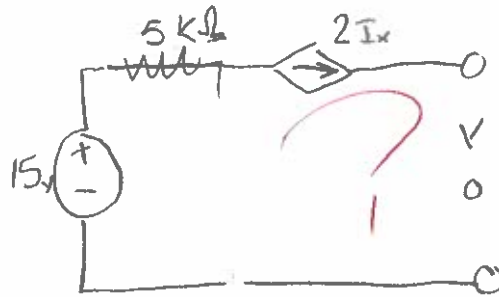
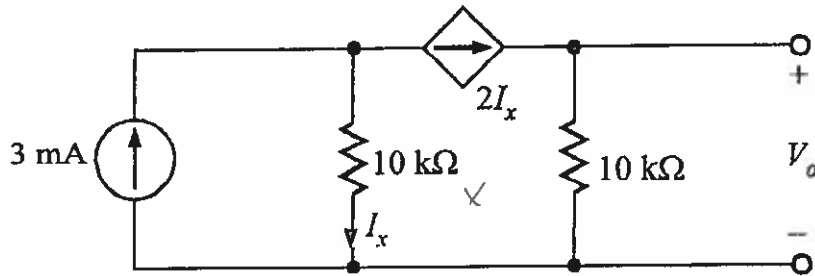
$$\frac{V_s}{3k} + \frac{V_s - V_1}{6k} + \frac{V_1}{3k}$$

$$\frac{9\text{V} + V_s}{6k} = \frac{V_o}{3k}$$

— 20

20

8. Solve for the value of the output voltage V_o in the following circuit.



$V_o = 30\text{V}$

— 20

ASSIGNMENTS FOR OUTCOME 1.3

Knowledge of solving circuits problems using software packages

**ELECTRICAL AND COMPUTER ENGINEERING
DEPARTMENT
OUTCOMES SPECIFIC ASSIGNMENT COVER SHEET
ELEG 2305 Network Theory 1
Fall 2021
Instructor: Dr. John Fuller**

Title of Assignment

Op Amp Problem

Outcome Measured Using this Assignment

Outcome

Knowledge of solving circuits problems using software packages

Check the complex engineering problem characteristics related to this assignment

Assignment problem	
	involves wide-ranging or conflicting technical issues,
X	has no obvious solution
	Addresses problems not encompassed by current standards and codes
	involves diverse groups of stakeholders
X	includes many component parts or sub-problems
	involves multiple disciplines
	has significant consequences in a range of contexts
Assignment problem involves the application of the principles of	
X	engineering
	science
X	mathematics

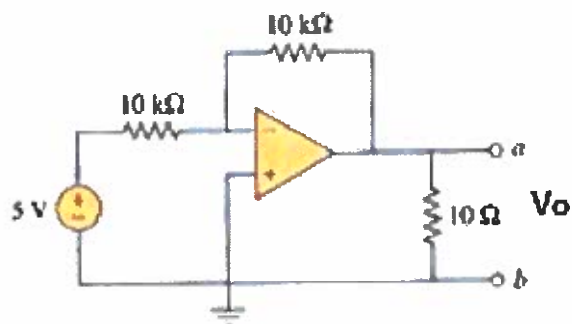
Brief justification of why this assignment is suitable for this outcome

The computer program tests the student's ability to solve electrical engineering circuit problems and how to use the computer in solving those problems.

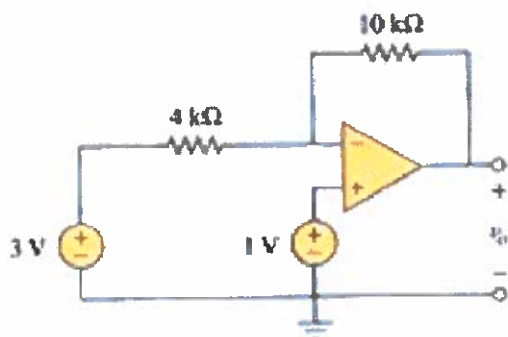
ASSIGNMENT

Homework for chapter 5 op amps 2 points each (total of 8 points)

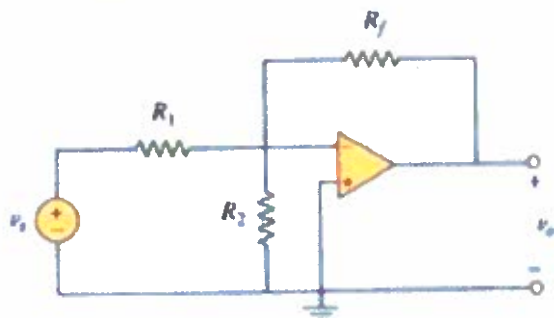
Value of output voltage V_o



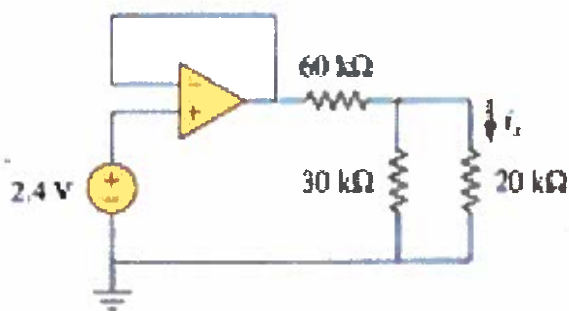
5.21 Calculate v_o in the op amp circuit of Fig. 5.60.



5.23 For the op amp circuit in Fig. 5.61, find the voltage gain v_o/v_s .



5.30 In the circuit shown in Fig. 5.68, find i_x and the power absorbed by the 20-kΩ resistor.



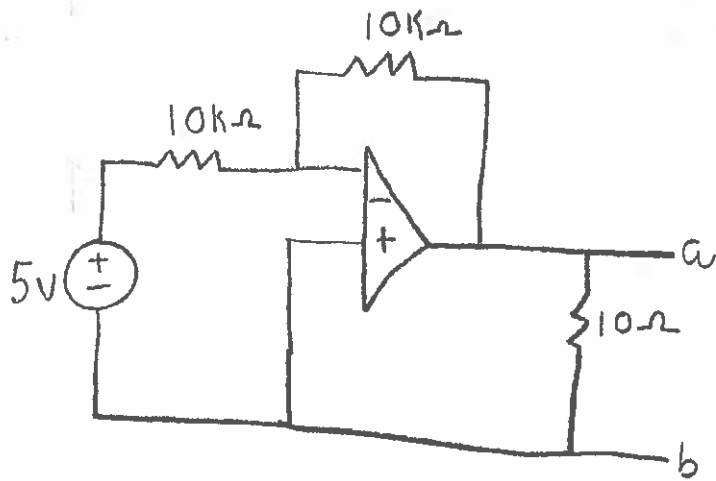
Sample of Student Work

ABOVE AVERAGE

Roshan Turner

Value of output voltage V_o

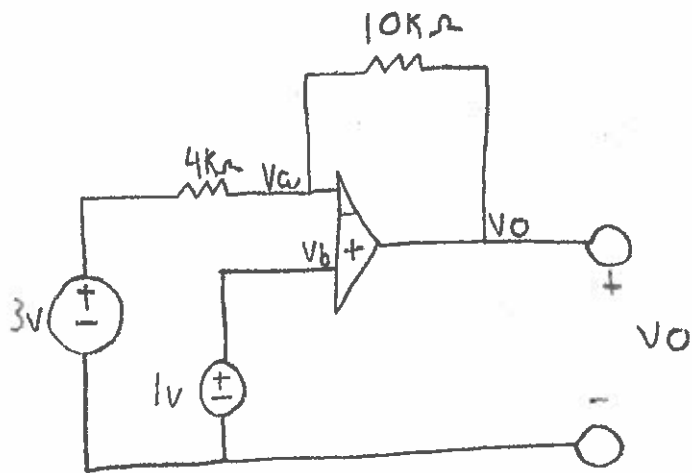
8/8



$$V_o = \frac{10000}{10000} (5)$$

$$V_o = 5V$$

5.21 Calculate v_o in the op amp circuit of fig 5.60



$$v_a = 1V$$

$$v_b = 1V$$

Node v_a

$$\frac{(v_a - v_o)}{10k\Omega} + \frac{(v_a - 3)}{4k\Omega} = 0$$

$$2v_a - 2v_o + 5v_a - 15 = 0$$

$$7v_a - 2v_o - 15 = 0$$

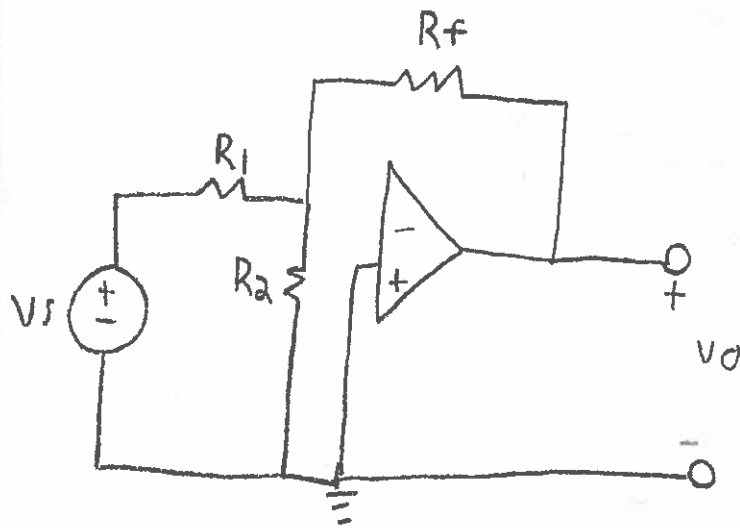
$$\frac{2v_o}{2} = \frac{7v_a - 15}{2}$$

$$v_o = \frac{7v_a - 15}{2}$$

$$v_o = \frac{7(1) - 15}{2}$$

$$\boxed{v_o = -4V}$$

5.23 For the op amp circuit in fig 5.61, find the voltage gain v_o/v_s



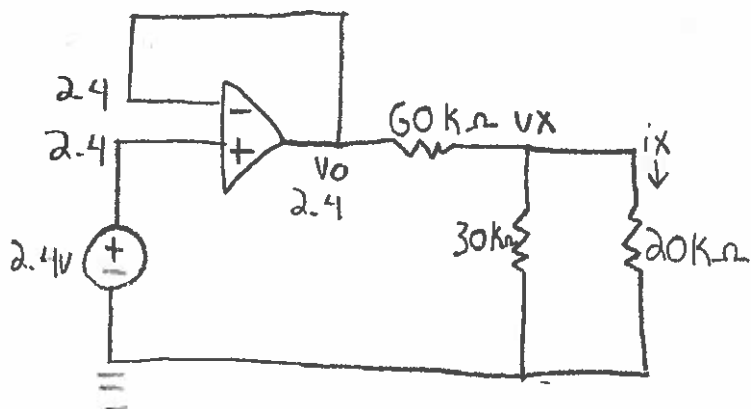
$$\boxed{\frac{v_o}{v_s} = -\frac{R_f}{R_1}}$$

$$\frac{v_s - 0}{R_1} = \frac{0}{R_2} + \frac{0 - v_o}{R_f}$$

$$\frac{v_s}{R_1} = -\frac{v_o}{R_f}$$

$$\frac{v_o}{v_s} = -\frac{R_f}{R_1}$$

$$P = \frac{V^2}{R}$$



$$\frac{V_x - 2.4}{60} + \frac{V_x}{30} + \frac{V_x}{20} = 0$$

$$V_x - 2.4 + 2V_x + 3V_x = 0$$

$$6V_x - 2.4 = 0$$

$$6V_x = 2.4$$

$$V_x = \frac{2.4}{6}$$

$$V_x = 0.4$$

$$i_x = \frac{V_x - 0}{20}$$

$$i_x = \frac{0.4}{20}$$

$$i_x = 0.02$$

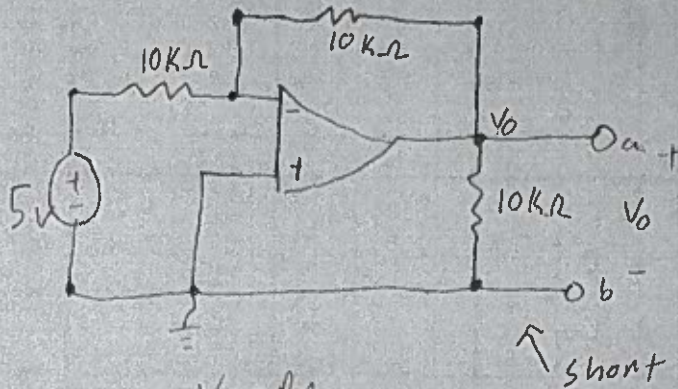
$$i_x = 20\mu A$$

$$P = \frac{(0.4)^2}{20000}$$

$$P = 8\mu W$$

AVERAGE

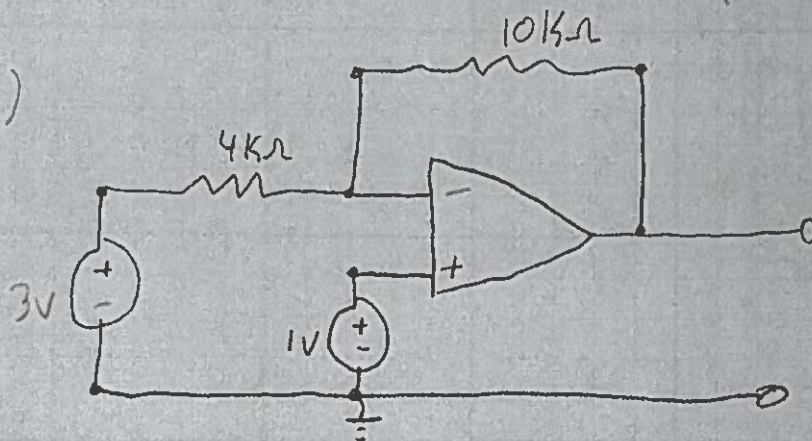
1)



$$V_o = \frac{-V_s \cdot R_f}{R_{in}} = \frac{-5 \cdot (10 \cdot 10^3)}{(10 \cdot 10^3)} = \boxed{-5V}$$

#3 is incorrect
Always state
problem

5.21)



$$V_1 = \frac{-3 \cdot (10 \cdot 10^3)}{(4 \cdot 10^3)} = -7.5V$$

$$V_2 = 1 \cdot \left(1 + \frac{10 \cdot 10^3}{4 \cdot 10^3}\right) = 3.5V$$

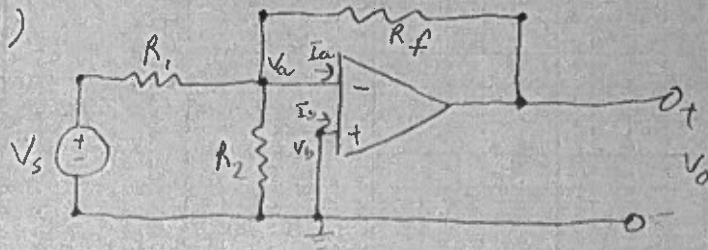
$$V_o = -7.5 + 3.5 = \boxed{-4V}$$

$$V_o = V_1 + V_2$$

$$V_1 = \frac{-V_s \cdot R_f}{R_{in}}$$

$$V_2 = V_i \left(1 + \frac{R_f}{R_{in}}\right)$$

5.23)



$$I_a = I_b = 0A$$

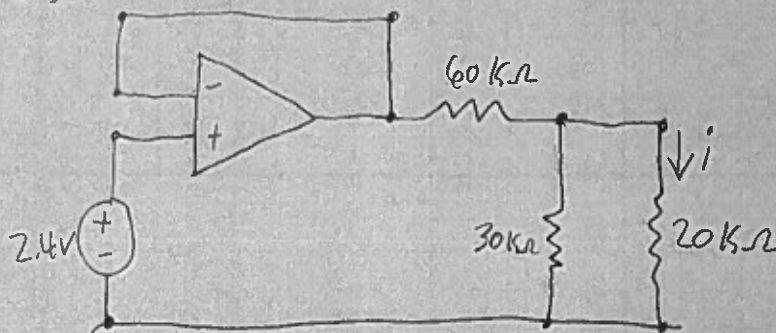
$$V_a = V_b$$

$$V_b = 0V$$

$$\frac{V_s - V_a}{R_1} = \frac{V_a}{R_2} + \frac{V_a - V_o}{R_f} + i_a$$

$$\frac{V_s}{R_1} = \frac{-V_o}{R_f} \rightarrow \boxed{\frac{V_o}{V_s} = \frac{-R_f}{R_1}}$$

5.30)

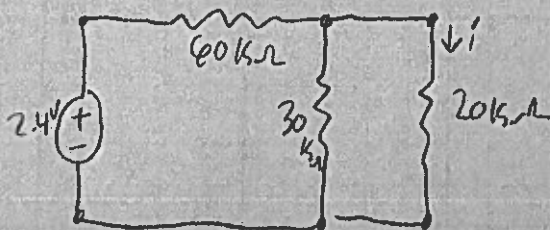


$$V_{in} = V_{out}$$

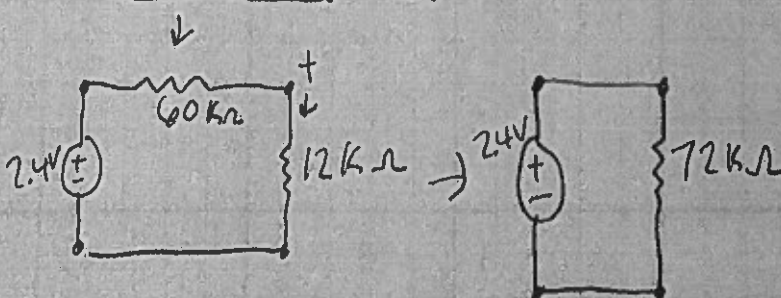
$$V_{out} = V_2 = V_1 = 2.4V$$

$$P_{20k} = i^2 \cdot R = 0.01998^2 \cdot 20k$$

$$\boxed{P_{20k} = 7.98mW}$$



$$\frac{20 \cdot 30}{20 + 30} = 12k$$



$$I_{total} = \frac{2.4}{72k} = 0.0333mA$$

$$i = 0.0333 \cdot \frac{30k}{20+30}$$

$$\boxed{i = 0.01998mA}$$

BELOW AVERAGE

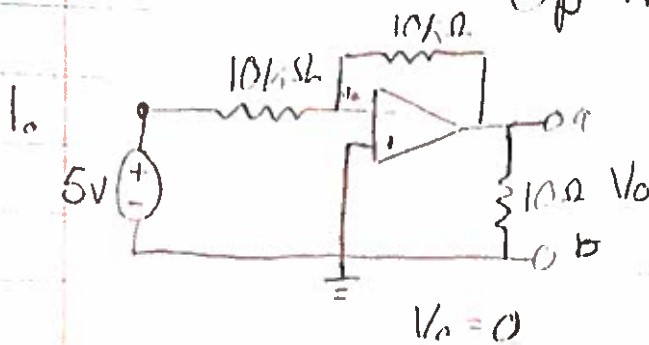
Nicholas Gregoire

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S should be volts instead of milli volts in problem 1

Always state problem

Op Amp HW

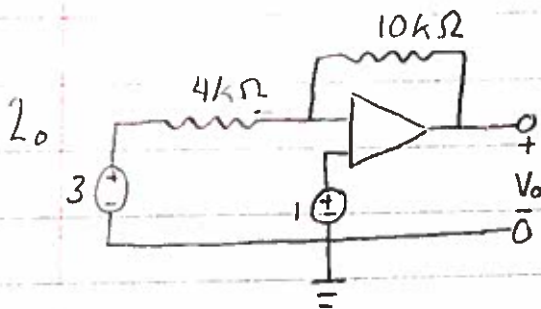


$$\frac{V_a - 5}{10k} + \frac{V_o - V_o}{10k} + \frac{V_o}{10} = 0$$

$$V_a - 5 + V_a - V_o + 1k V_o$$

$$2V_a - 5 - 999V_o = 0$$

$$V_o = -5mV$$



$$-V_s \frac{R_F}{R_R} = V_{o1}$$

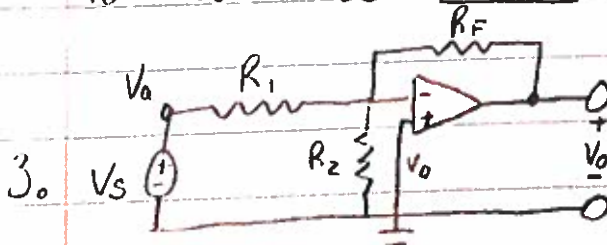
$$-3 \frac{10k}{4k} = -7.5v$$

$$(1 + \frac{R_F}{R_R}) \times V_s = V_{o2}$$

$$(1 + \frac{10}{4}) \cdot 1 = 3.5$$

$$V_o = V_{o1} + V_{o2}$$

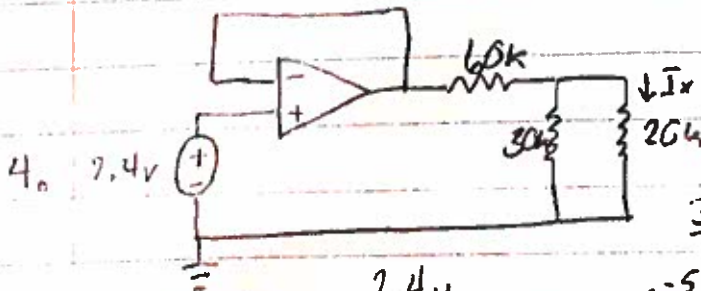
$$V_o = -7.5 + 3.5 = -4v = V_o$$



$$V_a = V_b = 0$$

$$\frac{V_s - V_a}{R_1} = \frac{V_a}{R_2} + \frac{V_a - V_o}{R_F}$$

$$\frac{V_s}{R_1} = -\frac{V_o}{R_F} \Rightarrow \frac{V_o}{V_s} = -\frac{R_F}{R_1}$$



$$\text{Voltage follower rule} = 204v$$

$$\frac{30 \times 20}{50} = 12k\Omega + 60 = 72k\Omega$$

$$\text{Current divider rule } \frac{204v}{72k} = 3.33 \times 10^{-5} A$$

$$3.33 \times 10^{-5} \cdot \frac{30}{50} = 2 \times 10^{-5} A = i_x$$

$$\text{Power} = i^2 \times R = (2 \times 10^{-5})^2 \cdot 20k = 8 \mu W$$