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IDENTIFIERS	Lane Community College OR

ABSTRACT

To facilitate transition and success of disadvantaged students in the regular community college vocational program, an Oregon project developed and demonstrated an integrated program of mathematical, writing, social, and vocational skills training. The project had three phases--research, implementation, and evaluation--and focused on construction training and employment. Research was done with an ERIC (Educational Resources Information Center) search, survey of construction employers in the Eugene-Springfield area, study of two Cognitive Mapping Workshops held at Mt. Hood Community College, and assessment by project staff of existing curriculum at Lane Community College. Project staff then designed an interdisciplinary curriculum that used the Construction Technology Program, a special five-credit Industrial Orientation class, and selected basic skills classes. Implementation included coordinating the Industrial Orientation class with classes in the Construction Technology Program, final selection of instructors, recruitment of students, evaluation of student skills, and an actual field test of the curriculum involving eighteen students at Lane Community College. A textbook was written for use in the field test (see Note). Evaluation focused on student evaluations of the class, student retention and employment characteristics and staff evaluation. (Appendixes include examples of class assignments, a cognitive mapping workplan, textbook section, and student evaluation form.) (YLB)

ED190765

STATE: Oregon
GRANT #: 20-650-149
SOURCE OF FUNDING: Research/Exemplary
$10,000

PROJECT: Lane Community College
Skilled Training for Disadvantaged
Students

LANE COMMUNITY COLLEGE

SKILLS TRAINING FOR DISADVANTAGED STUDENTS

PROJECT REPORT

June, 1980

This project report was prepared pursuant to Oregon State Department of Education Project in Vocational Education Request for Proposal 2-78-79 by Special Training Programs, Lane Community College.

CE 025 910

Appendix A

ABSTRACT

TO BE COMPLETED BY PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR

Project Title: Skills Training for Disadvantaged Vocational Students

Project Director/Principal Investigator and Organization: Leslie Rasor, Special Training Programs
Lane Community College
Eugene, Oregon 97405

Funding Period: March, 1979 (From) March, 1980 (To)

NUMBER OF STUDENTS AFFECTED: 18 NUMBER OF STAFF AFFECTED: 4

OBJECTIVES:

To develop and demonstrate an effective interdisciplinary program of basic skills training for Disadvantaged vocational students.

PROCEDURES:

To develop an integrated program of mathematical, writing, social and vocational skills training based on identified needs of disadvantaged students. To field test the model curriculum with selected students.

EXPECTED CONTRIBUTION OR POTENTIAL IMPACT ON VOCATIONAL EDUCATION:

To facilitate transition and success of Disadvantaged students in the regular community college vocational program.

PRODUCT(S) TO BE DELIVERED:

Final report

FOR OREGON DEPARTMENT OF EDUCATION USE ONLY

Submitted by: ______ State

Check One:
Approved Contract . . . . .State Contract No.: ______
In-House. . . . . .State Project No.: ______

Source of P.L. 94-482 Funds:

______ Sec. 131: $______ Charged to Fiscal Year ______
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______ Other: ______ (Source) ______ (Amount) Charged to Fiscal Year ______

(Optional Interim Use 10-77)

BUDGET

TITLE OF PROJECT Skills training for Disadvantaged Vocational Students

	TOTAL COSTS	LOCAL COSTS	FEDERAL COSTS
A. 1000 Instruction			
100 Salaries	14,905.	8,000	6,905
200 Employee Benefits	3,875	2,080	1,705
300 Travel	300		390
Other Purchased Services . .			
400 Supplies	3000	2,000	1.000
Instruction Subtotal	22,080	12,080	10,000
B. 2210 Improvement of Instructional Services			
100 Salaries	4,000	4,000	
200 Employee	1,040	1,040	
300 Travel	400	400	
Other Purchased Services . .			
400 Supplies			
Improvement of Instructional Services Subtotal	5,440	5,440	
C. 2220 Educational Media Services			
100 Salaries			
200 Employee Benefits			
300 Purchased Services			
400 Supplies			
Educational Media Services Subtotal			
D. 2500/2600 Support Services Business/Central			
Indirect Cost @ 43.75 %	9,660	9,660	
Support Service Business and Central Subtotal			
E. Other (Include explanation). . . .			
Other Subtotal			
Column Total	37,180	27,180	10,000.

BACKGROUND

The goals of the Skills Training for Disadvantaged Students Project were:

1. To identify and document the basic skills necessary to complete a vocational training program and to obtain entry level employment.
2. To teach and reinforce the basic skills necessary for employment in a structure designed to minimize failure.
3. To provide hands-on projects which reinforce text and lecture materials, measure individual progress, and invites positive feedback for students.
4. To allow students to begin learning basic skills at their own level.
5. To expand and reinforce understanding of the world of work.
6. To facilitate student progress in the regular vocational program.
7. To document procedures used to develop and implement the project.

The project was designed in three phases: Research, Implementation, and Evaluation, and focused on Construction training and employment.

Research was done with an ERIC Search, a survey of construction employers in the Eugene-Springfield area, study at two Cognitive Mapping workshops held by Mt. Hood Community College, and assessment by project staff of existing curriculum at Lane Community College. At the conclusion of the research phase the project staff designed an interdisciplinary curriculum that used the Construction Technology Program, a special five-credit Industrial Orientation class, and selected basic skills classes from the College's existing curriculum.

The Implementation phase included coordinating the Industrial Orientation class with classes in the Construction Technology Program, final selection of instructors, recruitment of students, evaluation of student skills, and an actual field test of the curriculum developed by the project staff. A textbook was written for use in the field test.

The Evaluation phase included student evaluations of the class, student retention and employment characteristics, and staff evaluation.

The field test involved 18 students 11 men and 7 women at Lane Community College during the Winter term, 1980. Four instructors, one counselor, and one administrator participated in implementing the field test.

SKILLS TRAINING FOR DISADVANTAGED STUDENTS

SECTION I - RESEARCH

SUMMARY OF EMPLOYER SURVEY

QUESTION	EMPLOYER RESPONSE: VERY IMPORTANT	SOMEWHAT IMPORTANT	NOT IMPORTANT
1. Basic skills wanted in employee:			
1.1 Good work habits	100%		
1.2 Math skills	43%	57%	
1.3 Writing skills	57%	43%	
1.4 Reading skills	57%	43%	
1.5 Oral communication skills	86%	14%	
1.6 Human relation skills	71%	29%	

Examples of skills as described by employers:

1.1 Dependable,attends to instructions,honesty, consistent work habits, safety awareness and practice.
1.2 Basic math, ability to use square and cubic units.reading and interpreting tools, quick and accurate.
1.3 Time cards, daily production reports, legible writing, accuracy.
1.4 Written job instructions, directions to jobs, reading blueprints, safety memos, materials lists.
1.5 Relaying oral instructions, ability to express self (stressed several times), understand directions, understand technical terms.
1.6 Public relations with customers (stressed many times), getting along with supervisors and co-workers.

2. Qualifications required:	VERY IMPORTANT	SOMEWHAT IMPORTANT	NOT IMPORTANT
2.1 Technical training	57%	43%	
2.2 Previous experience	71%	14%	
2.3 Previous work history	57%	43%	
2.4 Physical ability to do the job	57%	43%	

3. Other skills identified by employers(rank order):

3.1 Ambition
3.2 Good attitude
3.3 Responsibility
3.4 Willing to try new job
3.5 Willing to learn
3.6 Flexibility
3.7 Endurance
3.8 Alertness
3.9 Joyfulness

4. Employee qualifications wanted by employer (forced rank choice):

4.1 Work attitudes
4.2 Work habits
4.3 Ability to get alonf with others
4.4 Working skills
4.5 Technical skills
4.6 Math skills

June, 1979.
Construction employers
Eugene, Springfield

COGNITIVE STYLE SUMMARY

Cognitive style refers to the individual student's preferences for learning. It attends to helping the individual students understand and become responsible for their own learning. The Cognitive Style Mapping developed by Mt. Hood Community College consists of a 28 item questionaire and a student guide. The questionaire helps students assess their preferences for learning by theoretical or sensory modes, social influences on their learning, cultural determinants that affect learning, and their reasoning styles.

Students who understand their own learning style have increased ability to select classes, instructors, materials and times that maximize their learning potential. Students can also develop strategies for coping effectively with classes, materials and instructors which do not fit their preferred learning style.

Cognitive Mapping can also be used to help disadvantaged students overcome their preconceptions about their learning ability. When students learn that there are many valid learning styles and that learning by reading or listening to lectures are only two of many learning styles they are better able to focus on their abilities. Cognitive Mapping can help students recognize their skills and give them a foundation of success to build upon; with this foundation, they are then able to assess the lack of reading, writing, or math skills without self-defeating judgements of their total learning ability. Students in the field test began to see reading, for example, as "something I haven't learned very well yet," rather than "something I can't learn."

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SKILLS TRAINING FOR DISADVANTAGED STUDENTS

SECTION II - FIELD TEST

PROJECT DESIGN

(Winter Term, 1980)

FORMAT

Five credit, construction related Industrial Orientation class, consisting of Drafting (1 credit), Blueprint Reading (1 credit), Construction (2 credits), and Industrial Environments (1 credit). Each credit requires 12 hours of class time.

SCHEDULE

Drafting	8-10	AM	January 8, 10, 15, 17, 22, 24
Blueprint Reading	8-10	AM	January 29, 31, February 5, 7, 12, 14
Construction	10-12	AM	January 15, 17, 22, 24, 29, 31 February 5, 7, 12, 14, 19, 21
Industrial	10-12	AM	January 8, 10
Environments	8-10	AM	February 19, 21, 26, 28

Schedule was established to provide time for assessment at the beginning of the Drafting and Industrial Environments modules, and exposure early in the term to actual construction experience.

INSTRUCTORS

Instructors were chosen for their expertise in their curriculum area and for their ability to focus on the needs of individual disadvantaged students.

Drafting instructor: Instructor of Drafting 1 and Industrial Orientation Drafting; drafting experience in industry,

Blueprint Reading instructor: Instructor of Blueprint Reading classes for Construction Technology Program; taught the class students missed Fall Term, able to expedite coverage of immediately necessary information.

Construction instructor: Instructor of Construction classes;

instructor for project students in their Construction Program classes (sections were arranged to keep all project students together during Winter Term).

Industrial Environments instructor: Coordinator/Instructor for Industrial Orientation Program; Cognitive Style and work environment experience; counseling experience.

COORDINATION WITH CONSTRUCTION TECHNOLOGY PROGRAM

Industrial Orientation modules were scheduled for hours not filled by Construction Technology classes to insure that students could take all required classes. Regular Construction instructors were involved with the project to insure close coordination with the curriculum of the Construction Program and responsiveness to the needs of project students.

Building Construction I, a core Construction Program course, required for graduation from the Program, was waived for project students completing the 5 credit Industrial Orientation class.

Construction Program instructors were active in formulating the essential components of the construction related curriculum used in the project, in designing the Employer Survey used in the research phase of the project, and facilitating the recruiting and class scheduling during the field test of the project.

STUDENT CREDIT

The class was offered Pass/No Pass only. Credit was determined on the basis that the student has done the work (assignments repeatable until correct) or the student has chosen not to try to do the work. Students who attended class completed all assignments, some were able to complete extra work for more experience.

CURRICULUM DESIGN

Four modules of Industrial Orientation were developed to coordinate with the curriculum of the Construction Technology Program. These modules were: Drafting, Blueprint Reading, Industrial Environments (one credit each), and Construction (two credits).

Each of these modules included practical, related math and reading skills exercises which were woven into the classroom and laboratory projects, rather than imposed as specific math or reading exercises. Students were shown the necessity for math, reading, and writing skills in Construction classes and jobs in class assignments, projects and on site work. All basic skills were taught in sequential steps and the job relevance was stressed. Any student having difficulty was given individual assistance until they were capable of completing the assignment. Students were also encouraged to help each other to share and reinforce skills; helping other students also enabled the students to earn positive feedback for their own abilities.

The Drafting module taught students the use of drafting equipment, drafting methodology, measurement and translation of scale, spatial relationships, precision and the necessity for accuracy in building plans, and practical mathematics and writing skills. Assignments included: writing paragraphs for lettering assignments; basic math calculations during scale and measurement practice; drafting plans for foundations, stairways, cabinets, and framing.

The Blueprint Reading Module taught students construction methodology, spatial reasoning, the language of blueprints, translation of scale, and model building from blueprints. Assignments included: calculation of floor covering material required for specific rooms, siding needed for the exterior of a house and the drywall required to finish the interior of the house; reading specifications from blueprints, and translating scale to construct a model house from the blueprint.

The Construction module taught students construction terminology, tool and equipment names and use, the use of time cards, construction work opportunities, solar applications, materials, scheduling, and building codes. Students worked at the construction site for practical hands-on experience, as well as completing calculations for time cards, payroll and tax forms.

The Industrial Environments module was designed to help students overcome self-defeating attitudes, develop individual strategies for success, and understand their responsibilities in the work environment. Cognitive Mapping was used to introduce an analysis of individual students' learning styles, strengths and weaknesses. Discussions included the validity of diverse learning styles, strategies for maximizing success by utilizing strengths and developing individual strategies to improve under-developed skills. Students also learned to relate their individual learning styles to job selection, work style, and successfully interacting with others on the job. Students were given individual counsel or referred to College resources for experience or training to improve under-developed skills.

Class discussions introduced the concept of work environments as the interaction between employer, employee, and the work to be accomplished. The essential role of each was established before the rules and procedures of work environments was introduced. Students learned the basis of necessary rules and procedures rather than an arbitrary list of rules. Assignments included developing a rationale for hiring and firing, employee selection, and work scheduling: group decision making; games requiring logical deduction and inference; and outlining the effects on scheduling and ones' own workload if a co-worker is late or absent.

The instructor of the Industrial Environments module acted as a liaison with the instructors of the other modules to maintain communication and insure that class content was coordinated between modules. Each instructor used examples of skills and work tasks from other modules to insure that students understood the inter-relationship of the content areas and to reinforce basic skills.

INSTRUCTIONAL PHILOSOPHY

The project staff developed an instructional philosophy which permeated the instruction in all modules. The initial research done for the project and the experience based expertise of the project staff was combined to formulate this instructional philosophy.

Each instructor who participated in the project, as well as many other Department instructors, completed the Cognitive Style Mapping exercises that students later used. Each instructor became familiar with the diverse cognitive styles, their own individual style, and the patterns of interaction of different styles.

Instruction in the project was designed to meet the varied learning styles of students: lectures, written materials, demonstrations, media materials, individual and group projects, and individual tutoring were included in class work where the major emphasis was on practical hands-on experience for students.

The project was designed as an inter-disciplinary class. Basic skills were incorporated by the regular vocational instructor into the content of the vocational training. Each instructor was responsible for identifying the basic skills that are necessary for their area, for maximizing student progress in the basic skills, and for helping the students identify the relevance of the basic skills to success in vocational training and on the job.

Instruction was designed to meet student needs, rather than instructor needs. Teaching was done in small steps that lead students through the process. Instructors tried not to assume that students would fill in the gaps that instructors, with their subject familiarity, often leave in the sequence of conveying information to students; instead, instructors tried to show how each step leads to the next, and to show how each part relates to the total concept. Abstract principles were related by concrete examples. New material was related to the knowledge students had previously learned. Sequential instruction was used to demonstrate how learning is often transferable to facilitate comprehension of new material.

In order to maximize the success of the students' experience the class work was evaluated in three modes: can do, cannot yet do, and has not tried. This no-fail format has been successful with Industrial Orientation students in previous years: without the fear of failing on the first try, students are willing to risk learning.

The class was organized with a few clear but firm rules in order to provide clear understanding of expectations and to promote self-discipline for students. The rules for the class were:

1. Attend class
2. Be on time
3. Listen and follow directions.
4. Ask questions (Take an active role in your learning.)
5. Participate in class activities and complete assignments.
6. Be positive

STUDENT RECRUITMENT AND ASSESSMENT

Recruiting students was the most significant problem encountered during the project. The project staff determined that it would be essential that the class not be perceived by students as a "dummy's class"; the staff did not wish to add any stigma for students with disadvantaged academic histories. The class was not titled "Disadvantaged" or presented to students as a disadvantaged class, but was called Industrial Orientation for Construction Technology. In attempting to avoid the stigma for students enrolling in the class, the project staff made it difficult to enroll an adequate number of students when the class was first offered. It was necessary to revise our recruiting technique, causing the field test to be delayed for one term.

Initially, we used the counselor for the Construction Technology Program and the required Construction Technology Program meeting (held prior to registration) to inform students about the Industrial Orientation class. Many students were interested but did not wish to add five credits to the already substantial course load required for the program. With less than fifteen students enrolled in Industrial Orientation, the project staff decided to postpone the field test and revise the recruiting methods.

The following term the field test was put into operation. This time the students were informed, at the pre-registration meeting required for all new students, that Industrial Orientation was designed to make new students more successful in their Construction Technology classes, and was required for all new students. The students were also told that they had missed the first term (Fall Term) of a sequential program and the Program was providing them an abstract of the first term's work. This meets the concerns of many students who were apprehensive about entering the Program late; offering the class Winter Term better met students' actual needs.

The field test of the project during Winter Term enrolled 20 students; 18 students came to class, and 2 did not attend.

The first and second day of class was devoted to assessment of students' previous construction experience and basic skill levels. The project staff developed a self-assessment questionnaire; several Drafting assignments designed to assess skills in writing, reading, and comprehension of oral and written instructions; and utilized the Wide Range Achievement Test to determine math skill levels.

A profile was made for each student from test scores, subjective assessment of writing and comprehension assignments, and the students' self-assessment. The project staff determined that the student needed a minimum of 10th grade math and reading, readily understandable written work, accurate comprehension of directions, and one year construction experience to succeed in the program.

A meeting was held with each individual student to discuss the results of the student's profile. 5 students were excused from Industrial Orientation based on their profile; 4 of these students chose to take several modules of the class for additional experience. Each of the other 13 students was required to take the Industrial Orientation class and was referred to additional resources (Math I, Study Skills, GED classes) where appropriate. Many of the students with low skill levels were eager to improve their skills and enrolled in classes which met their needs. Two students maintained less enthusiastic attitudes and required frequent feedback and counsel to complete their required coursework during the term.

The instructor of the Industrial Environments module was responsible for meeting with each student to discuss the assessment profiles. During this initial meeting, each student was encouraged to come to the instructor for whatever assistance the student might need during and after Winter term. The instructor also was able to help the students incorporate their assessment profile with their Cognitive Style Map during the Industrial Environments module, and to help students with their assignments in other modules. This required, however, that instructor's attendance and participation in all of the other modules. This instructor was the primary contact for students, gave the class a continuity it might not have had with four instructors, and was responsible for early identification and resolution of student problems.

CONCLUSIONS AND SUMMARY

It became apparent during the project that the most critical element was the commitment of time and effort by the project staff. One person can prepare and summarize the research, but all staff members must be involved in the design, scheduling, and implementation of the project; without staff involvement there can be interruptions in the continuity of the curriculum, diffusion of instructional philosophy, and difficulties with scheduling of materials and activities.

The staff also determined that written instructional materials were essential for student learning. To insure that the materials used for the project class were specifically targeted to the curriculum designed for this class and to the skill level of the students, a textbook was written for the class. This also minimized the expense for students by requiring them to purchase only one book instead of a standard text for each module. If time and funding had allowed, we could have improved the accessibility to instructional materials for students with vision impairment, dyslexia, or severe deficiencies in reading skills by making audio tapes of the text where possible.

The field test reaffirmed our decision to prevent the class from garnering the stigma of Disadvantaged, remedial or "the dummies class." The class earned the reputation with students as a helpful addition to the Construction Program. Several students who were excused from the class, after assessment determined that they were not disadvantaged, chose to attend class; other students who entered the Program during earlier terms expressed regret that it had not been offered for them.

Evaluations by students, staff, and the Program administrator have prompted serious consideration of scheduling Industrial Orientation for Construction Technology students again during Winter Term, 1981.

In summary, the Industrial Orientation class designed for this project is an interdisciplinary combination of basic skills, vocational skills, and work environment skills. The interdisciplinary focus requires the coordinated efforts of all instructional staff to insure continuity and clarity for students, and to alleviate scheduling difficulties.

The instructional philosophy of the class gives priority to student needs, acknowledges the diversity of learning styles, devotes attention to maximizing students' strengths while improving under-developed skills, and encourages individual responsibility for students.

The curriculum content of each module teaches basic skills as vocationally related assignments while teaching students basic vocational skills in Drafting, Blueprint Reading, Construction, and Industrial Environments.

The class is designed to provide a no-fail environment with maximum postive feedback for students.

Because the class was in modular form with four instructors, it was necessary to have a primary instructor who was responsible for coordinating the class. This instructor was also the person who was responsible for appraising student progress, problem resolution, and maintaining student contact.

Adaptation of this class to other vocational programs would require:

1. Identification of basic vocational skills necessary for success in the regular program. For example: a welding program might require blueprint reading, basic metallurgy, and introductory arc and gas welding theory and practice.

2. Assessment of the basic skills necessary for success in the vocational program.
3. Incorporation of basic skills training into the vocational curriculum.
4. Staff training to develop expertise in Cognitive Style Mapping and understanding of the effect of differences in learning styles on student progress.
5. Developing written materials and assignments that meet the instructional goals of the class.
6. Staff commitment and coordinated efforts.

The Project Director will provide assistance in developing a similiar class at other institutions if requested. Copies of the textbook are available for the cost of printing from:

Special Training Programs
Lane Community College
4000 East 30th Avenue
Eugene, Oregon 97405

PROJECT FOLLOW-UP

The Construction Technology Program at Lane Community College is positively considering scheduling Industrial Orientation for Construction students Winter Term, 1980.

The textbook written for the class has been used as a resource by the Pre-apprenticeship Program at the College as they develop a curriculum and materials specific to their needs.

The class has also gained the attention of a group of employers who are interested in scheduling a Shop Fabrication class to train employees. If this class is scheduled, an Industrial Orientation that includes Welding, Blueprint Reading, Machine Shop and Industrial Environments may be used to provide students with good basic skills before vocational training for Shop Fabrication is begun.

Much of the design and implementation of Industrial Orientation for Construction Technology has been incorporated into the regular Industrail Orientation Program modules. The regular Program continues to provide career exploration and exposure to the technical/industrial trades for women and men, but increased attention to providing substantial skills training has been incorporated into the Program design.

SKILLS TRAINING FOR DISADVANTAGED STUDENTS

SECTION III - EVALUATION

PROJECT EVALUATION

This evaluation, written by a third party, is based on the material requested for the final report. Consequently, the program has been evaluated based on program goals, a summation of the significance of project outcomes resolving the needs of Disadvantaged students, reducing sex bias and stereotyping, and improving teaching techniques.

EVALUATION OF PROJECT GOALS

Goal 1. To identify and document the basic skills necessary to complete a vocational training program and to obtain entry level employment.

Both the employer skill survey and the discussion with the Construction Technology staff identified the basic skills required to succeed in a vocational training program and to meet employer requirements for employment. This design methodology is an effective functional approach in program research and design.

Goal 2. To teach and reinforce the basic skills necessary for employment in a structure designed to minimize failure.

To minimize failure, a Pass/No Pass grading system was employed, instructors focused on the students' strengths and provided extensive positive motivation and feedback. The positive approach to students appears to be an effective means of teaching and reinforcing basic skills.

Goal 3. To provide hands-on projects which reinforce text and lecture materials, measure individual progress, and invites positive feedback for atudents.

This goal was achieved by designing hands-on projects that incorporated basic skills. The thrust of the program tied positive feedback to the student for his or her achievement in class assignments and hands-on projects. The use of basic skills and hands-on projects combined with positive reinforcement was an effective means of achieving this goal.

Goal 4. To allow students to begin learning basic skills at their own level.

The use of assessment testing and individual conferences were used to determine basic skill requirements. Some students were assigned to the regular program because of this testing. Other students were counseled into various basic skills classes in addition to the regular program. This process to develop individual strategies for skill improvement was an effective means of achieving individually tailored basic skill learning that neither required the student to repeat unnecessary classes nor miss essential learning experiences. It also utilized existing College resources as well as the project experience.

Goal 5. To expand and reinforce understanding of the world of work.

The use of the Industrial Environments module and reinforcement by vocational instructors provided an overview of the requirements of the world of work. The goal, through these two educational approaches was adequately reached. The closure of the College, because of ice and snow, for two days during the Industrial Environments module prevented full implementation of the work environments curriculum; this makes it difficult to evaluate the implementation and impact of the total curriculum.

Goal 6. To facilitate student progress in the regular vocational program.

The use of the modules in Drafting, Blueprint Reading, and Construction facilitated rapid acquisition of the skills necessary to succeed in the regular Construction program. In addition, the fact that the students were identified as Disadvantaged made instructors more aware of their individual differences and needs. Also, the availability of the Industrial Environments instructor for individual assistance and counsel with students provided support and problem resolution for students.

Goal 7. To document procedures used to develop and implement the project.

This report, as an entity, documents the procedures used to develop and implement the project.

The Skills Training Program for Disadvantaged Vocational Students clearly demonstrated that positive instruction and reinforcement of student strengths results in increased learning and skill building. Perhaps the most significant result in this project was the high degree of success these students had in their regular Construction Technology classes. Clearly, the early identification, low student to teacher ratio, positive instruction and reinforcement, and relevant hands-on instruction greatly enhanced the potential for success. The attached student follow-up demonstrates this observation.

The project demonstrates that regular vocational programs can be improved by developing introductory and/or basic skills that insure increased awareness and appropriate attention for Disadvantaged students

Conversely, placement of Disadvantaged students in a regular vocational program without adequate instructional support increases the potential for the failure of those students.

The regular Industrial Orientation Program was designed, in its original format, as a non-traditional educational exploration for women and men. The College's design of this project to meet the needs of students in the Construction Technology Program again demonstrates that both women and men needing basic skills training can succeed in regular vocational programs.

The Industrial Orientation textbook has made a significant contribution to non-traditional and Disadvantaged industrial training programs. Minor revisions to this textbook can result in important educational applications for a variety of introductory industrial programs. The textbook has been disseminated upon request throughout the United States.

STUDENT EVALUATION SUMMARY

Students evalulated each module of Industrial Orientation for Construction Technology using the form included in the Appendix. The average student rating for each module (scale: 1, not worth my time, to 10, worth my time, good) was:

MODULE	RATING	COMMENTS
DRAFTING	8	Excellent teacher Liked learning why accuracy is necessary. Liked learning to use the tools in real projects. Liked learning read skills.
BLUEPRINT READING	6	Liked learning to build models. Learning symbols is boring. Learning to read blueprints was useful.
CONSTRUCTION	8	Visiting sites taught me a lot about construction methods. Hands-on work was best. Blueprints make more sense after we worked on the house.
INDUSTRIAL ENVIRONMENTS	9	Learning what employers expect ~~and what~~ I can do to get a job (was useful). Cognitive Mapping was extremely beneficial. Learning about unions and apprenticeship while we worked with journeymen.

Student evaluations of the benefits of the class for the individual student ranged from: "I wish other classes taught us how to do things and why we should." and "It was easy to learn here." to "I don't want to be here (in school) but I don't have anything else to do." Most students felt that the class was valuable, but wished it was longer and covered more material.

STUDENT FOLLOW-UP

The class enrolled 22 students, 15 men and 7 women. 4 of the men withdrew from school before attending any classes. The completion and follow-up statistics for the 11 men and 7 women who attended the project class are:

	WOMEN	MEN
COMPLETED INDUSTRIAL ORIENTATION	6*	10**
COMPLETED OTHER CLASSES	6	10
ENROLLED IN CONSTRUCTION SPRING TERM	3	9
ENROLLED IN OTHER VOCATIONAL PROGRAM SPRING TERM	2	0
ENTERED WORKFORCE SPRING TERM	1	1
NO FOLLOW-UP INFORMATION	1***	1**

* The woman student who did not complete classes left school for employment.

** We have no information about the male student who did not complete classes. His parents said he has a history of disappearing for months at a time. They had not heard from him and did not know why he had left.

*** The student's training contract was terminated by the CETA program.

The project staff has maintained contact with many of the students. Some are continuing to take vocational training at the College, a few are considering relocating in search of jobs, a few are discouraged with the lack of jobs during the recession and are considering leaving the construction field.

SKILLS TRAINING FOR DISADVANTAGED STUDENTS

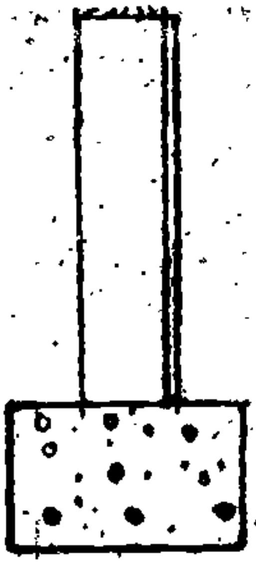
APPENDIX

Examples of class assignments

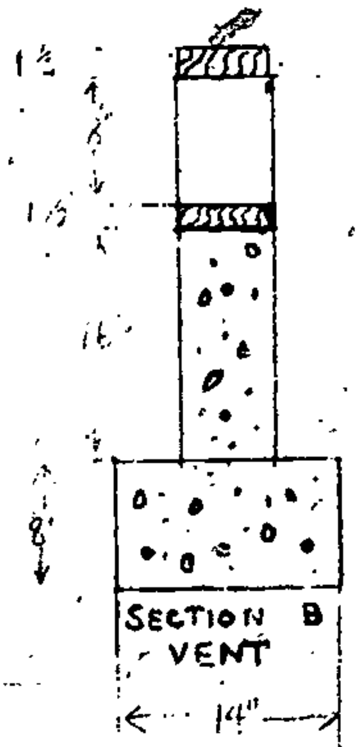
Cognitive Mapping Workplan

Textbook section

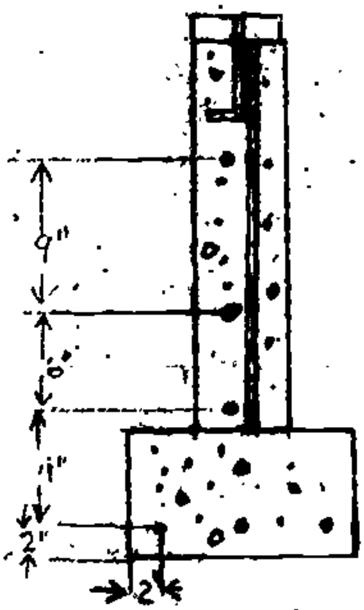
Student evaluation form



SECTION A
CRAWL HOLE



SECTION B
VENT



NOTE
STEEL
FOOTING - 3 - No. 4
MAINTAIN 2" CONCRETE COVER
STEM - 3 - No. 4 HORIZONTAL
- No. 4 VERTICAL
4'-0" ℄
PLATE, VENT, CRAWL FRAMING
STD + BTR, P.T DOUGLAS FIR
2 X 6 (1½ X 5½)

Drafting Assignment

Foundation sections

Lettering and Spelling

Addition and subtraction

BLUEPRINT READING MATH ASSIGNMENTS

(EXAMPLES)

1. How much sheetrock would you need to order to finish the kitchen? *

   Sheetrock can be ordered in ______ dimensions.

   Height________

   Perimeter________

   Doors__________ How many?________

   Windows________ How many?________

   Square footage = Height x Perimeter - Doors and (+) Windows

   Sheetrock needed = square footage ÷ square footage of 1 unit sheetrock.

   Draw a plan of how you would place sheetrock on the walls to minimize waste.

2. You need to order the mouldings for the doors and windows. How much moulding do you need (in linear feet)?

Number of doors________	Moulding required________
Number of windows (each size)________	Moulding required________
________	Moulding required________
________	Moulding required________
________	Moulding required________
	Total ________

   Remember: moulding is needed on all four dimensions of a window but only on three dimensions of a door.

3. How much laminate do you need to cover the counter tops in the kitchen?

   Kitchen (each counter)

   Length________ Width________ Backsplash________ Total________

   Length________ Width________ Backsplash________ Total________

   Total ________

*Each student is provided with blueprints of a three bedroom house.

LANE COMMUNITY COLLEGE

COMMUNITY EDUCATION DIVISION
SPECIAL TRAINING PROGRAMS
Industrial Orientation

Who Would You Hire?

Directions: Decide what qualities—you want an employee to have. Decide which one of the applicants to hire. Give the reasons for your decision.

You own a small construction company that you began two years ago. The business is doing fairly well, but it is still a struggle and most of your income must be put back into it. One of your employees just quit and you are very short handed. You need to hire another permanent worker to fill out your crew.

Your applicants are:

Sam, one of your current employees says his brother is looking for a job. The brother is 19, has had one year of construction classes in high school, and worked as a laborer for one summer. Sam is one of your best workers.

A man with 20 years of experience. He has never stayed with one employer for more than three months, but he knows framing, concrete finishing, roofing, painting, and dry wall taping.

A woman graduate of a two-year construction program with excellent references from her instructors and past employers. Her supervised field experience employers report said that she was an excellent worker but that she caused problems since the other employees wasted time testing the green horn.

A 40-year-old ex-minister who wants to change careers. He has had extensive woodworking experience, does fine cabinet making as a hobby. He helped to build a house 10 years ago with his father-in-law.

A man with four years framing experience. The grapevine says he comes in on weekends to steal building materials from the sites he works on, but no one has filed charges.

A black man, recently moved from the East coast, with 17 years of solid construction experience. His initial training was with the Navy Seabee's.

An experienced 40-year-old man who has owned his own construction company for 15 years with 7 years of construction experience before he began his own business. Recently filed bankruptcy. His firm had a reputation for cutting corners and shoddy building practices.

A former employee you fired for not coming to work on time and for frequent absences. He did good work when he was there, but he put you in a bind many times. He says he needs a job and he learned his lesson.

1/14/80

COGNITIVE MAPPING WORKPLAN NAME ______________________________

Each of us may need to develop strategies to make the best use of our preferred learning styles and to cope with instructors or class materials that are different than our preference.

1. SPOKEN LANGUAGE
Majors: Remember what they hear. Courses: Effective Learning, Reading.
Minors: May need oral listening skills; ask instructors if tapes are available. Courses: Effective Learning, Listening.
Negligibles: Need to improve listening skills. Courses: Listening, Effective Learning, Vocabulary.

2. SPOKEN NON-WORD SYMBOLS
Majors: May need to improve vocabulary, reading. Courses: Reading, Effective Learning, Listening.
Minors: Ask for written materials, charts, diagrams, take careful notes. Courses: Math, Effective Learning, Listening.
Negligibles: Improve listening skills, use written materials, notes. Courses: Same as Minors.

3. WRITTEN WORDS
Majors: May need listening skills, ask for written materials. Courses: Listening, Math.
Minors: Strengthen reading skills. Courses: Reading Skills, Effective Learning, Use of the Library.
Negligibles: Need to improve reading skills. Courses: Same as Minors; if skill level is low may also need Vocabulary Improvement, Read, Write and Spell.

4. VISUAL NON-WORD SYMBOLS
Majors: Ask for charts, maps, diagrams. May need reading or listening skills
Minors: Need to learn to use charts, diagrams, numbers. Courses: Math, Effective Learning.
Negligibles: Same as Minors.

5. SOUND PERCEPTION
Majors: Distracted by sounds; need to select environment carefully. Courses: Effective Learning, Coping Skills, Assertiveness.
Minors: May need to be more aware of sounds, particularly for job safety. Courses: Listening, Safety.
Negligibles: Same as Minors.

6. SMELL PERCEPTION
Majors: Distracted by odors; need to select environment carefully. Courses: Coping Skills, Assertiveness Training.
Minors: Not aware of odors in environment; need care around machinery, i.e., "hot smell." Ask if this may cause problems on the job.
Negligibles: Same as Minors.

7. TASTE PERCEPTION
Majors: Chewing gum, food, coffee, cigarettes may help concentration, may need to work within class or work restrictions. Courses: Coping Skills, Effective Learning.
Minors: May not do well as a wine taster, chef.
Negligibles: Same as Minors.

8. TOUCH PERCEPTION
Majors: May feel stress if work area is sticky, not clean, uneven. May be sensitive to heat, pain. Consider when choosing career and job location.
Minors: May annoy other if you clutter work area. Courses: Human Relations, Interpersonal Communications.
Negligibles: May lack sensitivity to heat, pain. Work area too cluttered. Courses: Time Management, Human Relations.

9. SIGHT PERCEPTION
Majors: Visual distractions hinder concentration. Select work and study areas. Courses: Effective Learning, Coping Skills.
Minors: May be able to work in any environment.
Negligibles: Need awareness of visual clues for safety around machines. May tend to wear clothes that distract others. Courses: Human Relations.

10. SYNTHESIZING
Majors: Boredom with too little challenge. Select career carefully.
Minors: Find dexterity requirements difficult. Work on coordination. Break down physical tasks. Courses: Physical Education.
Negligibles: Need methods to deal with complex physical tasks. Courses: Physical Conditioning, Effective Learning.

11. FEELINGS SENSITIVITY
Majors: Problems with assertiveness. Put other's before self. Need to learn coping techniques. Courses: Assertiveness Training, Coping Skills.
Minors: May hurt other's feelings. Learn to read visual and verbal clues. Courses: Human Relations.
Negligibles: Not aware of others, difficulty getting along with others. Courses: Interpersonal Communications, Human Relations.

12. AESTHETICS
Majors: Distracted by cluttered or sterile environments. Watch environmental settings. Courses: Coping Skills, Interpersonal Communications.
Minors: Need to watch self around majors. Work on orderliness. Courses: Human Relations, Basic Design.
Negligibles: Same as Minors, but awareness is less and problems may be more pronounced.

13. ETHICAL COMMITMENTS
Majors: Feel stress when crossing own values. May fight over minor points. Courses: Human Relations, Coping Skills, Interpersonal Communications.
Minors: Become aware of ethical issues in career choice.
Negligibles: May not be aware of ethics standards and obligations. Courses: Human Relations.

14. SOCIAL ROLES
Majors: Understand and can use social expectations. May be manipulative. Courses: Sales, Public Relations.
Minors: Less conforming to social roles. Courses: Job Hunting Skills, Interpersonal Communications, Human Relations.
Negligibles: Not flexible in social situations, social stress, unaware of social roles. Courses: Human Relations, Interpersonal Communication.

15. BODY/FACIAL EXPRESSION
Majors: Can't talk without their hands, expressive speaker.
Minors: Not animated speakers, lack enthusiastic speaking abilities.
Courses: Speech, Interpersonal Communications.
Negligibles: Not animated, poor public speaking abilities. Courses: Speech Fundamentals, Human Relations, Interpersonal Communications.

16. IMITATION
Major: Doing process correctly more important than product. Not an independent learner. Courses: Effective Learning, Use of Library, Reading Skills, Math.
Minors: Needs less demonstrating, may be more independent learner. Product may be more important than process.
Negligibles: Need to learn how to use demonstrations in learning. May be too product oriented, may be nonconforming, develop skills in using demonstrations.

17. JUDGE PHYSICAL DIFFERENCE
Majors: May work better with people than things, products.
Minors: Difficulty with judging others need for distance. Courses: Human Relations, Interpersonal Communications, Assertiveness Training.
Negligibles: Difficulty in social situations, unaware of distancing factors. Courses: Human Relations, Communications Skills, Assertiveness Training.

18. SELF-KNOWLEDGE
Majors: No apparent difficulties noted. Can rely on self-knowledge of skills.
Minors: May overextend abilities, energy, time, may have difficulty setting limits, recognizing personal limitations. Courses: Time Management, Assertiveness Training, Human Relations.
Negligibles: Same as Minors. Courses recommended for Minors; may need individual counseling.

19. IDEA COMMUNICATION
Majors: Influences others.
Minors: Not as influential. Difficulty putting across ideas. Courses: Assertiveness Training, Interpersonal Communications, Human Relations.
Negligibles: Difficulty dealing with others, putting across ideas. Courses: Communication Skills, Human Relations, Interpersonal Communications.

20. TIME ISSUE
Majors: Stress over time issues. Courses: Time Management, Coping Skills.
Minors: Frequently late, poor sense of time. Courses: Time Management.
Negligibles: Always late, poor sense of time. Courses: Time Management, Counseling.

21. PEER INFLUENCE
Majors: May have difficulty with mentor system, family or individual style instructors. Courses: Human Relations, Interpersonal Communications.
Minors: May experience difficulty working with peer group, co-workers. Courses: Human Relations.
Negligibles: Tend to isolate self from co-workers, peers. Courses: Human Relations.

22. FAMILY INFLUENCE

Majors: May have difficulty when separated from family or with peer or individual style instructors. Courses: Coping Skills, Human Relations, Interpersonal Communications.

Minors: Tend to seek out people other than family.

Negligibles: No close family influence. Counseling if this causes difficulties.

23. INDIVIDUAL INFLUENCE

Majors: Make decisions, work on individual basis. Seeks information not advice. May need awareness of support systems.

Minors: Needs others for support system. May have difficulty with peer or family style instructors.

Negligibles: May be influenced by only one group. Needs more diversification of support system. Relocation may be a problem. Courses: Human Relations, Coping Skills.

24. RULES

Majors: Stress when rules, regulations, policies are not clear. Courses: Interpersonal Communications, Human Relations, Coping Skills.

Minors: Tend to make decisions slower than majors. Develop skill in coping with rules and policies. Courses: Human Relations.

Negligibles: Slow to make decisions, difficulty adhering to rules, policy. Courses: Human Relations, Job Skills, Counseling.

25. DIFFERENCE REASONING

Majors: May have difficulty seeing likenesses.

Minors: Difficulty finding differences. Courses: Effective Learning.

Negligibles: Difficulty identifying differences. Courses: Thinking Skills.

26. RELATIONSHIP REASONING

Majors: May have difficulty looking at ideas, relationships from whole picture. Courses: Effective Learning, Thinking Skills.

Minors: May look at differences instead of likenesses. Don't generalize. Looks at specifics. Courses: Thinking Skills.

Negligibles: Difficulty understanding general rules. Courses: Thinking Skills.

27. APPRAISAL REASONING

Majors: Cover new material slowly, in detail. Always questioning. Courses: Human Relations, Effective Learning.

Minors: May tend to make hasty decisions without good reasoning. Courses: Thinking Skills, Effective Learning.

Negligibles: Hasty decisions without much reasoning. May be poor at questioning. Courses: Thinking Skills, Effective Learning.

28. LOGICAL REASONING

Majors: Difficulty evaluating general premises. Courses: Thinking Skills.

Minors: Do not rely on logical arguments, geometric proofs.

Negligibles: Have difficulty with logical evaluation of steps. Courses: Thinking Skills.

ELECTRONICS

TABLE OF CONTENTS

INTRODUCTION

The Electronics module will introduce the electrical concepts and terminology that are the basic foundation for both electronics and electricians occupations. Our class projects will give you practice using electronic components and equipment, making simple electrical repairs, making a circuit tester, and doing household wiring.

RELATED JOBS

APPLIANCE-REFRIGERATION TECHNICIAN

COMMUNICATIONS ENGINEERING TECHNICIANS

ELECTRONICS ASSEMBLERS

ELECTRONICS TECHNICIANS

ELECTRONICS ENGINEERING TECHNICIANS

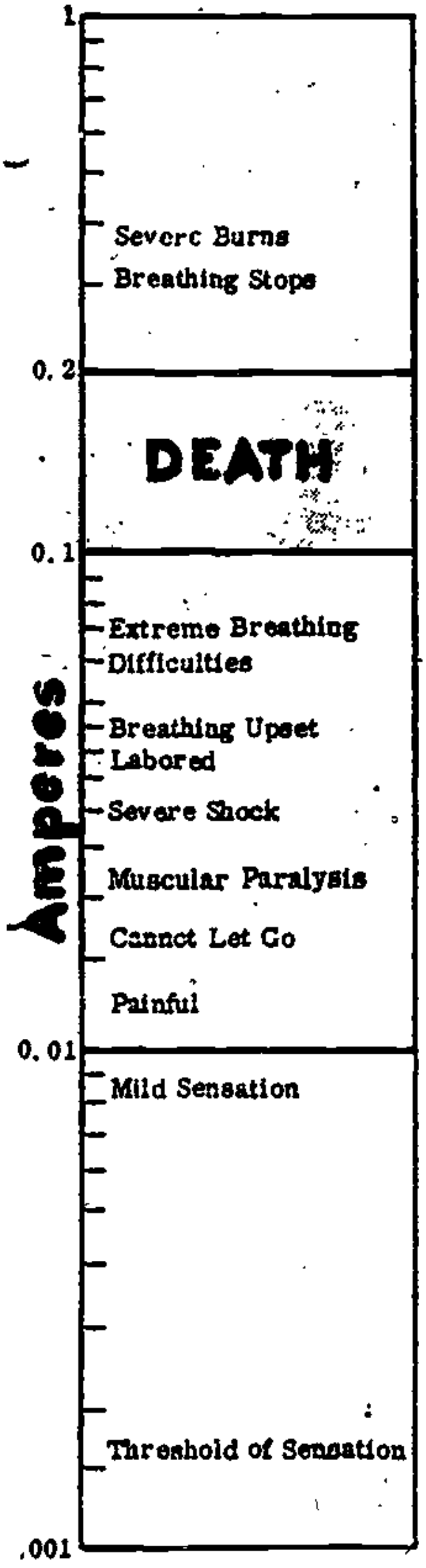
ELECTRICAL ENGINEERS

ELECTRIC MOTOR WINDERS

ELECTRICIANS
construction
inside
maintenance
manufacturing plant
railroad

TELEVISION-CABLE LINEPERSON

UTILITY ELECTRICAL WORKER



Physiological Effects of Electric Currents

Electricity Kills

Reprint from SAFER OREGON

The Fatal Current

Strange as it may seem, most fatal electric shocks happen to people who should know better. Here are some electro-medical facts that should make you think twice before taking that last chance.

It's the Current That Kills

Offhand it would seem that a shock of 10,000 volts would be more deadly than 100 volts. But this is not so. Individuals have been electrocuted by appliances using ordinary house currents of 110 volts and by electrical apparatus in industry using as little as 42 volts direct current. The real measure of a shock's intensity lies in the amount of current (amperes) forced through the body, and not the voltage. Any electrical device used on a house wiring circuit can, under certain conditions, transmit a fatal current.

While any amount of current over 10 milliamps (0.01 amp) is capable of producing painful to severe shock, currents between 100 and 200 ma (0.1 to 0.2 amp) are absolutely lethal. There is no known medical procedure that will revive the victim.

Currents above 200 milliamps (0.2 amp), while producing severe burns and unconsciousness, do not usually cause death if the victim is given immediate attention. Resuscitation, consisting of artificial respiration, will usually revive the victim.

From a practical viewpoint, after a person is knocked out by an electric shock it is impossible to tell how much current passed through the vital organs of his body. Artificial respiration must be applied immediately if breathing has stopped.

The Physiological Effects of Electric Shock

The chart on this page shows the physiological effects of various current densities. Note that voltage is not a consideration. Although it takes a voltage to make the current flow, the amount of shock-current will vary, depending on the body resistance between the points of contact.

As shown in the chart, shock is relatively more severe as the current rises. At values as low as 20 milliamps, breathing becomes labored, finally ceasing completely even at values below 75 milliamps.

As the current approaches 100 milliamps, ventricular fibrillation of the heart occurs—an uncoordinated twitching of the walls of the heart's ventricles. There's no worldly help for the victim.

Above 200 milliamps, muscular contractions are so severe that the heart is forcibly clamped during the shock. This clamping protects the heart from going into ventricular fibrillation, and the victim's chances for survival are good.

Danger—Low Voltage!

It is common knowledge that the victims of high-voltage shock usually respond to artificial respiration more readily than the victims of low-voltage shock. The reason may be the merciful clamping of the heart, owing to the high current densities associated with high voltages. However, lest these details be misinterpreted, the only reasonable conclusion that can be drawn is that 75 volts are just as lethal as 750 volts.

The actual resistance of the body varies depending upon the points of contact and the skin condition (moist or dry). Between the ears, for example, the internal resistance (less than skin resistance) is only 100 ohms, while from hand to foot it's closer to 500 ohms. The skin resistance may vary from 1000 ohms for wet skin to over 500,000 ohms for dry skin.

When working around electrical equipment, move slowly. Make sure your feet are firmly placed for good balance. Don't lunge after falling tools. Kill all power, and ground all high-voltage points before touching wiring. Make sure that power cannot be accidentally restored. Do not work on ungrounded equipment.

Don't examine live equipment when mentally or physically fatigued. Keep one hand in pocket while investigating live electrical equipment. Above all, do not touch electrical equipment while standing on metal floors, damp concrete or other well-grounded surfaces. Do not handle electrical equipment while wearing damp clothing (particularly wet shoes) or while skin surfaces are damp.

Do not work alone! Remember the more you know about electrical equipment, the more heedless you're apt to become. Don't take unnecessary risks.

What To Do for Victims

Cut voltage and/or remove victim from contact as quickly as possible—but without endangering your own safety. Use a length of dry wood, rope, blanket, etc., to pry or pull the victim loose. Don't waste valuable time looking for the power switch. The resistance of the victim's contact decreases with time. The fatal 100 to 200-milliampere level may be reached if action is delayed.

If the victim is unconscious and has stopped breathing, start artificial respiration at once. Do not stop resuscitation until medical authority pronounces the victim beyond help. It may take as long as eight hours to revive the patient. There may be no pulse and a condition similar to rigor mortis may be present; however, these are the manifestations of shock and are not an indication that the victim has succumbed. —*Printed through the Courtesy of Fluid Controls Company, Inc., Hillside, New Jersey and University of California Information Exchange Bulletin.*

2 State Industrial Accident Commission
Accident Prevention Division
Special Services Section

FACTS ON ELECTRICAL SHOCK

The resistance of the human body to electrical current depends on the skin condition and point of contact.*

TYPES OF RESISTANCE	RESISTANCE VALUES
Dry skin	100,000 to 600,000 Ohms
Wet skin	1,000 Ohms
Internal body	
Hand to foot	400 to 600 Ohms
Ear to ear	100 Ohms

With 120 Volts and a skin resistance plus internal resistance totaling 1200 Ohms, there would be 1/10 amperes (100 milliamperes) of electrical current. Skin resistance gradually decreases during prolonged contact.

SAFE CURRENT VALUES	Causes no sensation	1 milliamperes
	Sensation of shock but not felt, person can let go since muscle control is not lost.	1 to 8 milliamperes
UNSAFE CURRENT	Painful shock, person can let go since muscle control is not lost.	8 to 15 milliamperes
	Painful shock, muscle control lost in adjacent muscles, cannot let go.	15 to 20 milliamperes
	Painful, severe muscle contractions, difficult breathing.	20 to 50 milliamperes
	VENTRICULAR FIBRILLATION Instant death with no known remedy.	100 to 200 milliamperes
	Severe burns, severe muscle contractions that cause muscles to clamp heart and stop it during the shock. This prevents ventricular fibrillation.	200 or more milliamperes

*American Red Cross figures

Current is the killing factor in electrical shock. Voltage determines how much current will flow through a given resistance. Voltage as low as 25 volts can cause death; voltage over 1000 volts may not be as dangerous as a low voltage.

NAME________________________________

ELECTRICAL SHOCK

Place nearest correct answer in left margin:

____ 1. Which one of the following is regarded as the most damaging to life?

1. Voltage
2. Current
3. Resistance
4. Wattage

____2. Which of the following amounts of current is the most dangerous to life.

1. .001 Amps
2. .01 Amps
3. .15 Amps
4. .35 Amps
5. .45 Amps

____3.& 4. The electrical resistance of the body depends upon 2 answers.

____

1. Points of contact
2. Skin condition (moist or dry).
3. Weight
4. Height
5. Age
6. Health condition
7. Time of day
8. Season

____5. When working around electrical equipment

1. make sure equipment is grounded.
2. move slowly.
3. maintain good balance.
4. don't stand on metal or concrete floors.
5. None of above.
6. All of above.

____6. A typical resistance of dry skin is about.

1. 10 ohms
2. 100 ohms
3. 1,000 ohms
4. 10,000 ohms
5. 100,000 ohms

____7. A typical resistance of wet skin is about
(Use answers in Question 6.)

____8. A typical resistance (internal body) from ear-to-ear is about
(use answers in Question 6.)

____9. One milliamper is

1. 1/10 of an amp (.1).
2. 1/100 of an amp (.01).
3. 1/1,000 of an amp (.001).
4. 1/10,000 of an amp (.0001).
5. 1/100,000 of an amp (.00001).

____10. What is the meaning of the expression "keep one hand in pocket while investigating live electrical equipment?"

LANE COMMUNITY COLLEGE
ELECTRONICS DEPARTMENT

INTRODUCTION TO ELECTRONICS
(Exercise 2)

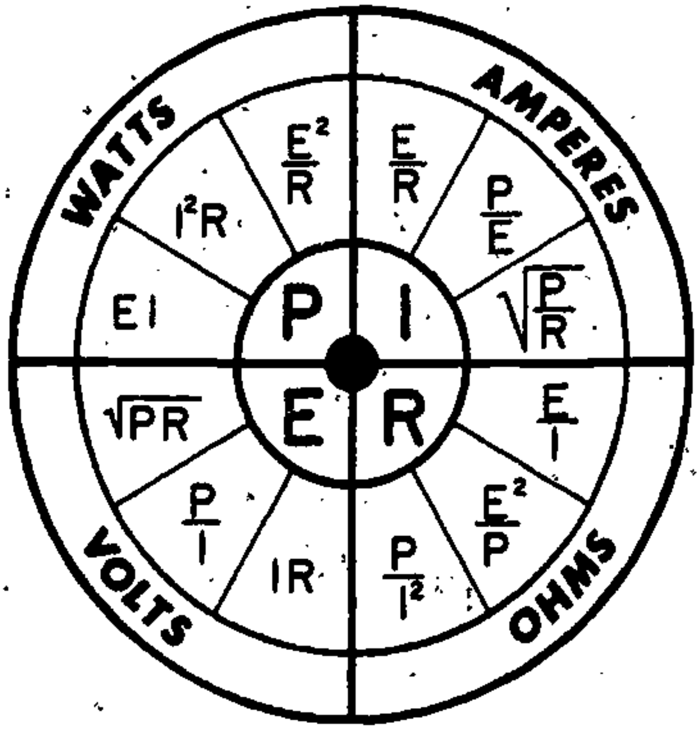
NAME ____________________

IDENTIFICATION OF PARTS

Number	Name	Symbol
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

COMMONLY USED

ELECTRICITY AND ELECTRONIC DATA



Ohms Law
Calculator

CIRCUIT FORMULAS

← SERIES PARALLEL →

RESISTANCE - OHMS

Series: $R_T = R_1 + R_2 + R_3 + \cdots \text{ETC}$

Parallel: $R_T = \dfrac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots \text{ETC.}}$

$R_T = \dfrac{R_1\, R_2}{R_1 + R_2}$

CAPACITANCE - FARADS

Series: $C_T = \dfrac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \cdots \text{ETC.}}$

$C_T = \dfrac{C_1\, C_2}{C_1 + C_2}$

Parallel: $C_T = C_1 + C_2 + C_3 + \cdots \text{ETC.}$

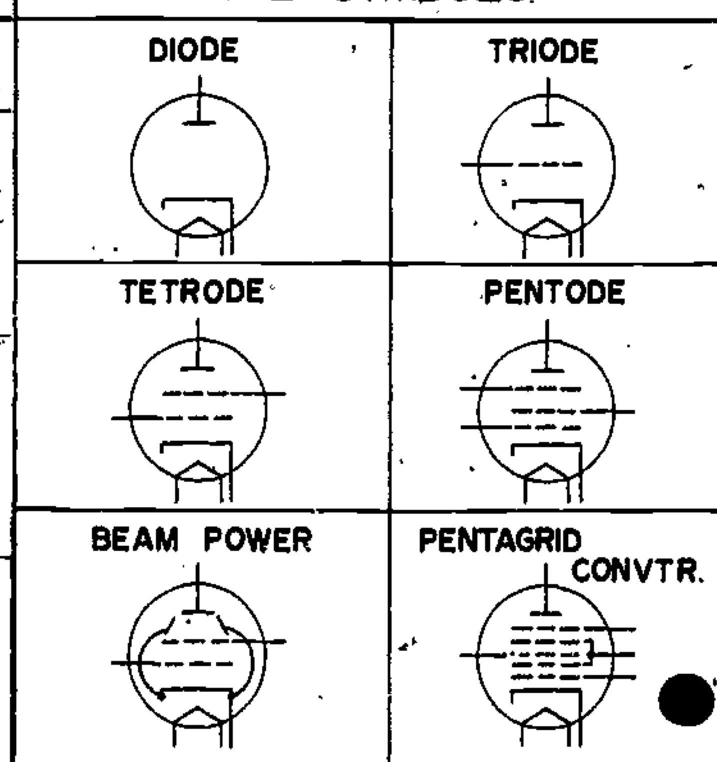
INDUCTANCE - HENRYS

Series: $L_T = L_1 + L_2 + L_3 + \cdots \text{ETC.}$

Parallel: $L_T = \dfrac{1}{\frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} + \cdots \text{ETC}}$

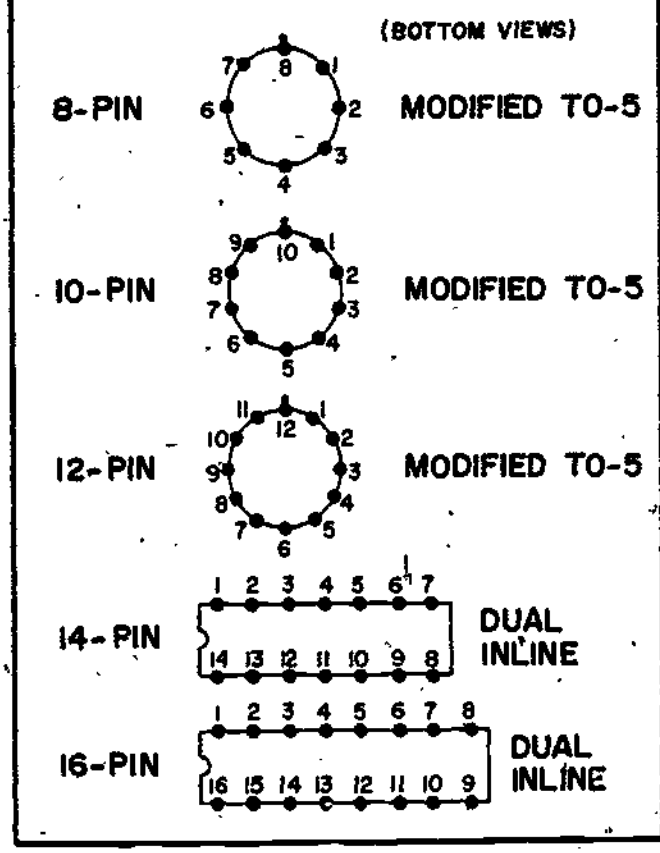
$L_T = \dfrac{L_1\, L_2}{L_1 + L_2}$

TUBE SYMBOLS

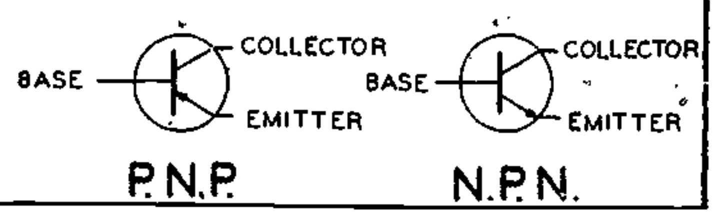


SOLID STATE

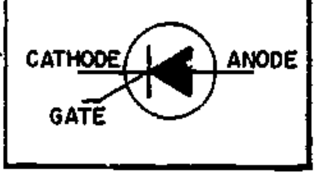
INTEGRATED CIRCUITS



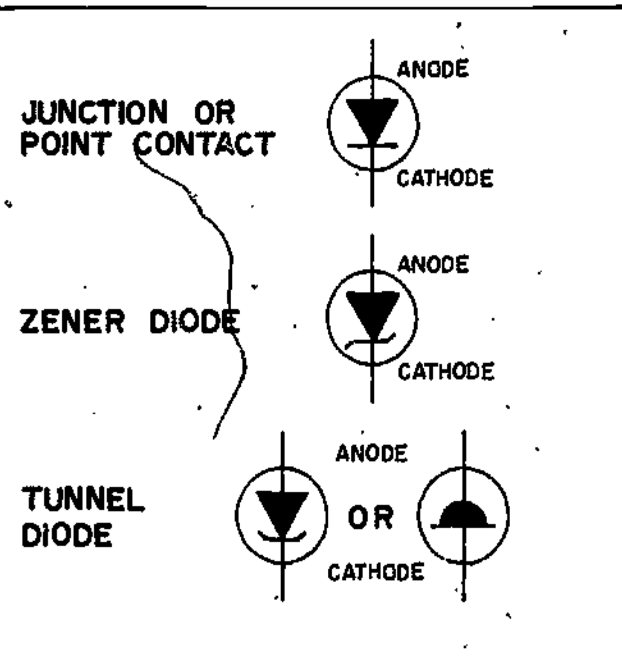
BIPOLAR TRANSISTORS



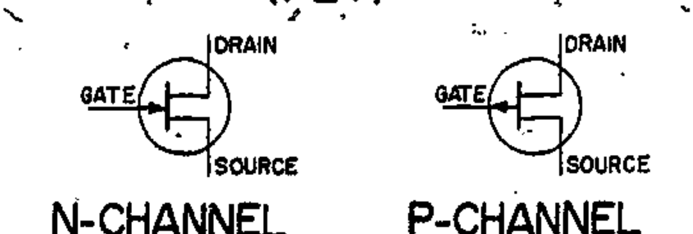
SCR



SEMI-CONDUCTOR DIODE



FIELD EFFECT TRANSISTORS (FET)



RESISTOR COLOR CODES AND USE OF THE OHMMETER

Objectives:

1. To acquire skill in identifying the value of resistors marked with the standard EIA color code.

2. To acquire skill in the use of the ohmmeter for resistance measurements.

Equipment and Supplies Needed:

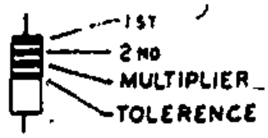
An assortment of carbon resistors identified by the EIA color code.

An ohmmeter of either the Volt-Ohm-Milliammeter (VOM) or the Vacuum Tube Voltmeter (VTVM) type.

Preliminary Information:

The EIA color coding system is based on the table below which lists the ten colors used and their number equivalents. You should memorize these color-number equivalents.

RESISTOR COLOR CODE



COLOR	SIGNIFICANT FIGURE	MULTIPLIER	TOLERENCE
BLACK	0	1	
BROWN	1	10	
RED	2	100	
ORANGE	3	1,000	
YELLOW	4	10,000	
GREEN	5	100,000	
BLUE	6	1,000,000	
VIOLET	7	10,000,000	
GRAY	8	100,000,000	
WHITE	9	1,000,000,000	
GOLD		0.1	5
SILVER		0.01	10
NO COLOR			20

Lab Procedure: A (Resistors)

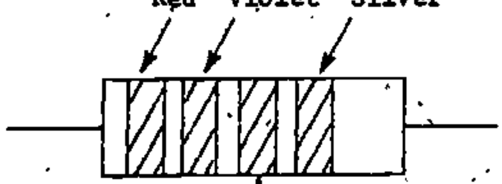
All axial lead EIA coded resistors bear at least 3 color bands and may bear a silver or gold band indicating the "tolerance", or accuracy of the resistor. Many resistors also have a fifth band indicating that they meet certain military specifications.

The resistor should first be turned so that the end bearing the color bands is to one's left; the resistor's value in ohms is then read from left to right as follows:

The first band (nearest the end) indicates the first significant figure, the second band the second significant figure, while the third band tells how many zeros follow these two digits.

A following silver band indicates the resistor is ± 10% of the value marked; a gold band, ± 5% of the value marked; and the lack of a silver or gold band indicates a tolerance of ± 20% of the marked value. Note that the tolerance stripe does not enter into the calculation of the value of the resistor.

An example follows:



Reading from left to right, the red band indicates the first significant number as 2; the violet band, the second significant number as 7. The orange band indicates the number of zeros that follow the first two digits, in this case, three zeros. The value of the resistor is then 27,000 ohms plus or minus 10%, the tolerance indicated by the silver band.

When resistors are less than 10 ohms, a modification of this system is used. The third band is always silver or gold. Silver indicates the first 2 digits are to be multiplied by the factor .01, gold by 0.1; for example, a resistor reads from left to right: brown, red, gold, silver. This indicates a value in ohms of 12 x 0.1, or 1.2 ohms ± 10%.

Wattage of a resistor is not directly related to its value in ohms but rather to the type of material it is constructed of and to its physical size which affects its ability to radiate heat.

Lab Procedure: B (Resistors)

List the values of the following resistors:

1. Yellow-violet-black-silver ______ ______
2. blue-gray-black-gold ______ ______
3. red-red-brown-silver ______ ______
4. yellow-violet-brown ______ ______
5. brown-black-red-gold ______ ______
6. brown-gray-red ______ ______
7. red-red-red-gold ______ ______
8. yellow-yellow-orange ______ ______
9. brown-black-yellow ______ ______
10. brown-black-green-silver ______ ______

Color-code the following resistors:

1. 56 ohms ± 10% ______ ______ ______ ______
2. 240 ohms ± 20% ______ ______ ______ ______
3. 2,700 ohms ± 5% ______ ______ ______ ______
4. 39,000 ohms ± 20% ______ ______ ______ ______
5. 120,000 ohms ± 10% ______ ______ ______ ______
6. 240,000 ohms ± 5% ______ ______ ______ ______
7. 300,000 ohms ± 10% ______ ______ ______ ______
8. 510,000 ohms ± 20% ______ ______ ______ ______
9. 1.2 megohms ± 5% ______ ______ ______ ______
10. 2.0 megohms ± 10% ______ ______ ______ ______

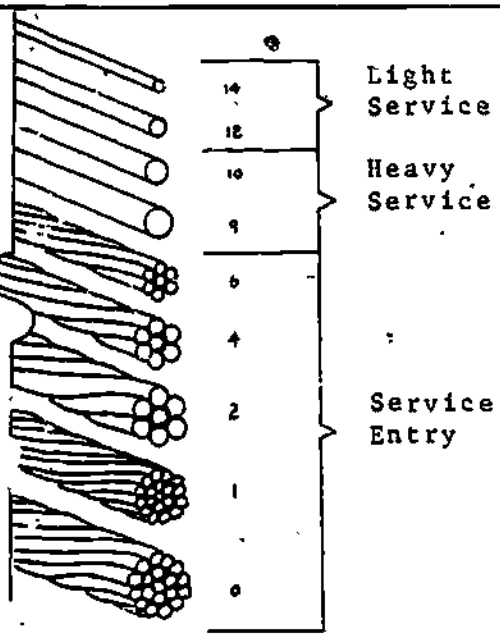
Lab Procedure: C (Resistors)

I. Obtain a set of 10 resistors from your instructor.

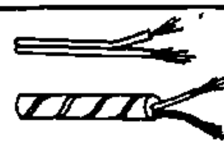
II. Measure each resistor carefully with an ohmmeter and record the color code, indicated value, and measured value in the table below.

	Color Code				Indicated Value	Measured Value
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

WIRE SIZE



TYPE AND USE



Used for lamps, appliances, etc. Available in light or heavy.

EXTENSION AND APPLIANCE CORDS

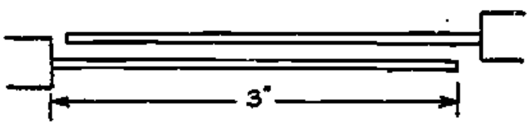
ROMEX

Resistant to water & corrosion. Use underground, above or inside.

ARMORED CABLE

Copper wire. Use with steel junction and switch box. Use only indoors in dry location.

WIRE JOINING METHOD



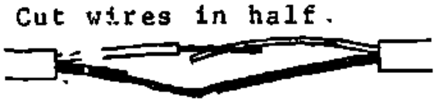
Cut insulation

6 to 8 twists

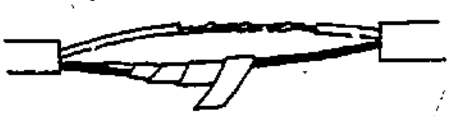
Solder an. tape

TWO-WIRE JOINING

Cut back insulation.
Cut wires in half.



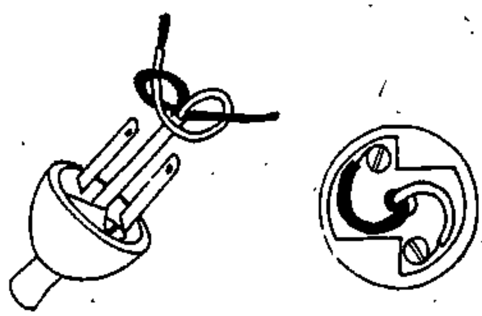
Strip 1" insulation.



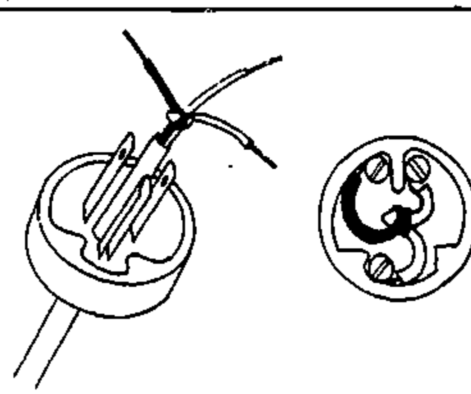
Twist and tape.

SPLICING CORD WIRES

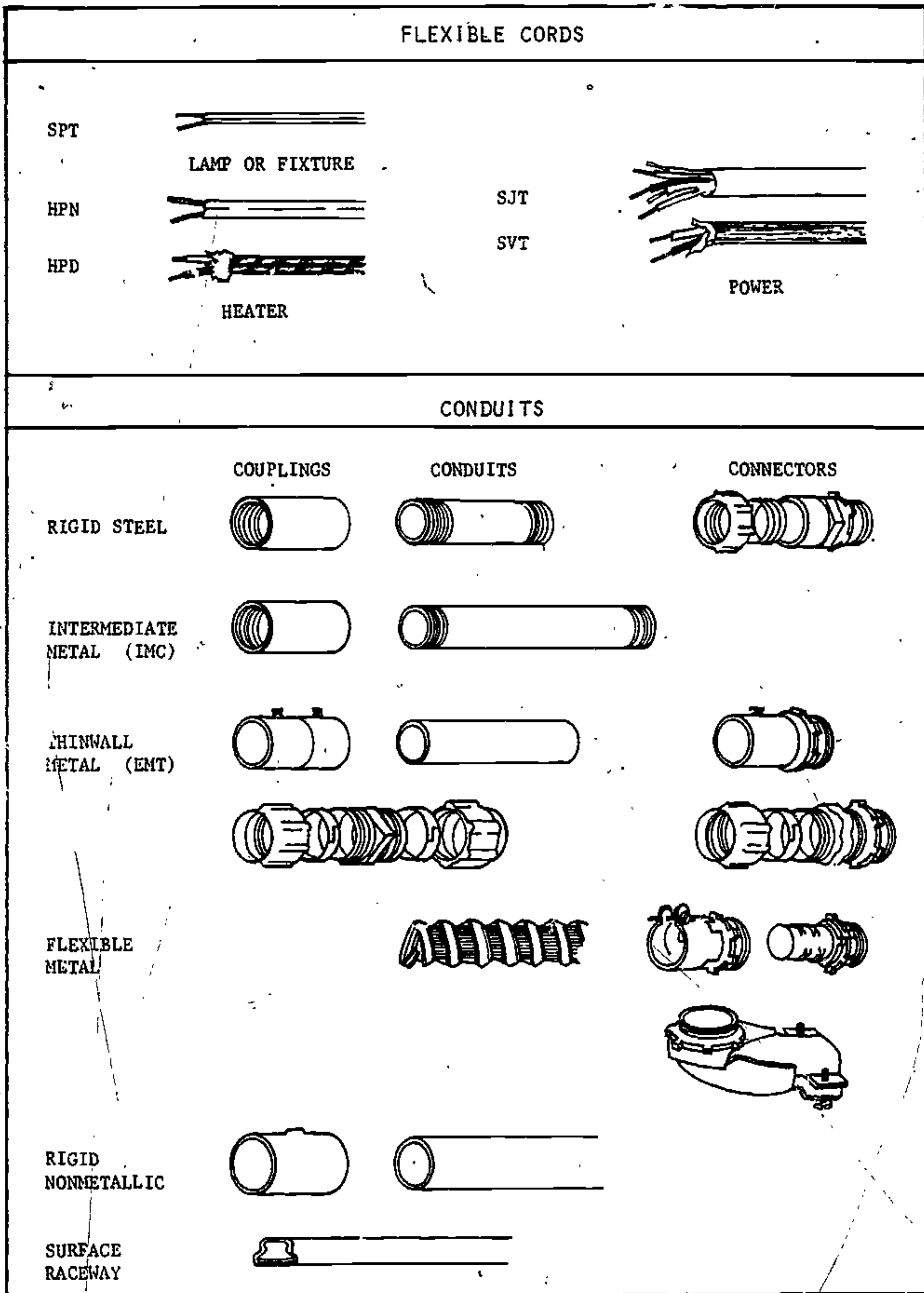
PLUGS



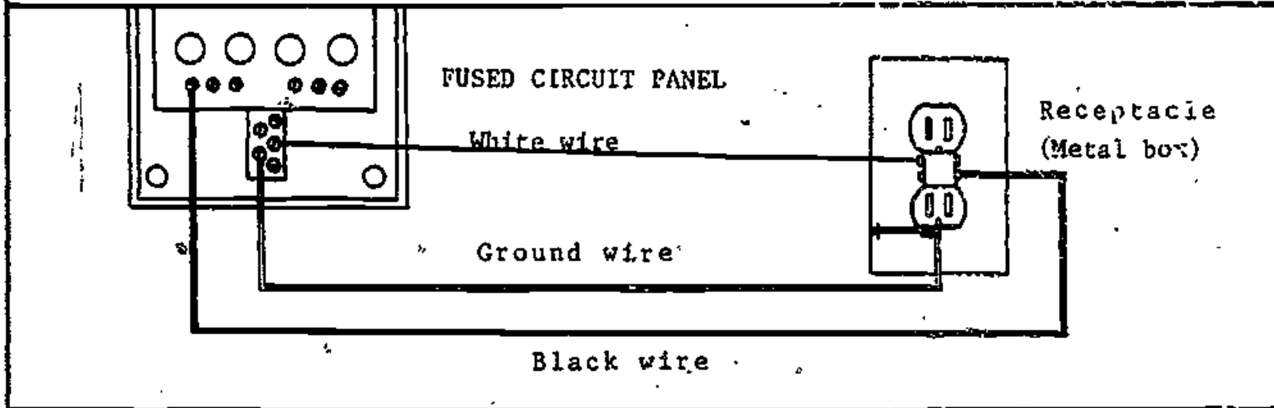
TWO PRONG PLUGS



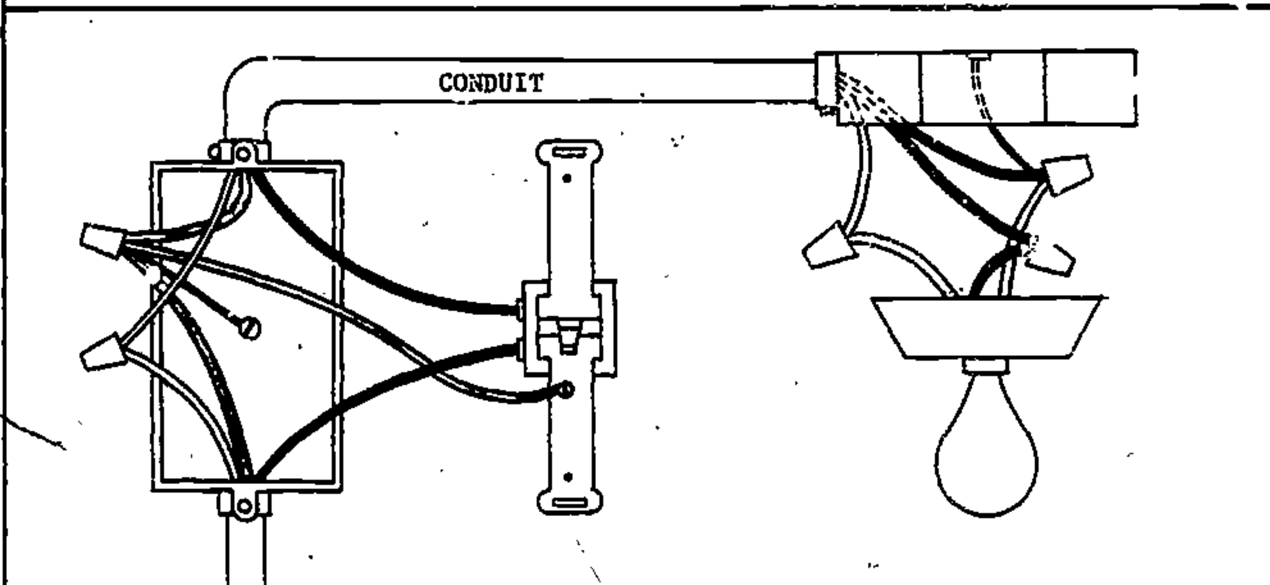
THREE PRONG PLUGS


FLEXIBLE CORDS
SPT
LAMP OR FIXTURE
HPN
HPD
HEATER
SJT
SVT
POWER
CONDUITS
COUPLINGS
CONDUITS
CONNECTORS
RIGID STEEL
INTERMEDIATE METAL (IMC)
THINWALL METAL (EMT)
FLEXIBLE METAL
RIGID NONMETALLIC
SURFACE RACEWAY

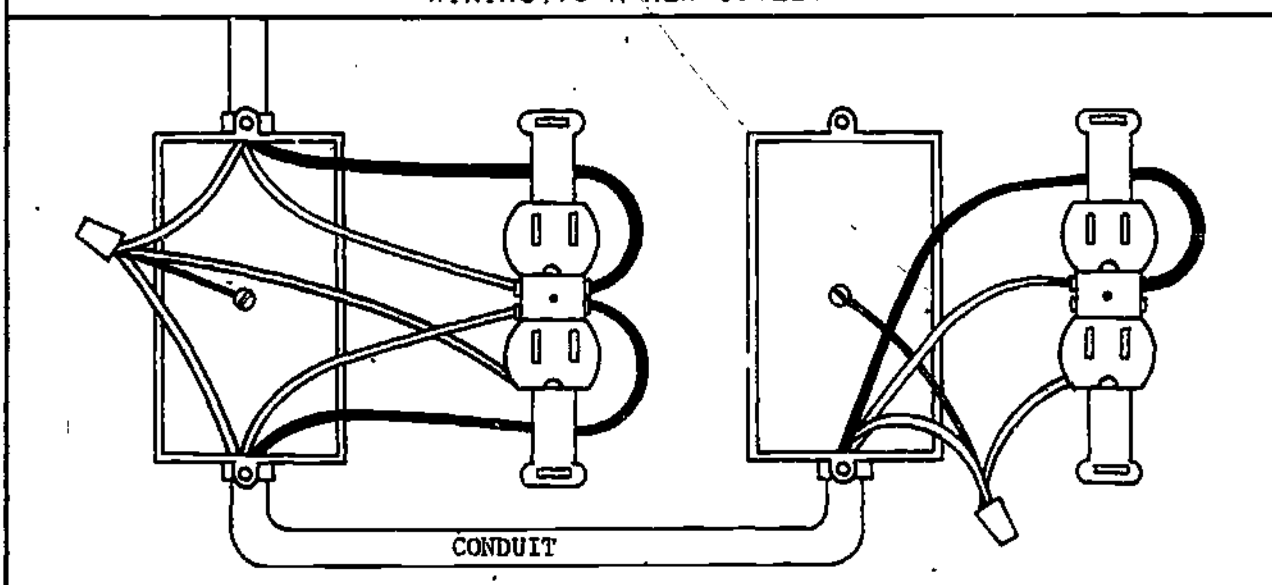
HOOKUP OF CIRCUIT AND RECEPTACLE



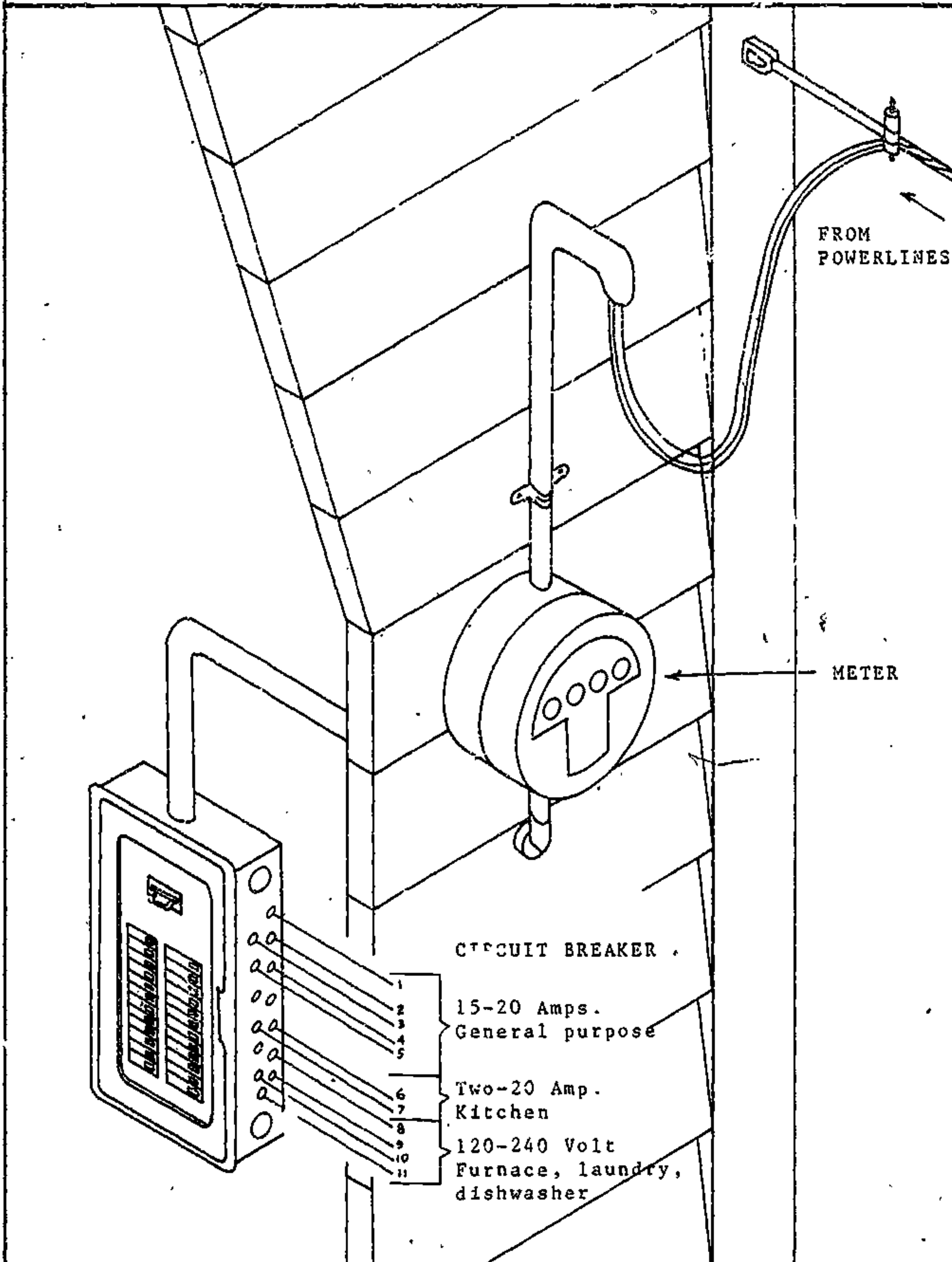
WIRING HOOKUP FOR LIGHT



WIRING TO A NEW OUTLET

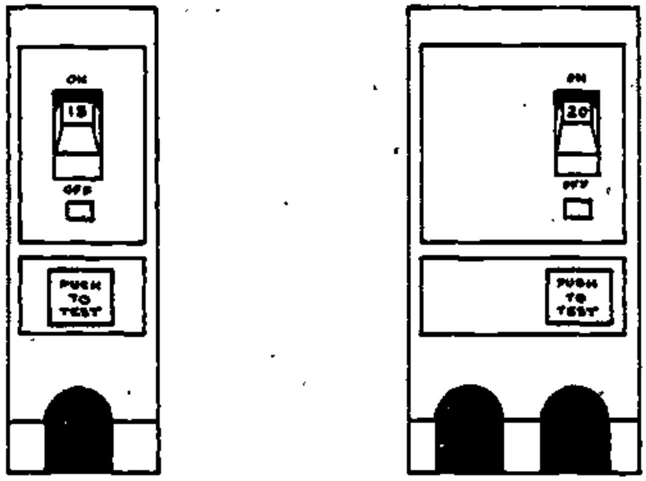


ELECTRICAL HOOKUP FROM POWERLINES

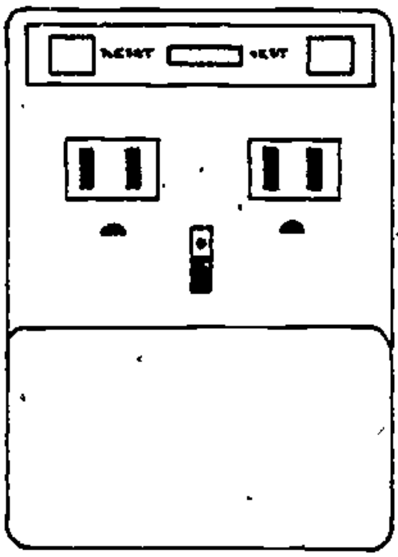


GROUND FAULT CIRCUIT INTERRUPTERS

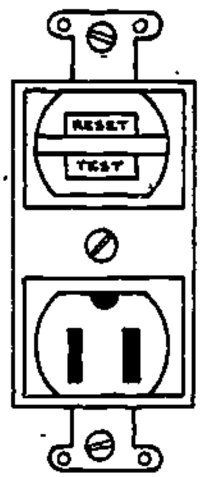
CIRCUIT BREAKERS



Ground fault circuit breakers have ampere ratings of 15 to 30. These devices can be installed in circuit breaker panels in order to break electrical current when a path is established between an ungrounded conductor and ground. Full circuit breaker panels with this protection are also available.



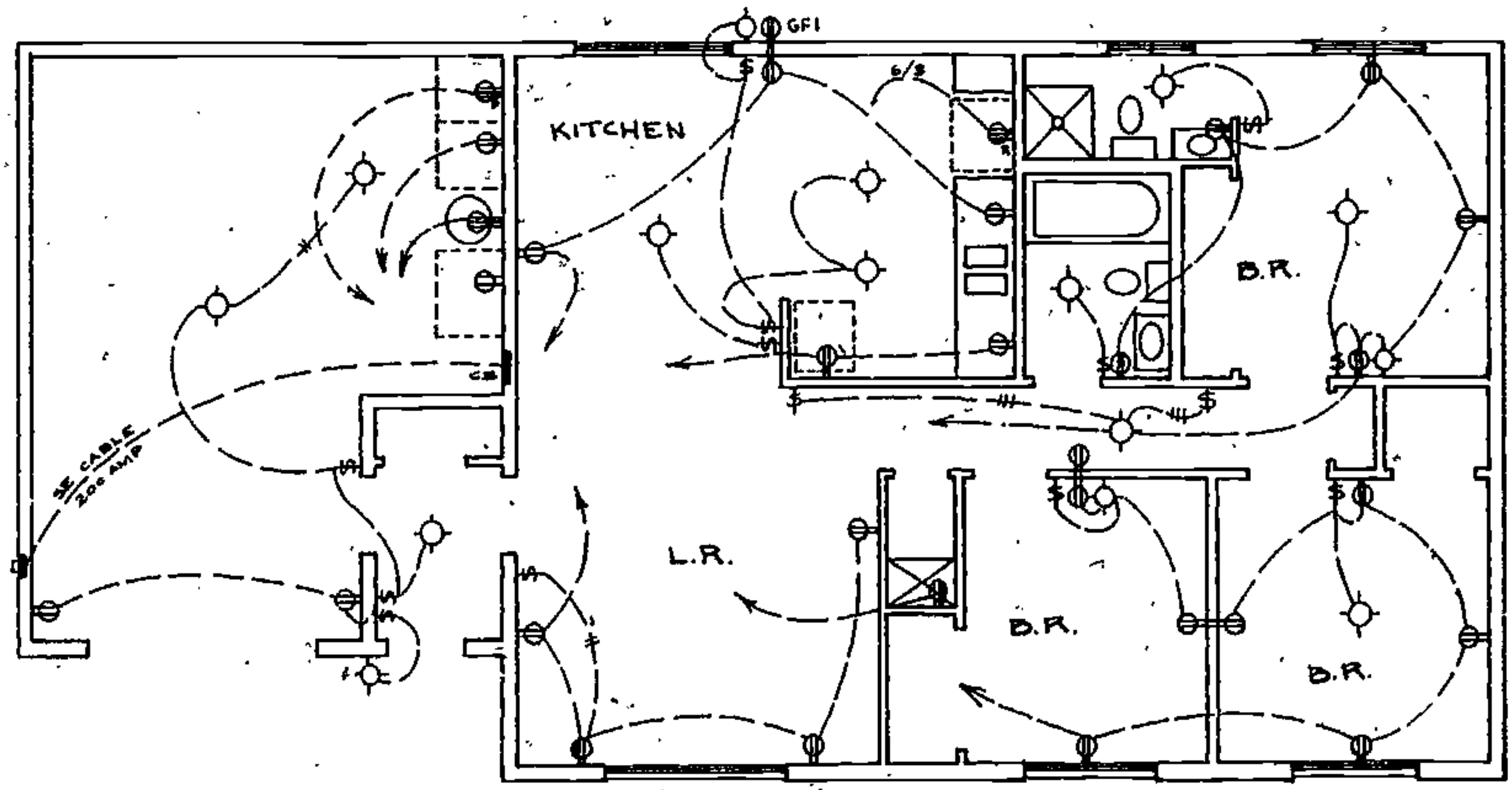
GROUND FAULT
PLUG-IN RECEPTACLE



GROUND FAULT
RECEPTACLE

These devices are available for protection at the point of installation. They can be connected to other downstream receptacles to provide further protection.

HOUSEWIRING SAMPLE



ELECTRICAL SYMBOLS

	LIGHT FIXTURE	S	SINGLE-POLE SWITCH		SPECIAL OUTLET
	DUPLEX RECEPTACLE	S_3	3-WAY SWITCH		DOOR BELL
	DUPLEX WITH HALF SWITCH		RANGE OUTLET		GROUND FAULT INTERRUPTER
			DRYER OUTLET		SWITCH WIRING

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AVERAGE WATT USE

Baseboard heater	1600	Radio	100
Blender	300-1000	Range	8000-15000
Can opener	100- 215	Range top	4000- 8000
Coffee maker	850-1600	Range, oven	4000- 8000
Corn popper	600	Refrigerator, frostless	960- 1200
Crock pot	110-1600	Refrigerator, manual	750
Dishwasher	1100-1800	Sander, portable	550
Drill, portable	360	Saw, circular	1200
Dryer, clothes	5600-9000	Sewing machine	75- 150
Electric blanket	200	Shaver	12
Exhaust fan	175	Soldering iron	150
Freezer, frostless	1050	Steam iron	1100
Freezer, manual defrost	720	Stereo receiver	450
Frying pan	1250-1460	Stereo turntable	15
Furnace, fuel fired	800	Sunlamp	300
Garbage disposal	300- 909	Television, BW	250
Hair dryer	250-1200	Television, color	300
Heater, portable	1000-1500	Toaster	800- 1600
Hot plate, two burner	1650	Toaster oven	1600
Light, flourescent	15- 75	Trash compacter	1250
Light, incandescent	25- 200	Vacuum cleaner	250- 800
Microwave oven	975-1575	Waffle iron	1200- 1450
Mixer	150- 250	Washer, clothes	850
Projector	350- 500	Water heater	4000- 5000

ESTIMATING GUIDE

(120/240 volt service, 100 amp minimum)

Number of square feet in house X 3 watts equals 1________

Number of 20 amp small appliance circuits X 1500 watts equals 2________

Laundry circuit equals 1500 watts 3________

Appliance use
- Water heater equals 4________
- Dryer equals 5________
- Dishwasher equals 6________
- Range equals 7________
- Shop equals 8________
- Other equals 9________
- Total equals (Add 4-9) 10________

Total above equals (Add 1,2,3,and 10) 11________

Multiply watts over 10,000 by 40% equals 12________

Add heat (Number of watts equals) 13________

TOTAL 14________

Divide TOTAL by 240 volts to find required amps 15________

LANE COMMUNITY COLLEGE

COMMUNITY EDUCATION DIVISION
Special Training Programs
Industrial Orientation

MODULE ______________________

TERM ______________________

MODULE EVULUATION

I would rate this module as:

1 2 3 4 5 6 7 8 9 10

(not worth my time) OK (worth my time/good)

The most useful part(s) of this module were:

____

____

The least useful part(s) of this module were:

____

____

Comments and suggestions for making this module better:

____

____

____

____

____

Rasor

11/79