REPORT RESUMES

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INNOVATIONS IN THE DEVELOPMENT OF CURRICULA FOR
DIFFERENTIALLY-PACED SYSTEMS.

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NEW YORK INST. OF TECHNOLOGY INC.

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A MODEL FOR CURRICULUM DEVELOPMENT WITH DIFFERENTIALLY PACED SYSTEMS OF LEARNING WAS DESIGNED, IMPLEMENTED, AND EVALUATED. THE MODEL WAS BASED ON THE CURRENT STATE-OF-THE-ART AND PROVIDED DETAILED MECHANIZATION BY WHICH STUDENTS IN MASS TRAINING EFFORTS COULD PROCEED AT THEIR OPTIMAL, INDIVIDUAL RATES OF LEARNING TOWARD THE ATTAINMENT OF COURSE OBJECTIVES. DETAILED PROCEDURES PRESENTED AN ITEM ANALYSIS FOR EACH COURSE ADAPTED TO THE MODEL--"DC AND AC CIRCUITS," BASIC ELECTRONICS," "GENERAL PHYSICS," AND "PRINCIPLES OF ECONOMICS." COURSE BREAKDOWNS BY TOPIC AND SUGGESTED SOURCE REFERENCES FOR STUDY WERE PROVIDED. PRELIMINARY EVALUATIONS OF THE NEW CURRICULUM MATERIALS INDICATED THE POTENTIAL FOR ENRICHMENT WHEN THE MATERIALS WERE USED AS MINIMUM COURSE REQUIREMENTS AND GUIDES. (GD)

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(5-664)

PROJECT TITLE

Innovations in the Development of Curricula for Differentially - Paced Systems

THE NEW YORK INSTITUTE OF TECHNOLOGY

CONTRACT NUMBER: OEC 1-6-058419-0434

DATE: December 15, 1966

The research reported herein was performed pursuant to a contract with the United States Department of Health, Education, and Welfare, Office of Education.

FINAL REPORT ON SMALL CONTRACT PROPOSAL

Project Title: Innovations in the Development of Curricula for Differentially-Paced Systems,

Submitted by:
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Date: December 15, 1966

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New York Institute of Technology

I. Objectives

The research described in this proposal is designed to provide a model for the development of curricula in differentially paced systems. It seeks to utilize modern technology and provide the detailed mechanism whereby each student in a mass training effort may proceed in his chosen curriculum at his optimal rate with a high probability of attainment of the objectives of the program. It must effect smooth inter and intra-course transitions which relate effectively to other pertinent disciplines and prerequisites, to spell out resources available, to provide diagnostic means for assessment of student performance, and to furnish recommended corrective and therapeutic measures quickly, where weaknesses are evident.

Finally, it strives to challenge, reinforce, and motivate each student towards greater effort in a differentially-paced, economical and logistically feasible system.

These broad aims may be detailed in a set of sub-objectives designed to insure the following:

1. That a detailed list of items for each course in a curriculum be formulated, and that the objectives for teaching each of the items be coded for later evaluative purposes. Items and codes will be programmed for a computer for storage, interpretation and easy retrieval.
2. That there be smooth transitions between successive courses within a departmental curricula.
3. That courses taken in one department be closely linked with those taken in other departments, so that needless repetition of materials be avoided; that each item of material be sufficiently covered; that prerequisites be supplied in proper time phase; and that newly acquired tools be put into use as quickly as possible.
4. That the materials for the courses be available; that the student know exactly how he should use the material; and that he be able to proceed at the rate best suited to his learning abilities as determined by the combined resources of instructor and computer.
5. That means be provided to continually evaluate the student's progress so that he can be advised of appropriate problem sessions, discussion groups, lectures and other services and facilities of value to him.

6. That the student be able to observe his own progress; that he learn of his mistakes quickly and be referred to remedial material; and that he be stimulated to proceed at a rate which will ensure both effective learning and good use of time in a differentially-paced program.

7. That the courses of instruction be continually assessed for quality and effectiveness.

8. That they serve as guides for students and faculty to primary and secondary sources so that they may obtain alternate approaches towards particular items and groups of items.

9. That they serve as guides for teachers in assigning outside reading or extra projects.

II. Procedures and Outcomes

Methods have been developed to meet the objectives listed above in a self-improving differentially-paced system. Detailed procedures are referred to in the appendices and attachments to the report. Specific illustrations of how the model system is meeting its objectives follow.

Course Objectives - An Item Analysis for each course represents the detailed topic-by-topic breakdown of course content. Specifically, each course has been analyzed with respect to:

a. a close breakdown of course sequence by topic

b. suggested source references for study of each topic

Sample pages from the Item Analysis of Electrical Technology 5011, DC and DC Circuit Analysis, in original and restructured forms are attached in Appendix A. (Attachment AA includes representative sets of curriculum analysis materials originally generated for use in the following courses:

ET5011 - DC and AC Circuits

ET5030 - Basic Electronics

PH4011 - General Physics

SS2010 - Principles of Economics)

Articles VII and VIII of the Curriculum Analysis Materials and Procedures Manual (see Attachment BB) provide detailed explanations and directions for generating courses designed for differential-pacing.

Curriculum Objectives - The Electrical Technology sequence, DC and AC Circuit Analysis, Basic Electronics, and Transistor Electronics demonstrate the type of curriculum planning facilitated by curriculum analysis methods. Courses presented in this way enable students and instructors to know immediately the direction of a particular course sequence as well as minimum course requirements. Sample pages showing the relationship of a topic presented at varying levels in each course are attached as Appendix B. Courses like College Algebra and Trigonometry, General Physics, and AC and DC Circuit Analysis are usually taken concurrently by freshmen technology majors. They are planned to avoid repetition and arranged so that pre-requisites and co-requisites in related courses are studied at appropriate times. In addition, inter-departmental conferences are aided in curriculum planning by the availability of Item Analysis material and other related curriculum analysis material.

Student Objectives and Progress - Instructions for student use of materials are precisely stipulated in brochures such as the one developed for an Off-Campus Program (see Appendix C). The sample output forms contained in Appendix D demonstrate how the computer aids the student in analyzing his difficulties and determining his own best pace for achieving course objectives. The sample individual print-out is available for each diagnostic test that a student takes. It is a test analysis which tells him the topics requiring review as well as his score. In addition, specific referrals to secondary resources are recommended for review of each topic requiring further study. Note that Item Analysis material in

Appendix A was restructured to indicate only prime source materials. The computer-oriented printout referrals give alternate media and sources for items in which students encounter difficulties.

The sample individual print-out shown in Appendix D represents a simplified version of the referrals shown in Attachment AA and originally described in the "Innovations in the Development of Curricula for Differentially-Paced Systems" proposal. The new output forms were developed by N.Y.I.T. and I.T.T. Human Engineering groups as an improvement in the use of the computerized techniques. For reinforcement, organization of study, and therapeutic purposes, it is desirable for the student to receive the results of diagnostic examinations as soon as possible. To achieve this, examinations are graded by computer and the following information printed on an individual output form for each exam a student takes:

a. Question number, correct answer and topic missed

b. Information category

c. Referral to secondary sources and page references

d. Level and extent of treatment for each suggested reference

New and better methods for storing and retrieving detailed referral information for each topic have obviated the need for condensed referrals suggested in the original proposal. By distinguishing between the prime sources and suggested secondary sources used in a course, it is possible to concentrate only on prime materials in designing the basic course outline and item analysis, yet to program specified secondary resources into the computer with indications that they are to be used for back-up, enrichment, or review.

Group section test analyses are also attached in Appendix D. These demonstrate the different dates at which varying members of students took a test covering the same topics. (Other important information printed on these forms will be referred to in other sections of this report.) A "learning laboratory" provides teaching machines, tape and film libraries, and a "live" instructor for scheduled or unscheduled study sessions. Resources in the laboratory are designed for a variety of specific review purposes. Depending upon whether a student needs more or less extensive review or a higher or lower level of presentation of topics, he is directed to the resources most suitable for him. His progress record and exams are generally the best indicators of his specific study needs.

Sample records of progress of students in an Off-Campus Program demonstrate how the principles of differential-pacing worked in a learning situation where the students were employed in industry and would not have been able to pursue college-level study in conventional curriculums with fixed time bases. These are attached in Appendix E.

The development and storage of Course Record Profiles and Student Record Profiles by computer provide further valuable information on the learning rates of individuals and groups for each course and topic studied. Selected data on each unit test a student takes is stored here as a permanent record for the purpose of long term analysis. Together with detailed explanations of each, sample Course Record Profiles and Student Record Profiles are attached in Appendix F.

Evaluation and Assessment

Group performance with respect to each question on a test can be readily assessed by reference to section test analyses readout by computer (see Appendix D). Individual performance within a course is stored by computer and printed in the form of a Course Record Profile (see Appendix F for detailed explanation). Overall individual performance in all courses is provided in the Student Record Profile (also contained in Appendix F). Other group distributions and correlations can be made as rapidly, once they are programmed into the computer. Continual assessment of quality and effectiveness of courses using covariant and regression analysis of selected data has been made feasible by the introduction of the computer into the system. In addition to human evaluation of course and curriculum content, it is now possible to correlate course content and methods with effective learning for a particular student or group. For a discussion of computer techniques and flexibility in grading examinations, see Article I of the Materials and Procedures Manual (attachment BB). It should be noted that while most procedures mentioned in the Manual are presently in use, some procedures have been further refined for use with a data-linked terminal, with an optical scanning mechanism, and for minor programming changes.

III Summary

Faculty response to the new curriculum methods indicates the potential for enrichment rather than limitation of instruction when the materials are used as minimum requirements and guides. By specifying primary and secondary sources, the Item Analyses and computer printouts indicate a direction for systematic expansion of the means for teaching and learning topics. The prospects for more creative teaching within the framework of a differentially-paced system are increasingly more apparent as more faculty members participate in the development and use of new curriculum methods.

1. An Item Analysis for each course represents the detailed breakdown of course content with respect to topics and source references.
2. Curriculum planning is facilitated by curriculum analysis methods with respect to the direction, minimum requirements, and levels of presentation for each sequence. Pre-requisites and co-requisites in related courses can be studied at appropriate times and needless repetitions avoided.
3. Instructions for student use of course materials are precisely stipulated. With the aid of computer, a student can analyze his own difficulties and find his own best pace for achieving course objectives. Specific referrals to secondary resources are recommended for review of any topic requiring further study. With a computer in the system, a student receives the results of diagnostic examinations more quickly than he does if conventional grading methods are used. A student can proceed at his own rate and be directed to use the resources of a "learning laboratory" for review, reinforcement, and corrective purposes. Selected data for each course and test taken is stored as part of a student's permanent record in the form of Course Record Profiles and a Student Record Profile.
4. Course Record Profiles, Student Record Profiles, section test analyses, and computer grading of exams provide the basis for continual assessment of the quality and effectiveness of courses. Eventually, course content and methods will be correlated with student learning behavior and evaluated accordingly.

The development of the new methods described in this report has made it possible to use curriculum analysis materials as the basis for a truly individualizing system in which every student can proceed at his own pace. Furthermore, because of the development of associated "hardware" (such as the installatior of the new data-phone and computer terminal and NYIT's "learning laboratory"), it is possible for remote, data-linked laboratories and classrooms to receive the benefit of differentially-paced education systems, controlled from a central computer facility via simple telephone lines.

APPENDIX A

Sample pages from the Item Analysis of Electrical Technology 5011, DC and AC Circuit Analysis, in original and restructured forms.

COURSE ET5011 SUBJECT STATIC ELECTRICITY

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
NUMBER	TITLE	140	150	151	155	125	100	95	160	375	105	
ET00010	States of Matter	3-4 7			9				1-4	17-32		
ET00020	Atomic Structure	6-8	5-8	4-7	10-12	2-1	449	278		33-50		
ET00030	Milikan Oil Drop Experiment (charge on electron)				12		487		36-40			
ET00040	Elements, Compounds,mixtures	4-6			9							
ET00050	Law of Electric Charges	8-10	207 21	241	6	1-1	449-50	277	4-7	51-77		
ET00060	Constitution of charges and charging	11-14			5	3-1, 4-1	452-4 509	294 297		188-99		
ET00070	Atoms & Ions	15-17		7-8	12-13					70-8		
ET00080	Coulomb's Law Force Between Charges Bodies	17-21	209	241-44	7	5-1	456	280	12-13 18	51-77 215-36	136	
ET00090	Distribution of Charges	26-29		243		8-1, 11-1	486	282- 283	34-36			
ET00100	Detection Devices Electroscope	24-25			8	5-1 3-1	453 457	279	7-11	200-28		
ET00110	Eoergy & Energy Levels	7										

COURSE ET5011 SUBJECT STATIC ELECTRICITY

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES			
NUMBER	Title	140		151	
ET00010	States of Matter	3-4, 7			
ET00020	Elements, Compounds, Mixtures	4-6			
ET00030	Atomic Structure	6-8		4-7	
ET00040	Law of Electric Charges	8-10		241	
ET00050	Constitution of Charges and Charging	11-14			
ET00060	Atoms and Ions	15-17		7-8	
ET00070	Coulomb's Law- Force Between Charged Bodies	17-21		241-244	
ET00080	Electric Field	21-24		242	
ET00090	Detection Devices Electroscope	24-25			
ET00100	Distribution of Charges	26-29		243	
ET00110	Lines of Force Field Intensity			241-244	
ET00120	Conduction, Insulation			9-12	
ET00121	Units of Measurement			13-17	

Item Analysis- Restructured Version

Appendix B

Sample pages show the relationship of topics presented at varying levels in the ET5011, ET5030, and ET5090 course sequence (DC and AC Circuit Analysis, Basic Electronics, and Transistor Electronics.)

Appendix B

Topic ET00020 - Atomic Structure

As presented in ET5011, the concept of atomic structure is the basis for defining such terms as electric current, voltage, and resistance.

Topic ET01790 - Thermionic Emission

Unless the student has a clear understanding of atomic structure as it was presented in the preceding course, he will not be able to understand the process of thermionic emission which he studies in ET5030.

Topic ET03770 - Conductors

In the ET5090 course, conductors are defined as materials that have a large number of loosely bound valence electrons. Such a definition would have no meaning to the student who had not learned the basic concept of "atomic structure."

COURSE ET5011 SUBJECT STATIC ELECTRICITY

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
NUMBER	TITLE	140	150	151	155	125	100	95	160	375	105	
ET00010	States of Matter	3-4 7			9				1-4	17-32		
ET00020	Atomic Structure	6-8	5-8	4-7	10-12	2-1	449	278		33-50		
ET00030	Milikan Oil Drop Experiment (charge on electron)				12		487		36-40			
ET00040	Elements, Compounds, mixtures	4-6			9							
ET00050	Law of Electric Charges	8-10	207 21	241	6	1-1	449-50	277	4-7	51-77		
ET00060	Constitution of charges and charging	11-14			5	3-1, 4-1	452-4 509	294 297		188-99		
ET00070	Atoms & Ions	15-17		7-8	12-13					70-8		
ET00080	Coulomb's Law Force Between Charges Bodies	17-21	209	241-44	7	5-1	456	280	12-13 18	51-77 215-36	136	
ET00090	Distribution of Charges	26-29		243		8-1, 11-1	486	282- 283	34-36			
ET00100	Detection Devices Electroscope	24-25			8	5-1 3-1	453 457	279	7-11	200-28		
ET00110	Energy & Energy Levels	7										

COURSE ET5030 SUBJECT Electron Emission-Diodes

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
NUMBER	TITLE	190	155	195	255	245	205	SCHURE	375			
ET01790	Thermionic Emission	1-2		9-11	32	94	1	Re210 3-9 Re240 5-9	248- 273			
ET01800	Secondary Emission	2				107		Re240 5				
ET01810	Filament Materials	1,7		10; 13-15	32-3	101-3						
ET01820	Filament Ckt.	2-3						Re210 17-18	704- 707			
ET01830	Plate Ckt.	3						Re210 13,15,18				
ET01840	Diode Uses			36	32	126-7		Re210 2-3	245-7			
ET01850	Diode Types			36,37	32,33	126-7						
ET01860	Diode; Vacuum	3	225, 279-80	34-8	35-7							
ET01861	Diode, Gas	11	227									
ET01870	Rectifier, Full Wave	5-7	225,-7	15,16		114, 123	5-7	Re210 14-18	654-75			
T01880	Rectifier, Half Wave	5-7	225;9	15,16	37	114-16 124	5-7	Re210 11-14	638-53			
T01890	Rectifier Ckt.	10,6,5				124	5	Re210 13,15				

COURSE: ET5090 SUBJECT: SEMICONDUCTOR FUNDAMENTALS page 1 of 3

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES							
Number	Title	280	284	282	295	300	375	293	283
E[illegible]03700	Development of semiconductor crystals & rectifiers	1-2						1	6-7
ET03720	Basic Terminology	3-5			18				
ET03730	Uses of Transistors	5-6							
ET03740	Division of Matter & its Structure	7-9			4	7-8			
ET03750	Atomic Structure	9-13	2-10	19-25	5-7	1-4	410-4		1-4
ET03760	Energy Bands		12-15	23-25 27-29		5-7			4-6
ET03770	Conductors, Insulators and Semiconductors	13-15		28-9	8-11	11-15			
ET03780	Crystaline Structure	15-21	18-20 26-8	25-6 32-40	#12-13	9-11	450-3		
ET03790	Impurities (Donor & Acceptor) in German-	18-21	22-5	40-5	14-16	18-22	454-8. 1675- 1700	4	9-10

Appendix C

NEW YORK INSTITUTE OF TECHNOLOGY - ITT

ORIENTATION BULLETIN

April 6, 1966

Congratulations on your acceptance into the New York Institute of Technology-ITT Off-campus Program. The faculty and staff of New York Institute of Technology welcome you and stand ready to assist you in your studies in every way we can. Although you will not be attending conventional classes, you will be taking the same courses for college credit as your on-campus counterparts.

This booklet has been prepared especially for you. It explains how to use the course materials, some of which were especially designed for this program. It will also tell you how to study and what types of facilities are available to help you if you encounter any problems in a course.

Together with the orientation session, this booklet is intended as a guide to explain what you have to do to complete each course successfully.

MATERIALS

For each course you will receive the following materials:

1. "Item Analysis and Source References, Book I"
2. "Diagnostic Questions, Book III"
3. IBM Port-A-Punch Unit
4. Student Answer Cards

In addition, this booklet and a sample computer read-out will be very useful to you if you have any questions later about how to proceed. Please keep these with you whenever you intend to study until you are experienced with the new methods.

Please contact Mr. Toddie, Manager of Education at ITTFL, regarding purchase of required texts for each course you take and the availability of other references and teaching machines.

COURSE ET5011 SUBJECT STATIC ELECTRICITY Page 1 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
NUMBER	TITLE	140	150	151	155	125	100	95	160	375	105	
ET00010	States of Matter	3-4 7			9				1-4	17-32		
ET00020	Atomic Structure	6-8	5-8	4-7	10-12	2-1	449	278		33-50		
ET00030	Milikan Oil Drop Experiment (charge on electron)				12		487		36-40			
ET00040	Elements, Compounds, mixtures	4-6			9							
ET00050	Law of Electric Charges	8-10	207 21	241	6	1-1	449-50	277	4-7	51-77		
ET00060	Constitution of charges and charging	11-14			5	3-1, 4-1	452-4 509	294 297		188-99		
ET00070	Atoms & Ions	15-17		7-8	12-13					70-8		
ET00080	Coulomb's Law Force Between Charges Bodies	17-21	209	241-44	7	5-1	456	280	12-13 18	51-77 215-36	136	
ET00090	Distribution of Charges	26-29		243		8-1, 11-1	486	282- 283	34-36			
ET00100	Detection Devices Electroscope	24-25			8	5-1 3-1	453 457	279	7-11	200-23		
ET00110	Energy & Energy Levels	7										

WHAT IS THE "ITEM ANALYSIS AND SOURCE REFERENCES, BOOK I?"

Book I contains a detailed list of topics covered in each course that you take.

Look at the attached sample page from course ET 5011, "Book I." You will see that eleven of the topics in the unit on Static Electricity are listed. Each topic item is numbered on the left-hand side of the page. On the right-hand side, there is a chart labeled "Source Reference Numbers and Pages." The source reference numbers are 140, 150, 151, 155, etc. Under each source reference number is a list of page (or frame) numbers for each topic item. All the source references are listed in Book I. Most of them are books.

A guide to the source references indicates that 140 is a programmed textbook, Basic Electricity, and that 151 is the second edition of Introduction to Electric Cirduits by Jackson. Most of the topics on the sample page are covered in these two required * books, but eight additional sources will be available for reference in a specially designated area at ITT. These additional sources may be textbooks, films, lectures, tapes or videotapes. You are expected to refer to these additional sources when you need them. When you want further clarification of any topic you do not understand, it is up to you to use the resources in the special room set aside for you. (As we get under way, we will increase the number of resources to give you additional possibilities for enrichment.)

Look at the sample page from ET 5011, "Book I" again. In the unit on Static Electricity, the first topic you study is "States of Matter" (number ET00010). Reference 140 is the required text, Basic Electricity. When you begin studying "states of matter" it is a good idea to start by reading pages 3-4 and 7 in Basic Electricity. Notice that this particular topic is not covered in reference 151, but that you may find it among the references available in the special room set up for your convenience.

Diagnostic questions on each topic will correspond to the references listed in "Book I". These questions appear in a separate volume ("Book III") designed so that you can test yourself to find out whether or not you have learned the topics in each unit of study.

*Please contact the Manager of Education (ITT), Mr. Toddie, regarding the purchase of required texts for each course.

NEW YORK INSTITUTE OF TECHNOLOGY

DIAGNOSTIC TEST

ET00010
through
ET00[illegible]

Course: ET5011
Unit No.: 1
Test Group: A

Question 1
ET00010
LW

If Hg. changes from a gas weighing 32 grams, to a solid, how many grams will Hg. weigh when it is in its solid phase?

A) 45 gms.

B) 64 gms.

C) 32 gms.

D) 48 gms.

Question 2
ET00020
LW

A Substance that cannot be broken down into simpler substances is called a (an):

A) Molecule

B) Element

C) Compound

Question 3
ET00030
TH

The core or nucleus of an atom consists of _______________, which have_____________and_______________ charges respectively.

A) Protrons and neutrons; positive zero

B) Positron and a neutron; positive zero

C) Positron and an electron; positive negative

D) Protron and a positron; positive positive

Question 4
ET00040
LW

A material which will not make a good permanent magnet is:

A) Steel

B) Nickel

C) Cobalt

D) Soft iron

WHY ARE "DIAGNOSTIC TESTS" NECESSARY?

Diagnostic tests taken after each unit help you to find out how well you are learning the subject, unit by unit. Aided by the computer, you will always be advised about how you should proceed in a course. The computer will print out which topics give you trouble and will recommend that you review those topics before going on to the next unit of study. By the time you complete the course you should know each topic in every unit. In fact, you cannot take an examination for credit until you are fully prepared for it. When you have successfully mastered the material in the diagnostic tests, you will be ready to take a final examination for course credit.

HOW DO YOU TAKE A "DIAGNOSTIC TEST?"

In the volume, "Diagnostic Question, Book III", there is at least one question for each item in each course. A diagnostic test generally consists of ten questions for each unit of study. The test is the "multiple choice" type; that is, for each question there is a choice of answers but only one is correct. There is no benefit gained in compromising on a diagnostic test because you are the only one who ever knows your score and which answers were correct, which incorrect. You will be given an IBM student identification (I.D.) number.Punch this number on every student answer card you use to take a diagnostic test. Since no one but you and the computer knows your I.D. number, no one but you and the computer knows your scores on the tests. The whole idea of the diagnostic tests is to help you find out where to concentrate your attention in your studies.

Look at the attached sample page from course ET5011, "Book III." You will see that there are five multiple choice type questions corresponding to the first five topic items in "Book I". If you studied carefully, you would know the correct answers to these questions and would get them all right. If, however, you didn't quite understand the topic on "atomic structure", for example, you would probably answer question 2 incorrectly and soon be reminded to review the topic before going on to the next unit.

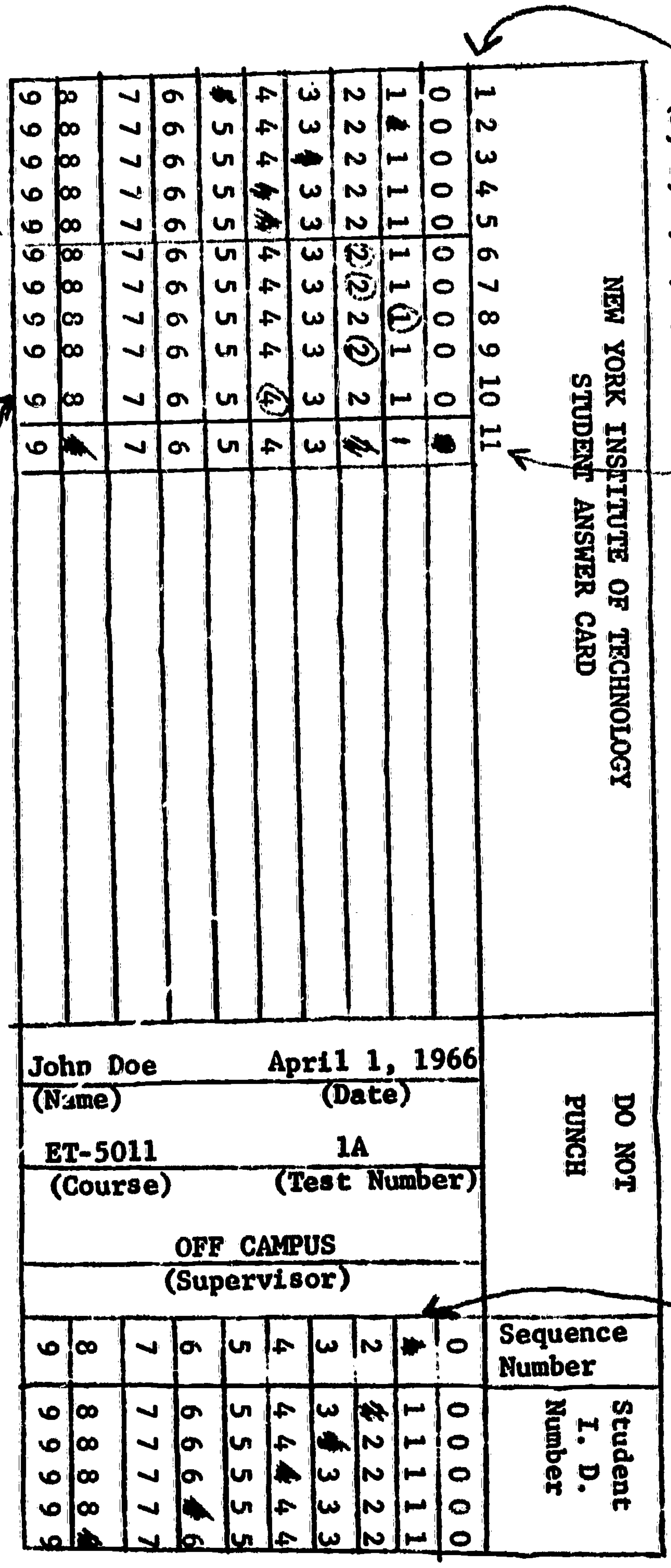
DIAGNOSTIC TEST PROCEDURE

Choose the answer you think is correct and use the IBM Student Answer Card and Port-A-Punch unit according to the directions below for each diagnostic test.

SAMPLE ANSWER CARD

Answers to questions 1-5 are punched (5, 1, 3, 4, 4)

Answers to Questions 6-10 are circled (2, 2, 1, 2, 4)



NEW YORK INSTITUTE OF TECHNOLOGY
STUDENT ANSWER CARD

DO NOT PUNCH

John Doe April 1, 1966
(Name) (Date)

ET-5011 1A
(Course) (Test Number)

OFF CAMPUS
(Supervisor)

Sequence Number

Student I.D. Number

0, 2, 8 in column after last answer

Sequence Number is "1"

I.D. Number is "23468"

1. Insert card, holding Port-A-Punch unit with opening on the left-hand side.

2. Write your name, date, course number and test number in the column labeled "do not punch." Write the word "off-campus" where it says "supervisor".

3. Punch your Student I.D. Number in the right-hand columns (36-40), punching each digit in a different column.

4. Punch a "1" in the column labeled "sequence number", (column 35.)

This indicates that this card is the only card for the test. (Most tests contain ten questions, but some may have as many as 20. You will require no more than one card per test.)

5. Answer each question on the test by circling your choice lightly in pencil or ink first. When you are sure of your choice, punch out the answers. Punch answer to Question 1 in column 1, answer to question 2 in column 2, etc.

6. After the last column of answers, punch 0, 2, 8 vertically in the next column as shown to indicate that the test has been completed. In a ten-question test, punch 0, 2, 8 in column 11.

7. Remove card carefully then clean off paper chips from the back of the card. The computer will reject cards improperly punched. Clean chips from Port-A-Punch unit by removing end cap and shaking chips out or running stylus along the rubber slots.

8. As soon as you can after you finish a diagnostic test, bring the test card to the room designated for the off-campus program. At the inception of the program, if the room is not available, please bring cards to the Office of the Manager of Education (ITT), Mr. Toddie.

HOW DO YOU FIND OUT YOUR SCORE, RIGHT ANSWERS, WRONG ANSWERS, AND RECOMMENDATIONS FOR STUDY?

Every diagnostic test you take will be processed by a computer which has stored information on the courses, source references, and test answers. For each test submitted, you will receive a computer read-out which tells you the test score, which items and source references to review, and the academic level and depth of coverage of the suggested review material for each topic item as well as other information shown on the sample and described below.

SAMPLE READ-OUT

I.D.#	SCORE	COURSE	TEST NUMBER	QUESTIONS COVERED	DATE	INSTRUCTOR
43352	40	ET 5011	1A 01010	ET00010 ET00100	2/7/66	LUTHER

QUESTION	TOPIC	SOURCE	PAGES	MP	AL	DEPTH
ET 0080	COULOMB'S LAW, FORCES BETWEEN CHARGED BODIES.				LW	
8	ET00080	0140	0017	PT	00	3
8	ET00080	0155	0007	NT	00	1
8	ET00080	0125	0501	PT	01	1

The above diagram of a computer read-out illustrates the following information regarding test number 1A for the course ET5011:

1. Score--Four out of ten questions were answered correctly. The test score is 40.

2. Topic to be reviewed - One of the questions answered incorrectly was question 8 (ET 0080). The question refers to COULOMB'S LAW. Notice that "LW" follows the statement of the law, indicating that the topic to be reviewed is a law. Where "BG" follows the topic statement, the topic to be reviewed is general information, or background. Where "CP" follows, the topic to be reviewed is a concept. (See the following Table of Abbreviations and Code Designations for more "Information Categories" which may appear in the read-outs.)

3. Source references and pages -- All available references to the topic to be reviewed are listed. The sample shows only three, (140, 155, 125.) The guide to the source references appears in "Book I" for each course.

4. Method of presentation (MP)-- The following table indicates that "PT" is a programmed textbook, and "NT" is a normal text. Other methods include machine presented programs, films, tapes, and workbooks. Note that source reference 140 is a programmed text, 155 a normal text on the sample diagram.

5. Academic level (AL)-- Source references are suggested with the academic level indicated as follows: "00" is high school level, "01" is first semester college, "02" is second semester, and so forth. The table on the following page contains these designations. Note that Coulomb's Law can be reviewed in source reference 140 or 155 on a level that is easier to understand than source reference 125.

6. Depth-- The extent of coverage of the topic to be reviewed is indicated simply by a 1 to 5 rating; the least coverage is designated as "1", the most extensive as "5". Note that the level and depth of coverage are not the same. Source reference 140 has more material on Coulomb's Law than 125 has, although 125 presents the material in a different, more advanced way.

NEW YORK INSTITUTE OF TECHNOLOGY

TABLE OF ABBREVIATIONS AND CODE DESIGNATIONS

A. Method of Presentation

01	CP	Class Presentation
02	PT	Programmed Text
03	MP	Machine Presented Film
04	FL	Film
05	LK	Lecture
06	VT	Video Tape
07	AT	Audio Tape
08	CN	Course Notes
09	NT	Normal Text
10	ST	Self-Study (self-taught)
11	LM	Laboratory Manual
12	WK	Theory and/or Problem Workbook
13	BT	Abridged Textbook

(99 such designations may be permitted)

B. Academic Level

00	High School
01	1st Semester College
12	12th Semester College

(09-12 are graduate level)

C. Information Categories

AT	Analytical Technique	pencil and paper operation
BG	Background, general information	

C. <u>Information Categories</u> - continued

CP	Concept	A mental construct - an idea not based upon sensory perceptions alone
DF	Definition	statement of meaning of a term
ED	Engineering Device	circuit or physical object designed and/or built
ET	Experimental technique	operation in lab or shop
FA	Fact	experimentally verified theory
FD	Factual data	units, constants, constraints and properties of materials as needed to effect a design of an instrument or an engineering device
IN	Instrument	a device used primarily for making an observation or a measurement
LW	Law	a statement summarizing a body of experiences or a logical deduction from basic principles
PE	Percept	phenomenon we become acquainted with through the senses
PR	Principle	plays the role of axiom or postulate and cannot be derived
SI	Special Illustration	item presented in class as an illustration of a topic already discussed
TH	Theory	
PF	Proof	rigorous mathematical or logical proof

Since a wrong response to a diagnostic test question will trigger an automatic referral to specific review material, you can correct your errors while they are still fresh in your mind before you go on to the next unit of study.

The computer read-out will be available shortly after you hand in your student answer card. Computer read-out information will be returned to you where you hand in your answer card.

WHEN CAN YOU BEGIN A NEW UNIT OF STUDY?

You can go on to the next unit as soon as you have satisfactorily completed the first unit. You will know when you are ready to go ahead because you will be advised (by computer) that you have no incorrect or omitted responses and have done well on all questions in the diagnostic test. If you are not ready to proceed, you will be advised of this too. You will have to review the topics you do not know and take the diagnostic test again until you answer satisfactorily. One important advantage of studying in this way is that you can take as much time as you need to learn the materials thoroughly or can accelerate where course work is not difficult.

WHEN CAN YOU TAKE A FINAL EXAMINATION FOR CREDIT?

After you have studied all the topics and units in a course and have satisfactorily completed all the diagnostic tests, you will be able to prepare for a final examination which will be given at various intervals as follows: end of 8th week, 12th week, 16th week, 20th week, 24th week. Consult announcements for specific dates and locations.

Appendix D

Sample printout forms demonstrate how the computer aids the student in analyzing his difficulties and finding his own best pace for achieving course objectives.

Appendix D

1. Sample individual printout is available for each diagnostic test that a student takes. It tells him which topics require review as well as his score. In addition, specific referrals to secondary resources are recommended for further study.

   It contains the following information for each examination:

   a. Question number, correct answer and topic missed

   b. Information category

   c. Referral to secondary resources and page references.

   d. Level and extent of treatment for each suggested reference

```
 90104   70  ET5011 1A              ET00010 ET00100 04/27/66 10      13     ITT O-C
QUEST  TOPIC   SRCE   PAGES          MP AL DEPTH PRE REG
ET00040  ELEMENTS, COMPOUND, MIXTURES. LW
 004  ET00040  0140   0004           PT 00   2
 004  ET00040  0155   0009           NT 00   1
ET00070  ATOMS AND IONS    CP  LW
 007  ET00070  0140   0015           PT 00   1
 007  ET00070  0151   0007           NT 01   1
 007  ET00070  0155   0012           NT 00   1
 007  ET00070  0375   0070           MP 01   1
ET00100  DETECTION DEVICES, ELECTROSCOPE      ED
 010  ET00100  0140   0024           PT 00   1
 010  ET00100  0155   0008           NT 00   1
 010  ET00100  0125   0301, 0501     PT 01   1
 010  ET00100  0100   0453, 0457     NT 01   2
 010  ET00100  0095   0279           NT 01   1
 010  ET00100  0375   0200           MP 01   2
```

SAMPLE: INDIVIDUAL STUDENT PRINTOUT

Appendix D

2. Group section test analyses show 12 different dates at which different groups took the same test. Information contained in these analyses provides a ready assessment of group performance with respect to each question on a test and the time the test is taken.

   Note, for example, the various responses to Question 007 which would indicate need for revising and/or discounting that particular question.

```
                 OFF-CAMP ET 5011 1A                     ET0001C ET00100 04/19/66 1C            4    ITT 0-C
QUEST NO                 A      B      C      D      E      OMIT      OPTION         PERCENT CORRECT
  001                   000    000    004*   000    000    000       000                 100
  002                   004*   000    000    000    000    000       000                 100
  003                   003    000    001*   000    000    000       000                  25
  004                   001    003*   000    000    000    000       000                  75
  005                   000    001    001    002*   000    000       000                  50
  006                   000    004*   000    000    000    000       000                 100
  007                   003    001*   000    000    000    000       000                  25
  008                   000    004*   000    000    000    000       000                 .00
  009                   000    000    004*   000    000    000       000                 .00
  010                   000    004*   000    000    000    000       000                 100
  MARK          FREQ        CUM FREQ       PERCENTILE
  070           001           001              25
  080           003           004             100
SUM OF MARKS                    NO OF STUDENTS          SUM OF MARKS SQUARED    MEAN     ST DEV
 000310                              004                    00024100             078    .768E+01
```

```
           OFF-CAMP ET5011  1A          ET00010 ET00100 04/27/66  10             13   ITT 0-C
QUEST NO      A      B      C      D      E     OMIT      OPTION       PERCENT CORRECT
  001        000    000    013*   000    000    000        000              100
  002        013*   000    000    000    000    000        000              100
  003        002    002    008*   000    000    001        000               62
  004        003    010*   000    000    000    000        000               77
  005        002    000    001    010*   000    000        000               77
  006        000    013*   000    000    000    000        000              100
  007        010    002*   001    000    000    000        000               15
  008        000    013*   000    000    000    000        000              100
  009        000    000    013*   000    000    000        000              100
  010        003    010*   000    000    000    000        000               77
  MARK     FREQ    CUM FREQ     PERCENTILE
   060      001      001             08
   070      003      004             31
   080      003      007             54
   090      006      013            100
SUM OF MARKS          NO OF STUDENTS        SUM OF MARKS SQUARED    MEAN        ST DEV
  001050                   013                   00086100           081      .787E+01
```

```
   OFF-CAMP ET5011  1A                        ET00010 ET00100 05/03/66  10          11   ITT 0-C
QUEST NO       A      B      C      D      E      OMIT     OPTION        PERCENT CORRECT
   001        000    000    011*   000    000    000       000              100
   002        011*   000    000    000    000    000       000              100
   003        002    001    008*   000    000    000       000               73
   004        002    009*   000    000    000    000       000               82
   005        000    000    002    008*   001    000       000               73
   006        000    011*   000    000    000    000       000              100
   007        008    003*   000    000    000    000       000               27
   008        000    011*   000    000    000    000       000              100
   009        000    000    011*   000    000    000       000              100
   010        000    011*   000    000    000    000       000              100
    MARK      FREQ       CUM FREQ         PERCENTILE
     060      001          001                09
     070      002          003                27
     080      001          004                36
     090      004          008                73
     100      003          011               100
 SUM OF MARKS             NO OF STUDENTS          SUM OF MARKS SQUARED     MEAN      ST DEV
   000940                      011                     00082200             085     .157E+02
```

APPENDIX

```
          OFF-CAMP ET5C11   1A                ET00010 ET00100 05/11/66 10               ITT O-C
QUEST NO          A         B         C         D         E        OMIT      OPTION       PERCENT CORRECT
  001            000       000       008*      000       000       000        000              100
  002            008*      000       000       000       000       000        000              100
  003            001       000       006*      000       000       001        000               75
  004            002       006*      000       000       000       000        000               75
  005            000       000       000       008*      000       000        000              100
  006            000       008*      000       000       000       000        000              100
  007            002       006*      000       000       000       000        000               75
  008            000       008*      000       000       000       000        000              100
  009            000       000       008*      000       000       000        000              100
  010            000       008*      000       000       000       000        000              100
  MARK      FREQ         CUM FREQ        PERCENTILE
   080       002            002                25
   090       002            004                50
   100       004            008               100
 SUM OF MARKS              NO OF STUDENTS            SUM OF MARKS SQUARED        MEAN       ST DEV
   000740                       008                      00069000                 093      .489E+01
```

```
        OFF-CAMP ET5C11  1A                       ET00010 ET00100 05/16/66 10                ITT O-C
QUEST NO        A       B       C       D       E       OMIT        OPTION         PERCENT CORRECT
   001         000     000     001*    000     000      000          000                100
   002         001*    000     000     000     000      000          000                100
   003         001     000     000*    000     000      000          000                 00
   004         000     001*    000     000     000      000          000                100
   005         000     000     000     001*    000      000          000                100
   006         000     001*    000     000     000      000          000                100
   007         000     001*    000     000     000      000          000                100
   008         000     001*    000     000     000      000          000                100
   009         000     000     001*    000     000      000          000                100
   010         000     001*    000     000     000      000          000                100
  MARK     FREQ         CUM FREQ         PERCENTILE
   090      001            001               100
SUM OF MARKS            NO OF STUDENTS          SUM OF MARKS SQUARED        MEAN       ST DEV
  000090                    001                      00008100               090     .000E-99
```

```
      OFF-CAMP ET5011  1A               ET00010 ET00100 05/17/66 10              ITT O-C
QUEST NO       A      B      C      D      E      OMIT     OPTION     PERCENT CORRECT
  001         000    000    003*   000    000    000       000            100
  002         003*   000    000    000    000    000       000            100
  003         001    000    001*   000    000    001       000             33
  004         001    002*   000    000    000    000       000             67
  005         000    000    001    002*   000    000       000             67
  006         000    003*   000    000    000    000       000            100
  007         002    001*   000    000    000    000       000             33
  008         000    003*   000    000    000    000       000            100
  009         000    000    003*   000    000    000       000            100
  010         000    003*   000    000    000    000       000            100
   MARK     FREQ      CUM FREQ      PERCENTILE
   070      001         001             33
   080      001         002             67
   090      001         003            100
 SUM OF MARKS          NO OF STUDENTS       SUM OF MARKS SQUARED     MEAN        ST DEV
   000240                   003                  00019400             080       .816E+01
```

```
  OFF-CAMP ET5011  1A              ET00010 ET00100 05/25/66 10      ITT O-C
QUEST NO      A      B      C      D      E     OMIT..   PERCENT CORRECT
  001        000    000    002*   000    000    000           100
  002        002*   000    000    000    000    000           100
  003        000    000    002*   000    000    000           100
  004        000    002*   000    000    000    000           100
  005        000    001    000    001*   000    000            50
  006        000    002*   000    000    000    000           100
  007        001    001*   000    000    000    000            50
  008        000    002*   000    000    000    000           100
  009        000    000    002*   000    000    000           100
  010        000    002*   000    000    000    000           100
  MARK       FREQ      CUM FREQ     PERCENTILE
   080        001         001              50
   100        001         002             100
SUM OF MARKS            NO OF STUDENTS       SUM OF MARKS SQUARED    MEAN        ST DEV
  000180                    002                   00016400           090      .100E+02
```

```
         OFF-CAMP ET5011  1A              ET00010 ET00100 05/26/66 10            ITT O-C
QUEST NO        A      B      C      D      E     OMIT      OPTION      PERCENT CORRECT
  001          000    000    001*   000    000    000        000            100
  002          001*   000    000    000    000    000        000            100
  003          000    000    001*   000    000    000        000            100
  004          000    001*   000    000    000    000        000            100
  005          000    000    000    001*   000    000        000            100
  006          000    001*   000    000    000    000        000            100
  007          001    000*   000    000    000    000        000             00
  008          000    001*   000    000    000    000        000            100
  009          000    000    001*   000    000    000        000            100
  010          000    001*   000    000    000    000        000            100
  MARK        FREQ     CUM FREQ          PERCENTILE
   090         001       001                100
SUM OF MARKS          NO OF STUDENTS       SUM OF MARKS SQUARED       MEAN        ST DEV
   000090                  001                  00008100               090       .000E-99
```

```
      OFF-CAMP ET5011  1A                 ET00010 ET00100 06/01/66 10               ITT -C
QUEST NO      A       B       C       D       E      OMIT      OPTION      PERCENT CORRECT
   001       000     000     003*    000     000     000        000             100
   002       003*    000     000     000     000     000        000             100
   003       001     000     002*    000     000     000        000              67
   004       001     002*    000     000     000     000        000              67
   005       000     001     000     002*    000     000        000              67
   006       000     003*    000     000     000     000        000             100
   007       002     001*    000     000     000     000        000              33
   008       000     003*    000     000     000     000        000             100
   009       000     000     003*    000     000     000        000             100
   010       000     003*    000     000     000     000        000             100
  MARK      FREQ     CUM FREQ      PERCENTILE
   070       001        001              33
   080       001        002              67
   100       001        003             100
SUM OF MARKS            NO OF STUDENTS       SUM OF MARKS SQUARED    MEAN      ST DEV
  000250                   003                      00021300          083     .145E+02
```

```
    OFF-CAMP ET5011  1A                  ET00010 ET00100 06/08/66 10          ITT O-C
QUEST NO     A       B       C       D       E      OMIT        OPTION     PERCENT CORRECT
  001       000     000     007*    000     000     000          000          100
  002       007*    000     000     000     000     000          000          100
  003       004     000     001*    000     000     002          000           14
  004       002     005*    000     000     000     000          000           71
  005       003     000     001     003*    000     000          000           43
  006       000     007*    000     000     000     000          000          100
  007       006     001*    000     000     000     000          000           14
  008       000     007*    000     000     000     000          000          100
  009       000     001     006*    000     000     000          000           86
  010       002     005*    000     000     000     000          000           71
  MARK      FREQ        CUM FREQ        PERCENTILE
   040      001            001              14
   060      002            003              43
   070      001            004              57
   080      002            006              86
   100      001            007             100
SUM OF MARKS          NO OF STUDENTS        SUM OF MARKS SQUARED      MEAN         ST DEV
  000490                       007                 00036500            070       .177E+02
```

```
        OFF-CAMP ET5011  1A                         ET00010 ET00100 07/06/66 10                ITT C-C
QUEST NO         A       B       C       D       E       OMIT       OPTION       PERCENT CORRECT
  001           000     000     001*    000     000      000         000              100
  002           001*    000     000     000     000      000         000              100
  003           000     000     001*    000     000      000         000              100
  004           000     001*    000     000     000      000         000              100
  005           000     000     000     001*    000      000         000              100
  006           000     001*    000     000     000      000         000              100
  007           001     000*    000     000     000      000         000               00
  008           001     000*    000     000     000      000         000               00
  009           000     001     000*    000     000      000         000               00
  010           001     000*    000     000     000      000         000               00
  MARK       FREQ       CUM FREQ             PERCENTILE
  060        001          001                   100
SUM OF MARKS          NO OF STUDENTS         SUM OF MARKS SQUARED     MEAN        ST DEV
  000060                   001                     00003600            060        .000E-99
```

```
          OFF-CAMP  ET5011  1A          ET00010 ET00100 08/22/66 10
QUEST NO     A        B      C      D      E      OMIT     OPTION                  ITT O-C
                                                                  PERCENT CORRECT
  001       000      000    001*   000    000     000       000        100
  002       001*     000    000    000    :000    000       000        100
  003       001      000    000*   000    000     000       000        00
  004       000      001*   000    000    000     000       000        100
  005       000      000    000    001*   000    000       000        100
  006       000      000*   001    000    000     000       000        00
  007       001      000*   000    000    000     000       000        00
  008       000      001*   000    000    000     000       000        100
  009       000      000    000*   001    000     000       000        00
  010       001      000*   000    000    000     000       000        00
  MARK     FREQ     CUM FREQ     PERCENTILE
  050      001        001            100
SUM OF MARKS           NO OF STUDENTS      SUM OF MARKS SQUARED      MEAN      ST DEV
  000050                   001                 00002500              050     .000E-99
```

Appendix E

Sample records of progress of students in an Off-Campus Program demonstrate how the principles of differential-pacing worked in a learning situation where the students were employed in industry and would not have been able to pursue college-level study in conventional, time-based curriculums.

Appendix E

OFF-CAMPUS PROGRAM: NYIT-ITT

Course# ET5011

Students Enrolled	DIAGNOSTIC EXAMINATIONS															Final Ex	
Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Date	Gra
Crawford, Ralf H.	8/22-50 1B 8/22-100	8/22=80															
Daub, Stanley	4/27-90 5/3-100	1B 4/27-80 5/3-100 2A 5/3-100	5/3-90 5/11-90	5/3-100 5/11-100	5/11-90	5/17-80 7/6-20	5/17-90	5/17-90	5/17-100	5/25-100	6/8-90 6/26-100	6/8-80 6/26-100	6/16-80	6/26-70	7/6-90 16A 7/19-80		
Davidoff, Robert	4/19-70	1B 4/27-60 2A 4/27-90	6/8-70	5/17-90	5/17-90	6/8-70 6/8-70	6/16-90	6/26-90	7/6-90	7/6-90	7/12-90 7/19-100	7/19-100	7/25-70	8/22-60	8/22-90 16A 8/22-90	9-23 66	9
DelGuercio, Alfonse	5/3-80	1B 5/11-80 2A 5/11-80															
DeSantis, Sabato	4/27-70	1B 4/27-100 2A 4/27-70															
Dobesh, Donald	4/27-90	1B 5/3-80 2A 5/17-80	5/17-70	7/6-100	6/26-100 7/6-100	6/26-90 7/6-90											
Dolan, John	4/27-80 5/19-90	1B 5/17-60 2A		6/8-100													
Eckerth, William J.	4/19-80 4/27-90 5/3-100	1B 5/11-80 2A 4/19-80 5/3-100	5/11-90	5/11-90	5/25-90	5/25-60	6/26-90	6/26-90	6/26-70	7/25-70							
Fargo, John J.	5/25-80	1B 8/2-100 2A 8/2-60															
Feldman, Morris	5/25-100	1B 5/25-100 2A 5/25-70	7/6-90														
Ferrin, Richard	6/8-60																
OC-1/10166																	

Appendix F

1. Sample Course Record Profile and detailed explanation.
2. Sample Student Record Profile and detailed explanation.

Appendix F

1. Course Record Profile is a record of an individual student's performance in a particular course. This record contains four subrecords:

   a. The Header which contains identification and summary information concerning various aspects of the student's course performance including:

      1) test and examination performance summary

      2) exposure and performance on questions classified by information category and student performance category

   b. Final Unit Test Area contains the dates and incorrect responses for quarterly, midterm and final examinations

   c. Examination Area contains the dates and incorrect responses for quarterly, midterm and final examinations. (not shown)

   d. Repeat Unit Test File contains the dates and incorrect responses for all failed unit tests.

Course Record Profile - Header, Examination, Test Units

Course No. 3011 Section - C	Unit Test Average 88	Quarterly Exam Grade	Student Identification Number 48377
Hurwith, Yardenna	Unit Passing Score 80	Midterm Exam Grade	Special Program - 12 weeks
Entry Date 9/19/66	Achievement Prediction	Final Exam Grade	Repeating Course - No Final Grade

Performance Categories -	H.S. Rank	CQT-V	CQT-N	CQT -I	CQT-T
Total Exposures -	10	10	10	10	0
Per Cent Correct -	70	100	90	90	0

Unit No.	Final Unit Marks	First Failure	Second Failure	Third Failure
1-	90			
2-	100	70		
3-	90			
4-	100			
5-				
6-				
7-				
8-				
9-				
10-				
11-				
12-				
13-				
14-				
15-				

Information Category	Total Errors	Out of	Total Exposures
AT	1		15
BG	0		1
CP	0		2
DF	2		16
ED	0		0
ET	0		0
FA	0		0
FD	0		0
IN	0		0
LW	2		5
PE	0		0
PR	0		0
SI	0		0
TH	0		0
PF	0		0

Course Record Profile - Final Unit Tests

Unit No. 1 Variation - 1 Exam Date 11/30/66

Question Number - 5
Incorrect Response D

Unit No. 3 Variation- 1 Exam Date 11/30/66

Question Number - 9
Incorrect Reponse D

Unit No. 2 Variation- 1 Exam Date 11/30/66

Question Number -
Incorrect Response

Unit No. 4 Variation- 1 Exam Date 11/30/66

Question Number -
Incorrect Response

2. <u>Student Record Profile</u> is a record which summarizes the individual student's performance in currently enrolled courses. The record contains:

   a. identification information

   b. current academic status and objectives

   c. cumulative exposure and performance by student performance categories

   d. current student programs and achievement in each currently enrolled course

Course Record Profile - Repeat Unit Tests

Unit No. 2 Variation- 1 Exam Date 11/30/66

Question Number -	5	7	10
Incorrect Response	B	C	B

Student Record Profile

Hurwith, Yardenna   Credits Completed 0   Degree Objective BS   Admission Date 0/0/0
Student I.D. Number 48377   Cumulative Index .0   Major Mechanical Design   Campus Old Westbury

Student Sex - Female   Program Type On-Campus   Minor No Minor

	HS Rank	CQTV	CQTN	CQTI	CQTT
Capability Profile	0	8	9	8	8
Percentage Correct	85	91	84	94	0
Performance Exposure	33	33	32	32	0

No. 1 Course 3011 Section C Number of Credits-3 Number of Repeats-0 Special Program-12 Weeks Beginning Date 9/19/66

First Marks Per Unit 1-90 2-70 3-90 4-100 5- 6- 7- 8- 9- 10- 11- 12- 13- 14- 15-

Test Average- 88 Quarterly Examination Mark- Midterm Examination Mark- End Term Examination Mark-

No. 2 Course 4011 Section H Number of Credits-4 Number of Repeats-0 Special Program-16 Weeks Beginning Date 9/19/66
First Marks Per Unit 1-70 2-90 3-100 4-90 5- 6- 7- 8- 9- 10- 11- 12- 13- 14- 15-
Test Average-88 Quarterly Examination Mark Midterm Examination Mark- End Term Examination Mark-

No. 3 Course-5011 Section A Number of Credits-3 Number of Repeats-0 Special Program-16 weeks Beginning Date 9/19/66

First Marks Per Unit 1-100 2-90 3-80 4-80 5-100 6- 7- 8- 9- 10- 11- 12- 13- 14- 15-
Test Average- 90 Quarterly Examination Mark- Midterm Examination Mark- End Term Examination Mark-

No. 4 Course 1010 Section E Number of Credits-3 Number of Repeats-0 Special Program-16 weeks Beginning Date 9/19/66

Quarterly Examination Mark- Midterm Examination Mark- End Term Examination Mark-

No. 5 Course 2010 Section E Number of Credits-3 Number of Repeats-0 Special Program-16 weeks Beginning Date 9/19/66

Quarterly Examination Mark- Midterm Examination Mark- End Term Examination Mark-

No. 6 Course 3012 Section I Number of Credits-1 Number of Repeats-0 Special Program-16 weeks Beginning Date 9/19/66

Attachment AA

Representative Sets of Curriculum Analysis Materials

Electrical Technology 5011 - DC and AC Circuits

Electrical Technology 5030 - Basic Electronics

The attached copies of Books I, II, III, and IV represent two courses in the Electrical Technology sequence as they were originally developed to be used in a differentially-paced system.

NEW YORK INSTITUTE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY 3011

ITEM ANALYSIS

and

SOURCE REFERENCES

Book I

NEW YORK INSTITUTE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY 5011

Project Director	Bertram Spector, Ph.D. Dean of Academic Affairs
Project Coordinator and Author	John Luther Assistant Professor of Educational Research and Electrical Technology

ET5011

SOURCE REFERENCES

Ref. No.	Source Title	Author	Year	Publisher	Mtd. Pres.
0095	College Physics	Weber, White, Manning	1963	McGraw-Hill	09
0100	College Physics	Sears & Zemansky	1960	Addison-Wesley	09
0105	College Physics	Schaum	1961	Schaum	12
0125	First Year College Physics	NYIT	1963	McGraw-Hill	02
0140	Basic Electricity	NYIT	1963	McGraw-Hill	02
0145	Basic Electricity (Laboratory Manual)	Zbar	1958	McGraw-Hill	11
0150	Introduction to Electric Circuits	Jackson	1959	Prentice-Hall	09
0155	Basic Electricity	Turner	1963	Holt, Rinehart, & Winston	09
0160	Electrostatics	Schure	1958	Rider	13
0165	DC Circuit Analysis	Schure	1959	Rider	13
0170	Magnetism and Electromagnetism	"	1959	"	"
0175	AC Circuit Analysis	"	1958	"	"
0180	Transformers	"	1961	"	"
0185	Resonant Circuits	"	1957	"	"
0186	R-C, R-L Time Constants	"	1954	"	"
0375	First Year Electronics (Autotutor)	U. S. Indust. Inc.		U. S. Industries Inc.	03

COURSE ET5011 SUBJECT STATIC ELECTRICITY Page 1 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES									
NUMBER	TITLE	140	150	151	155	125	100	95	160	375	105
ET00010	States of Matter	3-4 7			9				1-4	17-32	
ET00020	Atomic Structure	6-8	5-8	4-7	10-12	2-1	449	278		33-50	
ET00030	Milikan Oil Drop Experiment (charge on electron)				12		487		36-40		
ET00040	Elements, Compounds, mixtures	4-6			9						
ET00050	Law of Electric Charges	8-10	207 21	241	6	1-1	449-50	277	4-7	51-77	
ET00060	Constitution of charges and charging	11-14			5	3-1, 4-1	452-4 509	294 297		188-99	
ET00070	Atoms & Ions	15-17		7-8	12-13					70-8	
ET00080	Coulomb's Law Force Between Charged Bodies	17-21	209	241-44	7	5-1	456	280	12-13 18	51-77 215-36	136
ET00090	Distribution of Charges	26-29		243		8-1, 11-1	486	282- 283	34-36		
ET00100	Detection Devices Electroscope	24-25			8	5-1 3-1	453 457	279	7-11	200-28	
ET00110	Energy & Energy Levels	7									

COURSE ET5011 **SUBJECT** **STATIC ELECTRICITY** **Page 2 of 2**

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES									
NUMBER	TITLE	140	150	151	155	125	100	95	160	375	105
ET00120	Lines of Force Field Intensity		209 to 211	241-3		5-1 9-1 8-1	470-2	281-284	23-29		137
ET00130	Electric Field	21-24	208-12	242	5	7-1	467	281	21-23	340-62	137
ET00140	Gauss' Law					10-1	475		29-34		
ET00150	Units of Measurement		8-12	13-17	9,12 7	6-1 7-1	460	280		215-36	261
ET00160	Conduction, Insulation		14-16	9-12	15		454	278 334	4,40	317-40	
ET00170	Semiconduction							333-4			

COURSE ET 5011 SUBJECT CHARGES IN MOTION Page 1 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES									
NUMBER	TITLE	140	150	151	155	125	100	95	165	375	105
ET00180	Electric Current in Solids	31-33	16-19 30-32		14	21-1	536-39	303,306			146
ET00190	Current in Liquids and Gasses				66-72		587-606	440-45			
ET00200	Conductivity and Resistivity Resistance	33-37	36-52	46-54 58-62	32-36	24-1 22-1	541-43 544	331-32	5-6 8-9 15-16	638 - 835	146 156
ET00210	Temperature Effects		45	54-58	33	23-1	546-8	332-3	16-17	766-790	156
ET00220	Potential (Elect.) Potential Gradient		20-28	30		12-1	493-499 506-7	290-92 295	6-8		147
ET00230	Potential Difference (Voltage)	38-40	20-28	30	9	12-1	499-501 561-4	290-309 315-16		350 - 363	
ET00240	Voltage Drop		28-30	31-3	41,53	26-1		319			
ET00250	Potential of Charged bodies and Surfaces					14-1	501-503	293 296			
ET00260	Work, energy, potential relationships		28 55-63	30		26-1 27-1 32-1	503-04 558	290 340-44			
ET00270	Complete Electric Circuit	40-41		20	18		540	304,315		384 - 412	
ET00280	Electron Velocity drift velocity		5-6	24-5							

COURSE ET 5011 SUBJECT CHARGES IN MOTION Page 2 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
NUMBER	TITLE	140	150	151	155	125	100	95	165	375	105	
ET00290	Efficiency		57-58	70								
ET00291	Units of Measurement	32	16	21-3 29-30						413-420 755-760		
ET00300	Sources of EMF	41-42	21-27	33-41	15-16 22-31	26-1 35-1 86-1	557	297 304-8		363 - 383		
ET00310	Terminal Voltage						564			420 - 440		
ET00320	Electro-chemistry Thermochemistry		21-27	33-41		83-1	587-606	304-8		363 - 383		
ET00330	Electric Symbols	42-44	4	12	34,35 54-65					1232 - 1245		

COURSE ET5011

SUBJECT Battery-Resistor Circuit Fundamentals

Page 1 of 2

NUMBER	TOPIC TITLE	SOURCE REFERENCE NUMBERS AND PAGES 140	150	151	155	125	100	95	165	145	105	375
ET00340	Schematic Diagrams	46-48										1232- 1261, 1306-56
ET00350	Ohms Law	48-55	35	46-8		23-1 22-1	543	310-11 315	9-10	16	146-52	0437-88
ET00360	Batteries in Series / parallel	55-58			47	32-1 89-1	572	320-22			161	0489- 509
ET00370	Internal Resistance		72	86-8	49	26-1		319				2550-75
ET00380	Resistor Series Circuits	70-88	60-72	82-4	37	29-1	559-68	316-7	20-26	18	156-8	1262-99 1356-77
ET00390	Kirchoff's Voltage Law	81-86	70	84	46	33-1	574		54-58		157-165	1741- 1834
ET00400	Resistor Parallel Circuits	89-95	75-79	90-2 94-6	38	29-1	570	317-18	26-29	21	157-61	1378-98 2163-2237
ET00410	Kirchoff's Current Law	86-87	75	90-2	46	33-1	574		52-54	26	157-165	1726-40
ET00411	Conductance		76-9	92-4					8-9			
ET00420	Resistor Series/ parallel Circuits	97-101	79-83	96-99	39,40	30-1	568-73	322-2	30-32 46-51	24	159-168	2385- 2473
ET00430	Standard Resistors						543					
ET00440	Practical Resistors					34-6						
ET00450	Color Code									13		0930- 1089

COURSE ET5011 SUBJECT Battery-Resistor Circuit Fundamentals

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
NUMBER	TITLE	140	150	151	155	125	100	95	165	145	105	375
ET00460	D.C. Power	65-69	58-63	71-5	43	27-1	577		38-41		153-5	1572-1725 2222-2291
ET00461	Efficiency		57	70-71								
ET00470	Maximum Power Transfer		73-4	88-9	49	89-1			42-44			
ET00480	Joule's Law					27-1	552	341				
ET00490	Voltage Dividers	102-9	83-5	100-3	44					32,29		1887-1920
ET00500	Potentiometers			187-8		34-1	566	334	32-33			2015-72
ET00510	Simple Hardware				54-65							
ET00520	Simple Switch and Fuse Circuits	58-63										1306-55

COURSE ET5011 SUBJECT MAGNETISM AND MAGNETIC INDUCTION Page 1 of 3

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES								
NUMBER	TITLE	140	150	151	155	125	100	95	375	105
ET00530	Magnets	110-111	109	132	73	57-1	607		1-6	
ET00540	Flux, Flux Density		116-120	140			612	351	68-86	
ET00550	Magnetic Materials	114-16	120-121	144-7		55-1	676	379-80	87-90	
ET00560	Forces on Moving Charges: Torques		150	176-9		41-1 46-1	512-20 608-12	350-1 356-58	24-31	
ET00570	Cyclotron					42-1 43-1 44-1	613			
ET00580	Magnetic Field	113-14	109-113	132-6	74-5	36-1 to 47-1	608-612		32-67	181,173
ET00590	Permeability		118-119,125	142 150	81	53-1 56-1	678	379	90	
ET00600	Sources of Magnetic Fields					48-1				
ET00610	Law of Magnetic Poles	111-12			73-77	57-1	691		7-23	181
ET00620	Ampere's Rule					49-3	642, 49			173
ET00630	Magnetization Characteristics		122-130	148-54	82	60-1	685-88	380-81	241-276	

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COURSE ET5011 SUBJECT MAGNETISM AND MAGNETIC INDUCTION

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES									
NUMBER	TITLE	140	150	151	155	125	100	95	375	105	
ET00640	Magnetic Field Around Conductors	116- 118	113	137-9	78	50-1 52-1	644	353, 358	196-213 873	173-5	
ET00650	Electrical Analogies					60-1 61-1					
ET00560	Magnetic Shieling		131	155	77-8		691		90-97		
ET00670	Field of a Solenoid	118- 121	115	139-40	79,85	51-1	647-50	354			
ET00680	Torroid Field		115	139		51-1	650	352, 355			
ET00690	Magnetic Circuit		132- 145	156-67	83-85		700	382-3			
ET00700	Lenz's Law	121- 24	175	204-5		69-1	663	392	417-38		
ET0.710	Bio-Savart Relationship					49-1					
ET00720	Air Gap		140	166-7			700				
ET00730	Reluctance		117	142			702	382			
ET00740	Induced EMF Magnetic Induction	124-5	173-4	202-4		36-1 to 38-1	657, 66	390-92	890	190	
ET00750	Self-Inductance	134- 137	177	190-1		72-1		404	918 453	206,7	

COURSE ET5011 SUBJECT MAGNETISM AND MAGNETIC INDUCTION Page 3 of 3

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES											
NUMBER	TITLE	140	150	151	155	125	100	95	375	105			
ET00760	Units of Measurement		117	140-44	80	39-1, 40-1 46-2			890-3 453-6				
ET00770	Mutual Inductance	128-134						405	924-36 439-52				
ET00780	Faraday's Law		175	204			659	391		159			
ET00790	B, H. µ		119-120	148-53		68-1	682	378					
ET00800	Practical Problems, Examples, Circuits		132-145	156-68	85-88				282-97				

COURSE ET5011 SUBJECT Generator Action Page 1 of 1

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES							
NUMBER	TITLE	140	150	151	155	125	100	95	375
ET00810	Angle of Cutting	137-140	248	285	94	66-1	666	393	665-79
ET00820	Flux-Time rate of Change		247	284	92	67-1	667	393	687-700
ET00830	Generator Cycle Sine Curve	144-149	244-50	281-6	95-6		667	394	665-79 589-95
ET00840	Basic Construction	143	243-44	281	93		668	406	665-70
ET00850	Commutator Action	149-152						406-7	722-741

COURSE ET5011 **SUBJECT** Fundamentals of A-C and AC Resistive Circuits **PAGE 1 OF 2**

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
NUMBER	TITLE	140	150	151	155	125	100	95	175	375	145	105
ET00860	Current Direction	177-8	244-6	281	94	70-1			4-10	585		
ET00870	Frequency Period	178-186	251	290	95-7 102-3	70-3				589	46	197
ET00880	Amplitude Wavelength				103					589		
ET00910	Phase	186-8 199 0244			96, 103	71-1,7	730-5		25,29 22			197
ET00920	Phase Differences	187						427-8	22			
ET00930	Voltage-Current Relationships	199				71-5	730	427	11-17 22			
ET00940	Non-Sinusoidal Waves;Harmonics				101-2 103					626		
ET00950	Instantaneous & Peak Values of Sine Wave	189-93	250	287	97-9		729			626		197
ET00960	Average Values of Sine Wave		259	296					13-16	626		
ET00970	Effective EMF	192-3		296			728-30	426	16,17	626		

COURSE ET5011 SUBJECT Fundamentals of A-C and AC Resistive Circuits PAGE 2 OF 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
NUMBER	TITLE	140	150	151	155	125	100	95	175	375	145	105
ET00980	Resistive Power -	241	259	294	103 70-4,5		738		22			198
ET00981	Instantaneous Power in Resistance		257							596		
ET00982	Average Power in Resistance, Effective	241	259-60	294	103		728			626		
ET01000	Instantaneous Current in Resistance		255-7	293						596		
ET01010	A-C Resistive Circuits	244-7							20			
ET01020	AC Power (General Treatment)	228-31	312-13	356	161-3							

COURSE ET 5011 SUBJECT INDUCTANCE Page 1 of

TOPIC NUMBER	TOPIC TITLE	SOURCE REFERENCE NUMBERS AND PAGES 140	150	151	155	125	100	95	185	375	145	105
ET01050	Self Inductance	134-7 196-7	177	207	127	72-1;2	706-7	404	22		53-6	190
ET01060	Units	198-99	178	209	128	72-3	706	405	22	890	53-4	
ET01070	Q	288-90	363-4	410	163						53-6	
ET01080	Series Connections	198-99		211	137-8 143				26	924 983		
ET01090	Factors governing Inductance		178-80	209						918		
ET01100	Time Constant Instantaneous I		187-9 189-94	218			708-9 709					
ET01110	Parallel Connections			211	138 143				27	983	57-9	
ET01120	Energy stored by Inductance		194-7	226			710-12	405				190
ET01140	Inductive effect on Current	202	197-99	229						894 937 948		
ET01150	Series-Parallel				138-40 143				27	983	57-9	
ET01160	Voltage-Current Phase Relations	199-201			145-6	73-1;4			22,23 25	948		
ET01170	Inductive Reactance	201-203	267-9	304	143, 141	72-5-7			4,25	948	53-6	

COURSE ET 5011 SUBJECT INDUCTANCE Page 2 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
NUMBER	TITLE	140	150	151	155	125	100	95	185	375	145	105
ET01180	Practical Inductors	231-6	184 299	215 340						1014		
ET01190	Power + Power Factor	269-71	321-9 313-5	358,67						996		198
ET01200	R-L Circuits	249-272	294-300	336	147-8 151-2	74-1;8	708-10				53-9	
ET01210	Phase and Phase Diagrams	249-66 266-7	294-301	336	148		728			948		197
ET01220	Impedance	255-261	294-308	336	147-8 151		727			948 967		198

COURSE ET5011 SUBJECT TRANSFORMERS Page 1 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
NUMBER	TITLE	140	150	151	155	125	100	95	185	375	145	105
ET01240	Transformer Action	226-8	379-97	431		82-1,5	740			1478	60-3	198-9
ET01243	Lenz's Law	121-4	175	204, 213		69-1	663	392		1464		
ET01246	Inducing a Current	124-5				36-1 to 38-1	657-66	390-92		1464 890		190
ET01249	Counter EMF		177	206						1464		
ET01252	Self-Inductance	134-7	177	206		72-1	706	404		918 1472		190-1
ET01255	Mutual Inductance	128-34	390	204 431	168			405		924 1481		
ET01258	Coupling and Coupling Coefficient		389	459	169							
ET01261	Type of Transformers	237	381 388 394	434 442	171 180		741			1531		
ET01264	Impedance Ratio		382	434						1551		
ET01265	Impedance Matching		0383 388	436 443	174							
ET01267	Voltage and Current Ratios		382	434						1531		
ET01270	Phase Angle									1566		

COURSE ET5011 SUBJECT TRANSFORMERS Page 2 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
NUMBER	TITLE	140	150	151	155	125	100	95	185	375	145	105
ET01273	Transfomer Losses		385	439						1576		
ET01276	Ideal/Practical Transformers	231-7										
ET01279	Transformer Applications		384-94	438-65	172-80					1603		
ET01282	Testing a Transformer		385	439						1645		
ET01285	Power/Efficiency					82-5					60-3	200
ET01286	Power Transformer Color Code									1672		
ET01288	Vector Techniques	251-65	276-91	320-34		74-3						

COURSE ET 5011 SUBJECT: CAPACITANCE Page 1 of 2

TOPIC NUMBER	TOPIC TITLE	SOURCE REFERENCE NUMBERS AND PAGES										
		140	150	151	155	125	100	95	Schure	145	105	375
ET 01290	Charge & Discharge	208-10	223-5	258-60	106-7 116-8		715-6	419	Re-186 10-16 19-23			1143-62
ET 01295	Time Constant		225-8	260-1								
ET 01300	Dielectrics	206-8	212-3 221	247-8	108-11	16-1 to 16-8	523-9 530-2	417-20	Re 160 40-1			1170- 1200 1230-35
ET 01310	Units	213-5	216		107	17-3 to 17-5		416	Re 160 51	66		1162-69
ET 01320	Formulas for Capacitor Design	206-8 210-13	214-23	248-56	105-12	17-1 to 1767	516-23				138	1170- 1260
ET 01330	Voltage, Charge Relation		216-7 236-8	250-1 272-4			515-6	415-7	Re 160 5-6		137-8	1162- 69
ET 01340	Phase Relations	216-7	235-6	272-3	146-7		729 736	430				1245- 1300
ET 01350	Series/Parallel Connections	219-21	221-2	256-7	112-14 122			418-9	Re 175 32-4	72-4	138	1317- 29
ET 01360	Capacitive Reactance	217-9	271-4	311-5	116-8		726-9	430	RE 175 28-32		197	1307- 16

COURSE ET5011 SUBJECT CAPACITANCE Page 2 of 2

TOPIC NUMBER	TITLE	SOURCE REFERENCE NUMBERS AND PAGES 140	150	151	155	125	100	95	Schure	145	105	375
ET01380	Energy in Capacitors	221-2	234-6	270-2	108			420	Re 160 51-2		138	
ET01385	Power in Capacitors		315-6	360-1								
ET01390	Voltage Ratings	223-4										
ET01400	Practical Capacitors				105-8 114-5 119-21			417		65-6		
ET01410	R-C Circuits	274-7	224	259	153-4		714-5	430	RE 160 24-9	70-2	198-9	231-504 1215-1401
ET01420	Phase Diagrams	217	318	362			728	430	Re 160 26-8		199	262-70 287-306 1232-44
ET01430	Color Code	315-27								63-6		

COURSE ET5011 SUBJECT RCL CIRCUITS AND RESONANCE Page 1 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
NUMBER	TITLE	140	150	151	155	125	100	95	145	185	105	375
ET01440	RCL Phase Relationships	279-81	278-9	344-9	159	7801-3	732		86	10,32		1677-1722 1010-22 1856-76
ET01450	Impedance	284	335-41	409	154 158	8002-3	733	429	79-80 86	9-12 24	198	1677-1722 1856-76
ET01460	Conditions for Minimum Z	284	359-61	410-11		8004-5	735		79			862-84
ET01470	Resonance	283-8	370	411-12								1022-44
ET01490	Resonance Curve	291-4	361-2	410-13	156		736	433	88	37,40		1723-30
ET01510	Selectivity		367	417-8					80	15,33 48,56		
ET01530	Q	290	363-4	413-15 420-24	163				79	13-18, 27-32 49-52 63-4		1050-90 1876-83
ET01540	Time Constant				160-1							
ET01550	Series Resonance	288-91	361-3	411-13	154-5		737-8		78-84	7-18		846-61
ET01560	Parallel Resonance		369	418-20	156-8				85-91	19-29		1722
ET01570	Bandwidth	293	370	417-8						15,33		1050-90 1825-55 1890-99

COURSE ET5011 SUBJECT RCL CIRCUITS AND RESONANCE Page 2 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
NUMBER	TITLE	140	150	151	155	125	100	95	145	185	105	375
ET01580	1/2 Power Points	292	368	418								1076-90 1890-99
ET01584	Resistive and Reactive Power		318-21	361-3								1900-17
ET01585	Power Factor		321-9	367-74								
ET01590	Practical Applications		370	420-26					78,85	64		1120-27 1894-1900

COURSE ET5011 SUBJECT Measuring Instruments Page 1 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
NUMBER	TITLE	140	150	151	155	125	100	95	165	145	105	375
ET01600	Basic Meter Movements		154 167	179-80	348	6301	548	366	33-4		185	
ET01601	D'Arsonval	154-6	153-4	179-80	349	6301-6						724-748
ET01610	Ammeters	155-60	154-7	180-4	348-54	6401-5	548 632	370	36-8	7	147 185	749-89
ET01620	Shunt Design	158-60	155	182-4	351	6402	623	371		38	185	749-89
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ET01650	Voltmeter as an Ohmmeter		163	191								
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ET01671	Ohmmeter Calibration	164-5	162	190								815-25
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COURSE ET5011 SUBJECT Measuring Instruments Page 2 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES										
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ET01690	Multimeters				354-61		579					326-49 887-914
ET01691	Wattmeters	154	167-8	196	362-4		634	371				
ET01700	Meter Sensitivity and Accuracy	163-4		184			367					740-49
ET01720	Oscilloscope				378-83			448 451		46		1-723
ET01730	Wave Form Generators							307 400 409				
ET01740	Time/Frequency Measurement				375-6							
ET01750	Power Factor				376	8103			38-44			
ET01760	Voltage Divider (Potentiometer)	102-7	83, 211	187						29		2751 - 2782
ET01780	Circuit Loading Effects - resistive, capacitive	168-71								32,44		872-86

NEW YORK INSTITUTE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY 5011

DETAILED REFERRALS
and
CODING INFORMATION

Book II

9/65

NEW YORK INSTITUTE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY

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COMPUTER CURRICULUM ANALYSIS

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ET5011

SOURCE REFERENCES

Ref. No.	Source Title	Author	Year	Publisher	Mtd. Pres.
0095	College Physics	Weber, White, Manning	1963	McGraw-Hill	09
0100	College Physics	Sears & Zemansky	1960	Addison-Wesley	09
0105	College Physics	Schaum	1961	Schaum	12
0125	First Year College Physics	NYIT	1963	McGraw-Hill	02
0140	Basic Electricity	NYIT	1963	McGraw-Hill	02
0145	Basic Electricity (Laboratory Manual)	Zbar	1958	McGraw-Hill	11
0150	Introduction to Electric Circuits	Jackson	1959	Prentice-Hall	09
0155	Basic Electricity	Turner	1963	Holt, Rinehart, & Winston	09
0160	Electrostatics	Schure	1958	Rider	13
0165	DC Circuit Analysis	Schure	1959	Rider	13
0170	Magnetism and Electromagnetism	"	1959	"	"
0175	AC Circuit Analysis	"	1958	"	"
0180	Transformers	"	1961	"	"
0185	Resonant Circuits	"	1957	"	"
0186	R-C, R-L Time Constants	"	1954	"	"
0375	First Year Electronics (Autotutor)	U. S. Indust. Inc.		U. S. Industries Inc.	03

NEW YORK INSTITUTE OF TECHNOLOGY

CURRICULUM ANALYSIS AND DEVELOPMENT

Coding Information
ET 5011

Sample Title Line

Topic Number	Topic Title	Information Categories
ET00010	States of Matter	LN PR

Sample Detailed Referral Line

Topic Number	Source Reference Number	Page Number	Method of Presentation	Academic Level	Extent of Treatment	Prerequisite
ET00010	0140	0001, 0003 ≠	02	00	1 ≠	
ET00010	0155	0009 ≠	09	00	1 ≠	
ET00010	0375	0017 ≠	03	01	1 ≠ ≠	

Note: The ≠ symbol is used for computer purposes only.

NEW YORK INSTITUTE OF TECHNOLOGY

TABLE OF ABBREVIATIONS AND CODE DESIGNATIONS

A. Method of Presentation

01	CP	Class Presentation
02	PT	Programmed Text
03	MP	Machine Presented Program
04	FL	Film
05	LK	Lecture
06	VT	Video Tape
07	AT	Audio Tape
08	CN	Course Notes
09	NT	Normal Text
10	ST	Self-study (self-taught)
11	LM	Laboratory Manual
12	WK	Theory and/or Problem Workbook
13	BT	Abridged Textbook

(99 such designations may be permitted)

B. Academic Level

00	High School
01	1st Semester College
12	12th Semester College

(09-12 are graduate level)

C. Information Categories

AT	Analytical Technique	pencil and paper operation
BG	Background, general information	

NEW YORK INSTITUTE OF TECHNOLOGY

CP	Concept	a mental construct - an idea not based upon sensory perceptions alone
DF	Definition	statement or meaning of a term
ED	Engineering Device	circuit or physical object designed and/or built
ET	Experimental technique	operation in lab or shop
FA	Fact	experimentally verified theory
FD	Factual data	units, constants, constraints and properties of materials as needed to effect a design of an instrument or an engineering device
IN	Instrument	a device used primarily for making an observation or a measurement
LW	Law	a statement summarizing a body of experiences or a logical deduction from basic principles
PE	Percept	phenomenon we become acquainted with through the senses
PR	Principle	plays the role of axiom or postulate and cannot be derived
SI	Special Illustration	item presented in class as an illustration of a topic already discussed
TH	Theory	
PF	Proof	rigorous mathematical or logical proof

DETAILED REFERRALS
STATIC ELECTRICITY

ET00010 States of Matter LW PR

ET00010 0140 0001, 0003 # 02 00 1 #

ET00010 0155 0009 # 09 00 1 #

ET00010 0375 0017 # 03 01 1 # #

ET00020 Atomic Structure TH

ET00020 0140 0006 # 02 00 2 #

ET00020 0150 0005 # 09 01 1 #

ET00020 0151 0004 # 09 01 1 #

ET00020 0155 0010 # 09 00 2 #

ET00020 0125 0201 # 02 01 1 #

ET00020 0100 0449 # 09 01 1 #

ET00020 0095 0278 # 09 01 1 #

ET00020 0375 0033 # 03 01 2 # #

ET00030 Milikan Oil Drop Experiment; charges on electron ET AT

ET00030 0155 0012 # 09 01 1 #

ET00030 0100 0487 # 09 01 1 # #

ET00040 Elements, compounds, mixtures LW

ET00040 0140 0004 # 02 00 2 #

ET00040 0155 0009 # 09 00 1 # #

DETAILED REFERRALS
STATIC ELECTRICITY

ET00050 Law of Electric Charges LW

ET00050 0140 0008 # 02 00 2 #

ET00050 0150 0021, 0207 # 09 01 1 #

ET00050 0151 0241 # 09 01 1 #

ET00050 0155 0006 # 09 00 1 #

ET00050 0125 0101 # 02 01 1 #

ET00050 0100 0449 # 09 01 2 #

ET00050 0095 0277 # 09 01 1 #

ET00050 0375 0051 # 03 01 2 # #

ET00060 Constitution of Charges and Charging CP PR

ET00060 0140 0011 # 02 00 2 #

ET00060 0155 0005 # 09 00 1 #

ET00060 0125 0301, 0401 # 02 01 2 #

ET00060 0100 0452, 0509 # 09 01 1 #

ET00060 0095 0294, 0297 # 09 01 1 #

ET00060 0375 0188 # 03 01 1 # #

ET00070 Atoms and Ions CP LW

ET00070 0140 0015 # 02 00 1 #

ET00070 0151 0007 # 09 01 1 #

ET00070 0155 0012 # 09 00 1 #

ET00070 0375 0070 # 03 01 1 # #

DETAILED REFERRALS
STATIC ELECTRICITY

ET00080 Coulomb's Law (forces between charged bodies) LW

ET00080 0140 0017 # 02 00 3 #

ET00030 0155 0007 # 09 00 1 #

ET00080 0125 0501 # 02 01 1 #

ET00080 0100 0456 # 09 01 1 #

ET00080 0095 0280 # 09 01 1 #

ET00080 0105 0136 # 12 01 1 #

ET00080 0150 0209 # 09 01 1 #

ET00080 0151 0241 # 09 01 2 #

ET00080 0375 0051, 0215 # 03 01 3 # #

ET00090 Distribution of Charges LW CP

ET00090 0140 0026 # 02 00 2 #

ET00090 0151 0243 # 09 01 1 #

ET00090 0125 0801, 1101 # 02 01 2 #

ET00090 0100 0486 # 09 01 1 #

ET00090 0095 0282 # 09 01 1 # #

ET00100 Detection Devices, Electroscope ED

ET00100 0140 0024 # 02 00 1 #

ET00100 0155 0008 # 09 00 1 #

ET00100 0125 0301, 0501 # 02 01 1 #

ET00100 0100 0453, 0457 # 09 01 2 #

ET00100 0095 0279 # 09 01 1 #

ET00100 0375 0200 # 03 01 2 # #

DETAILED REFERRALS
STATIC ELECTRICITY

ET00110 Energy and Energy Levels LW PR CP
ET00110 0140 0007 # 09 01 1 # #

ET00120 Lines of Force; Field Intensity PR CP
ET00120 0125 0501 # 02 01 2 #
ET00120 0125 0801 0901 # 02 02 2 #
ET00120 0100 0470 # 09 01 2 #
ET00120 0095 0281 # 09 01 3 #
ET00120 0105 0137 # 12 01 1 #
ET00120 0150 0209 # 09 02 2 #
ET00120 0151 0241 # 09 02 1 # #

ET00130 Electric Field CP
ET00130 0140 0021 # 02 00 2 #
ET00130 0155 00055 # 09 00 1 #
ET00130 0125 0701 # 02 01 1 #
ET00130 0100 0467 # 09 01 1 #
ET00130 0095 0281 # 09 01 1 #
ET00130 0105 0137 # 12 01 1 #
ET00130 0150 0208 # 09 02 2 #
ET00130 0151 0242 # 09 02 2 #
ET00130 0375 0340 # 03 01 1 # #

DETAILED REFERRALS
STATIC ELECTRICITY

ET00140 Gauss' Law LW

ET00140 0125 1001 # 02 01 2 #

ET00140 0100 0475 # 09 01 1 # #

ET00150 Units of Measurement FD

ET00150 0150 0008 # 09 01 2 #

ET00150 0151 0013 # 09 01 2 #

ET00150 0155 0007 # 09 00 2 #

ET00150 0125 0601, 07[illegible]1 # 02 01 2 #

ET00150 0100 0460 # 09 01 1 #

ET00150 0095 0280 # 09 01 1 #

ET00150 0105 0261 # 12 01 1 #

ET00150 0375 0215 # 03 01 2 # #

ET00160 Conduction, Insulation CP LW

ET00160 0150 0014 # 09 01 2 #

ET00160 0151 0009 # 09 01 1 #

ET00160 0155 0015 # 09 00 1 #

ET00160 0100 0454 # 09 01 1 #

ET00160 0095 0278, 0334 # 09 01 2 #

ET00160 0375 0317 # 03 01 2 # #

ET00170 Semiconduction CP LW

ET00170 0095 0333 # 09 01 1 # #

DETAILED REFERRALS
CHARGES IN MOTION

ET5011

ET00180	ELECTRIC CURRENT IN SOLIDS					CP	LW
ET00180	0140	0031	#	02	00	1	#
ET00180	0150	0030	#	09	01	1	#
ET00180	0150	0016	#	09	01	2	#
ET00180	0155	0014	#	09	00	1	#
ET00180	0125	0021	#	02	01	1	#
ET00180	0100	0536	#	09	01	1	#
ET00180	0095	0303	#	09	01	1	#
ET00180	0105	0146	#	09	01	1	# #

ET00190	CURRENT IN LIQUIDS AND GASSES					CP	LW
ET00190	0155	0066	#	09	00	1	#
ET00190	0100	0587	#	09	01	5	#
ET00190	0095	0440	#	09	01	2	#

ET00200	CONDUCTIVITY AND RESISTIVITY					DF	LW	FD
ET00200	0140	0033	#	02	00	1	#	
ET00200	0150	0036	#	09	01	3	#	
ET00200	0151	0046,0058	#	09	01	2	#	
ET00200	0155	0032	#	09	00	1	#	
ET00200	0125	2401	#	02	01	1	#	
ET00200	0125	2201	#	02	01	1	#	
ET00200	0100	0541	#	09	01	2	#	
ET00200	0095	0331	#	09	01	1	#	
ET00200	0165	0008	#	13	01	1	#	
ET00200	0375	0638	#	03	01	4	#	
ET00200	0105	0146	#	12	01	1	#	#

ET5011

DETAILED REFERRALS
CHARGES IN MOTION

ET00210 TEMPERATURE EFFECTS FD

ET00210	0150	0045	#	09	01	1	#
ET00210	0151	0054	#	09	01	1	#
ET00210	0155	0033	#	09	00	1	#
ET00210	0125	2301	#	02	01	1	#
ET00210	0375	0766	#	03	01	2	# #

ET00220 POTENTIAL (ELECTRICAL) - POTENTIAL GRADIENT CP

ET00220	0125	1201	#	02	01	1	#
ET00220	0100	0493	#	09	01	2	#
ET00220	0100	0506	#	09	01	1	#
ET00220	0290	0095	#	09	01	2	#
ET00220	0165	0006	#	13	01	1	#
ET00220	0105	0147	#	12	01	1	#
ET00220	0150	0020	#	09	01	2	#
ET00220	0151	0030	#	09	01	1	# #

ET00230 POTENTIAL DIFFERENCE (VOLTAGE) LW CP

ET00230	0140	0038	#	02	01	1	#
ET00230	0150	0020	#	09	01	1	#
ET00230	0151	0030	#	09	01	1	#
ET00230	0155	0009	#	09	00	1	#
ET00230	0125	1201	#	02	01	1	#
ET00230	0100	0499	#	09	01	1	#
ET00230	0100	0561	#	09	01	1	#
ET00230	0095	0290	#	09	01	1	#
ET00230	0095	0309,0315	#	09	01	3	#
ET00230	0375	0350	#	03	01	1	# #

ET5011

DETAILED REFERRALS
CHARGES IN MOTION

ET00240 VOLTAGE DROP CP PR

ET00240	0150	0028	#	09	01	1	#
ET00240	0151	0031	#	09	01	1	#
ET00240	0155	0041	#	09	00	1	#
ET00240	0155	0053	#	09	00	1	#
ET00240	0125	2601	#	02	01	1	#
ET00240	0095	0319	#	09	01	1	# #

ET00250 POTENTIAL OF CHARGED BODIES AND SURFACES CP LW

ET00250	0125	1401	#	02	01	1	#
ET00250	0100	0501	#	09	01	1	#
ET00250	0095	0293	#	09	01	1	# #

ET00260 WORK, ENERGY, POTENTIAL; RELATIONSHIPS LW

ET00260	0150	0028	#	09	01	1	#
ET00260	0150	0055	#	09	01	3	#
ET00260	0151	0030	#	09	01	1	#
ET00260	0125	2601,2701,3201	#	2	01	3	#
ET00260	0100	0503,0558	#	09	01	1	#
ET00260	0095	0290	#	09	01	1	#
ET00260	0095	0340	#	09	01	2	# #

DETAILED REFERRALS
CHARGES IN MOTION

ET00270 COMPLETE ELECTRIC CIRCUIT ED

ET00270	0140	0040	#	02	00	1	#
ET00270	0151	0020	#	09	01	1	#
ET00270	0155	0018	#	09	00	1	#
ET00270	0100	0540	#	09	01	1	#
ET00270	0095	0304	#	09	01	1	#
ET00270	0095	0315	#	09	01	1	#
ET00270	0375	0384	#	03	01	3	# #

ET00280 ELECTRON VELOCITY; DRIFT VELOCITY FD

ET00280	0150	0005	#	09	01	1	#
ET00280	0151	0024	#	09	01	1	# #

ET00290 EFFICIENCY DF

ET00290	0150	0057	#	09	01	1	#
ET00290	0151	0070	#	09	01	1	# #

ET00291 UNITS OF MEASUREMENT FD

ET00291	0140	0032	#	02	00	1	#
ET00291	0150	0016	#	09	01	1	#
ET00291	0151	0021,0029	#	09	01	2	#
ET00291	0375	0413,0755	#	03	01	2	# #

DETAILED REFERRALS
CHARGES IN MOTION

ET00300 SOURCES OF EMF ED

ET00300	0140	0041	#	02	00	1	#
ET00300	0150	0021	#	09	01	2	#
ET00300	0151	0033	#	09	01	2	#
ET00300	0155	0015	#	09	00	1	#
ET00300	0155	0022	#	09	00	2	#
ET00300	0125	2801,3501,8601	#	02	01	1	#
ET00300	0100	0557	#	09	01	1	#
ET00300	0095	0297	#	09	01	1	#
ET00300	0095	0304	#	09	01	1	#
ET00300	0375	0363	#	03	01	3	# #

ET00310 TERMINAL VOLTAGE PR DF

ET00310	0100	0564	#	09	01	1	#
ET00310	0375	0420	#	03	01	2	# #

ET00320 ELECTROCHEMISTRY; THERMOCHEMISTRY FD

ET00320	0150	0021	#	09	01	2	#
ET00320	0151	0033	#	09	01	2	#
ET00320	0125	8301	#	02	01	1	#
ET00320	0100	0587	#	09	01	5	#
ET00320	0095	0304	#	09	01	3	#
ET00320	0375	0363	#	03	01	2	# #

DETAILED REFERRALS
CHARGES IN MOTION

ET5011

ET00330 ELECTRIC SYMBOLS FD

ET00330	0140	0042	#	02	00	1	#
ET00330	0150	0004	#	09	01	1	#
ET00330	0151	0012	#	09	01	1	#
ET00330	0155	0034	#	09	00	1	#
ET00330	0155	0054	#	09	01	3	#
ET00330	0375	1232	#	03	01	3	# #

DETAILED REFERRALS
BATTERY-RESISTOR CIRCUIT FUNDAMENTALS

```
ET00340   Schematic Diagrams   ED

ET00340   0140   0046 ##  02  00  1 ##

ET00340   0145   0003 ##  11  00  1 ##

ET00340   0375   1232, 1306 ##  03  01  3  ## ##


ET00350   Ohms Law   LW

ET00350   0140   0048 ##  02  00 1 ##

ET00350   0150   0035 ##  09  01 1 ##

ET00350   0151   0046 ##  09  01 1 ##

ET00350   0125   2201, 2301  ##  02  01  1 ##

ET00350   0100   0543  ##  09 01  1 ##

ET00350   0095   0310, 0315  ##  09  01  1 ##

ET00350   0165   0009 ##  09  01  1 ##

ET00350   0145   0016  ##  11 00  1 ##

ET00350   0105   0146  ##  12  01  1 ##

ET00350   0375   0437  ##  03  01 2 ## ##


ET00360   Batteries in Series / Parallel   ED

ET00360   0140   0055  ##  02  00  1 ##

ET00360   0155   0047  ##  09  00  1 ##

ET00360   0125   3201  ##  02  01  1  ##

ET00360   0125   8901  ##  02  01  1  ##

ET00360   0100   0572      09  01  1 ##

ET00360   0095   0320 ##  09  01  1 ##

ET00360   0105   0161 ##  12  01  1 ##

ET00360   0375   0489  ##  03  01  2  ## ##
```

DETAILED REFERRALS
BATTERY-RESISTOR CIRCUIT FUNDAMENTALS

ET00370 Internal Resistance LW CP

ET00370 0150 0072 ## 09 01 1 ##

ET00370 0151 0086 ## 09 01 1 ##

ET00370 0155 0049 ## 09 00 1 ##

ET00370 0125 3201, 8901 ## 02 01 1 ##

ET00370 0100 0572 ## 09 01 1 ##

ET00370 0095 0320 ## 09 01 1 ##

ET00370 0375 2550 ## 03 01 2 ## ##

ET00380 Resistor - Series Circuits ED

ET00380 0140 0070 ## 02 00 4 ##

ET00380 0150 0068 ## 09 01 2 ##

ET00380 0151 0082 ## 09 01 1 ##

ET00380 0155 0037 ## 09 00 1 ##

ET00380 0125 2901 ## 02 01 1 ##

ET00380 0100 0559 ## 09 01 3 ##

ET00380 0095 0316 ## 09 01 1 ##

ET00380 0165 0020 ## 13 01 1 ##

ET00380 0145 0018 ## 11 00 1 ##

ET00380 0105 0156 ## 12 01 1 ##

ET00380 0375 1262, 1356 ## 03 01 3 ## ##

DETAILED REFERRALS
BATTERY-RESISTOR CIRCUIT FUNDAMENTALS

ET00390 Kirchoff's Voltage Law LW

ET00390	0140	0081	##	02	00	2	##	
ET00390	0150	0070	##	09	01	1	##	
ET00390	0151	0084	##	09	01	1	##	
ET00390	0155	0046	##	09	00	1	##	
ET00390	0125	3301	##	02	01	1	##	
ET00390	0100	0574	##	09	01	1	##	
ET00390	0165	0054	##	13	01	1	##	
ET00390	0105	0157	##	12	01	2	##	
ET00390	0375	1741	##	03	01	4	##	##

ET00400 Resistor Parallel Circuits ED

ET00400	0140	0089	##	02	00	1	##	
ET00400	0150	0075	##	09	01	2	##	
ET00400	0151	0090, 0094	##	09	00	2	##	
ET00400	0155	0038	##	09	00	1	##	
ET00400	0125	2901	##	02	01	1	##	
ET00400	0100	0570	##	09	01	1	##	
ET00400	0095	0317	##	09	01	1	##	
ET00400	0165	0052	##	13	01	1	##	
ET00400	0145	0026	##	11	00	1	##	
ET00400	0105	0157	##	12	01	2	##	
ET00400	0375	1378, 2163	##	03	01	4	##	##

DETAILED REFERRALS
BATTERY-RESISTOR CIRCUIT FUNDAMENTALS

ET5011

ET00410 Kirchoff's Current Law LW

ET00410 0140 0086 ≠≠ 02 00 1 ≠≠

ET00410 0150 0075 ≠≠ 09 01 1 ≠≠

ET00410 0151 0092 ≠≠ 09 01 1 ≠≠

ET00410 0155 0046 ≠≠ 09 00 1 ≠≠

ET00410 0125 3301 ≠≠ 02 01 1 ≠≠

ET00410 0100 0574 ≠≠ 09 01 1 ≠≠

ET00410 0165 0052 ≠≠ 13 01 1 ≠≠

ET00410 0145 0026 ≠≠ 11 00 1 ≠≠

ET00410 0105 0157 ≠≠ 12 01 2 ≠≠

ET00410 0375 1726 ≠≠ 03 01 2 ≠≠ ≠≠

ET00411 Conductance CP

ET00411 0150 0076 ≠≠ 09 01 1 ≠≠

ET00411 0150 0092 ≠≠ 09 01 1 ≠≠ ≠≠

ET00420 Resistor Circuits - Series/Parallel ED

ET00420 0140 0097 ≠≠ 02 00 1 ≠≠

ET00420 0150 0079 ≠≠ 09 01 1 ≠≠

ET00420 0151 0096 ≠≠ 09 01 1 ≠≠

ET00420 0155 0039 ≠≠ 09 00 1 ≠≠

ET00420 0125 3001 ≠≠ 02 01 1 ≠≠

ET00420 0100 0568 ≠≠ 09 01 2 ≠≠

ET00420 0095 0322 ≠≠ 09 01 1 ≠≠

ET00420 0165 0030, 0046 13 01 1 ≠≠

ET00420 0145 0024 ≠≠ 11 00 1 ≠≠

ET00420 0105 0159 ≠≠ 12 01 2 ≠≠

ET00420 0375 2385 ≠≠ 03 01 3 ≠≠ ≠≠

DETAILED REFERRALS
BATTERY-RESISTOR CIRCUIT FUNDAMENTALS

ET00430 Standard Resistors ED

ET00430 0100 0543 09 01 1 ## ##

ET00440 Practical Resistors ED

ET00440 0125 3406 02 00 1 ## ##

ET00450 Resistor Color Code ED

ET00450 0145 0013 ## 11 00 1 ##

ET00450 0375 0930 ## 03 01 3 ## ##

ET00460 DC Power CP LW

ET00460 0140 0065 ## 02 00 1 ##

ET00460 0150 0058 ## 09 01 1 ##

ET00460 0151 0071 ## 09 01 1 ##

ET00460 0155 0043 ## 09 00 1 ##

ET00460 0125 2701 ## 02 01 1 ##

ET00460 0100 0577 ## 09 01 1 ##

ET00460 0165 0038 ## 13 01 1 ##

ET00460 0105 0153 ## 12 01 1 ##

ET00460 0375 1572, 2222 ## 03 01 3 ## ##

ET00461 Efficiency DF CP

ET00461 0150 0057 ## 09 01 1 ##

ET00461 0151 0070 ## 09 01 1 ## ##

ET00470 Maximum Power Transfer AT LW CP

ET00470 0150 0073 ## 09 01 1 ##

ET00470 0151 0088 ## 09 01 1 ##

ET00470 0155 0049 ## 09 00 1 ##

ET00470 0125 8901 ## 02 01 1 ##

ET00470 0165 0042 ## 13 01 1 ## ##

ET5011

DETAILED REFERRALS
BATTERY-RESISTOR CIRCUIT FUNDAMENTALS

ET00480 Joule's Law LW

ET00480 0125 2701 ## 02 01 1 ##

ET00480 0100 0552 ## 09 01 1 ##

ET00480 0095 0341 ## 09 01 1 ## ##

ET00490 Voltage Dividers ED

ET00490 0140 0102 ## 02 00 2 ##

ET00490 0150 0083 ## 09 01 1 ##

ET00490 0151 0100 ## 09 01 2 ##

ET00490 0155 0044 ## 09 00 1 ##

ET00490 0145 0029, 0032 ## 11 00 1 ##

ET00490 0375 1887 ## 03 01 2 ## ##

ET00500 Potentiometers ED IN

ET00500 0151 0109 ## 09 01 1 ##

ET00500 0125 3401 ## 02 01 1 ##

ET00500 0100 0566 ## 09 01 1 ##

ET00500 0095 0334 ## 09 01 1 ##

ET00500 0165 0032 ## 13 01 1 ##

ET00500 0375 2015 ## 03 01 3 ## ##

ET00510 Simple Hardware ED

ET00510 0155 0054 ## 09 00 1 ## ##

ET00520 Simple Switch and fuse Circuits ED

ET00520 0140 0058 ## 02 00 2 ##

ET00520 0375 1306 ## 03 01 2 ## ##

DETAILED REFERRALS

MAGNETISM AND MAGNETIC INDUCTION

ET00530 MAGNETS ED PR

ET00530 0140 0110 # 02 00 1 #

ET00530 0155 0073 # 09 00 1 #

ET00530 0125 5701 # 02 01 1 #

ET00530 0100 0607 # 09 01 1 #

ET00530 0150 0109 # 09 01 1 #

ET00530 0151 0132 # 09 01 1 #

ET00530 0375 0001 # 03 01 1 # #

ET00540 FLUX, FLUX DENSITY LW PE

ET00540 0150 0116 # 09 01 2 #

ET00540 0151 0140 # 09 01 2 #

ET00540 0100 0612 # 09 01 1 #

ET00540 0095 0351 # 09 01 1 #

ET00540 0375 0068 # 03 01 2 # #

ET00550 MAGNETIC MATERIALS ED FD

ET00550 0140 0114 # 02 00 1 #

ET00550 0151 0144 # 09 01 1 #

ET00550 0150 0120 # 09 01 1 #

ET00550 0125 5501 # 02 01 1 #

ET00550 0100 0678 # 09 01 1 #

ET00550 0095 0379 # 09 01 1 #

ET00550 0375 0087 # 03 01 1 # #

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DETAILED REFERRALS

ET5011

MAGNETISM AND MAGNETIC INDUCTION

ET00560 FORCES ON MOVING CHARGES, TORQUES PE LW
ET00560 0150 0150 # 09 01 1 #
ET00560 0151 0176 # 09 01 1 #
ET00560 0125 4101, 4601 # 02 01 2 #
ET00560 0100 0612, 0608 # 09 01 2 #
ET00560 0095 0350, 0356 # 09 01 1 #
ET00560 0375 0024 # 03 01 1 # #

ET00570 CYCLOTRON ED
ET00570 0125 4201, 4301, 4401 # 02 01 3 #
ET00570 0100 0613 # 09 01 1 # #

ET00580 MAGNETIC FIELD PE, LW, PR
ET00580 0140 0113 # 02 00 1 #
ET00580 0151 0132 # 09 01 1 #
ET00580 0150 0109 # 09 01 1 #
ET00580 0155 0074 # 09 00 1 #
ET00580 0125 3601, 4701 # 02 01 2 #
ET00580 0100 0608 # 09 01 2 #
ET00580 0105 0173, 0181 # 12 01 1 #
ET00580 0375 0032 # 03 01 2 # #

DETAILED REFERRALS

MAGNETISM AND MAGNETIC INDUCTION

ET00590 PERMEABILITY DF FD

ET00590 0150 0118, 0125 # 09 01 1 #

ET00590 0151 0142, 0150 # 09 01 1 #

ET00590 0155 0081 # 09 00 1 #

ET00590 0125 5301, 5601 # 02 01 2 #

ET00590 0100 0678 # 09 01 1 #

ET00590 0095 0379 # 09 01 1 #

ET00590 0375 0090 # 03 01 1 # #

ET00600 SOURCES OF MAGNETIC FIELDS LW CP

ET00600 0125 4801 # 02 01 1 # #

ET00610 LAW OF MAGNETIC POLES LW PR

ET00610 0140 0111 # 02 00 1 #

ET00610 0155 0073 # 09 00 2 #

ET00610 0125 5701 # 02 01 1 #

ET00610 0100 0691 # 09 01 1 #

ET00610 0105 0181 # 12 01 1 #

ET00610 0375 0007 # 03 01 3 # #

ET00620 AMPERE'S RULE LW

ET00620 0125 4903 # 02 01 1 #

ET00620 0100 0688 # 09 01 1 #

ET00620 0105 0173 # 12 01 1 # #

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DETAILED REFERRALS
MAGNETISM AND MAGNETIC INDUCTION

ET5011

ET00630 MAGNETIZATION CHARACTERISTICS FD CP

ET00630 0150 0122 # 09 01 2 #

ET00630 0151 0148 # 09 01 2 #

ET00630 0155 0082 # 09 00 1 #

ET00630 0125 6001 # 02 01 1 #

ET 00630 0100 0685 # 09 01 2 #

ET00630 0095 0380 # 09 01 1 #

ET00630 0375 0241, 0276 # 03 01 2 # #

ET00640 MAGNETIC FIELD AROUND CONDUCTORS CP LW

ET00640 0140 0116 # 02 00 1 #

ET00640 0150 0113 # 09 01 1 #

ET00640 0151 0137 # 09 01 1 #

ET00640 0155 0078 # 09 00 1 #

ET00640 0125 5001, 5201 # 02 01 2 #

ET00640 0100 0644 # 09 01 1 #

ET00640 0095 0353 # 09 01 2 #

ET00640 0105 0173 # 12 01 1 #

ET00640 0375 0196, 0873 # 03 01 3 # #

[illegible]

ET00650 ELECTRICAL ANALOGIES LW

ET00650 0125 6001, 6101 # 02 01 2 # #

ET00660 MAGNETIC SHIELDING ED LW

ET00660 0150 0131 # 09 01 1 #

ET00660 0151 0155 # 09 01 1 #

ET00660 0155 0077 # 09 00 1 #

ET00660 0375 0090 # 03 01 1 # #

DETAILED REFERRALS
MAGNETISM AND MAGNETIC INDUCTION

ET00670 FIELD OF A SOLENOID LW

ET00670 0140 0118 # 02 00 1 #
ET00670 0150 0115 # 09 01 1 #
ET00670 0151 0139 # 09 01 1 #
ET00670 0155 0079, 0085 # 09 00 1 #
ET00670 0125 5101 # 02 01 1 #
ET00670 0100 0647 # 09 01 1 #
ET00670 0095 0354 # 09 01 1 # #

ET00680 FIELD OF A TORROID LW

ET00680 0150 0115 # 09 01 1 #
ET00680 0151 0139 # 09 01 1 #
ET00680 0125 5101 # 02 01 1 #
ET00680 0100 0650 # 09 01 1 #
ET00680 0095 0352 # 09 01 1 # #

ET00690 MAGNETIC CIRCUIT ED

ET00690 0150 0132 # 09 01 3 #
ET00690 0151 0156 # 09 01 3 #
ET00690 0155 0083 # 09 00 1 #
ET00690 0100 0700 # 09 01 1 #
ET00690 0095 0382 # 09 01 1 # #

DETAILED REFERRALS
MAGNETISM AND MAGNETIC INDUCTION

ET5011

ET00700 LENZ'S LAW LW
ET00700 0140 0121 # 02 00 1 #
ET00700 0150 0175 # 09 01 1 #
ET00700 0151 0204 # 09 01 1 #
ET00700 0125 6901 # 02 01 1 #
ET00700 0100 0663 # 09 01 1 #
ET00700 0095 0392 # 09 01 1 #
ET00700 0375 0417 # 03 01 1 # #

ET00710 BIO-SAVART RELATIONSHIP LW
ET00710 0125 4901 # 02 01 1 # #

ET00720 AIR GAP LW CP
ET00720 0150 0140 # 09 01 1 #
ET00720 0151 0166 # 09 01 1 #
ET00720 0100 0700 # 09 01 1 # #

ET00730 RELUCTANCE DF CP
ET00730 0150 0117 # 09 01 1 #
ET00730 0151 0142 # 09 01 1 #
ET00730 0100 0702 # 09 01 1 #
ET00730 0095 0382 # 09 01 1 # #

ET00740 INDUCED EMF - MAGNETIC INDUCTION LW CP
ET00740 0140 0124 # 02 00 1 #
ET00740 0125 3601, 3801 # 02 01 2 #
ET00740 0100 0657, 0666 # 09 01 1 #

DETAILED REFERRALS
MAGNETISM AND MAGNETIC INDUCTION ET5011

ET00740 INDUCED EMF - MAGNETIC INDUCTION LW CP (continued)

ET00740 0095 0390 # 09 01 1 #

ET00740 0105 0190 # 12 01 1 #

ET00740 0150 0173 # 09 01 1 #

ET00740 0151 0202 # 09 01 1 #

ET00740 0375 0890 # 03 01 1 # #

ET00750 SELF INDUCTANCE LW CP

ET00750 0140 0134 # 02 00 1 #

ET00750 0150 0177 # 09 01 1 #

ET00750 0151 0206 # 09 01 1 #

ET00750 0125 7201 # 02 01 1 #

ET00750 0095 0404 # 09 01 1 #

ET00750 0105 0190 # 12 01 1 #

ET00750 0375 0453, 0918 # 03 01 1 # #

ET00760 UNITS OF MEASUREMENT FD

ET00760 0150 0117 # 09 01 1 #

ET00760 0151 0140 # 09 01 1 #

ET00760 0155 0080 # 09 00 1 #

ET00760 0125 3901, 4001, 4602 # 02 01 3 #

ET00760 0375 0453, 0890 # 03 01 1 # #

DETAILED REFERRALS
MAGNETISM AND MAGNETIC INDUCTION

ET5011

ET00770 MUTUAL INDUCTANCE LW CP
ET00770 0140 0128 # 02 00 1 #
ET00770 0095 0405 # 09 01 1 #
ET00770 0375 0439, 0924 # 03 01 3 # #

ET00780 FARADAY'S LAW LW
ET00780 0100 0659 # 09 01 1 #
ET00780 0095 0391 # 09 01 1 #
ET00780 0145 0169 # 11 00 1 #
ET00780 0105 0169 # 12 01 1 #
ET00780 0150 0175 # 09 01 1 #
ET00780 0151 0204 # 09 01 1 # #

ET00790 B, H, μ RELATIONS LW, DF
ET00790 0150 0119 # 09 01 1 #
ET00790 0151 0148 # 09 01 2 #
ET00790 0125 6801 # 02 01 1 #
ET00790 0100 0682 # 09 01 1 #
ET00790 0095 0378 # 09 01 1 # #

ET00800 PRACTICAL PROBLEMS, EXAMPLES, CIRCUITS ED, SI
ET00800 0150 0132 # 09 01 2 #
ET00800 0151 0156 # 09 01 2 #
ET00800 0155 0085 # 09 00 1 #
ET00800 0375 0282 # 03 01 2 # #

DETAILED REFERRALS
Generator Action

ET00810 Angle of Cutting PR LW

ET00810 0140 0137 ≠≠ 02 00 1 ≠≠

ET00810 0151 0285 ≠≠ 09 01 1 ≠≠

ET00810 0150 0248 ≠≠ 09 01 1 ≠≠

ET00810 0155 0066,0094 ≠≠ 09 00 1 ≠≠

ET00810 0125 0066 ≠≠ 02 01 1 ≠≠

ET00810 0100 0666 ≠≠ 09 01 1 ≠≠

ET00810 0095 0393 ≠≠ 09 01 1 ≠≠

ET00810 0375 0665 ≠≠ 03 01 2 ≠≠ ≠≠

ET00820 Flux; Time Rate of Change - EMF LW, CP

ET00820 0150 0247 ≠≠ 09 01 1 ≠≠

ET00820 0151 0284 ≠≠ 09 01 1 ≠≠

ET00820 0155 0092 ≠≠ 09 00 1 ≠≠

ET00820 0125 0067 ≠≠ 02 01 1 ≠≠

ET00820 0100 0667 ≠≠ 09 01 1 ≠≠

ET00820 0095 0393 ≠≠ 09 01 1 ≠≠

ET00820 0375 0687 ≠≠ 03 01 1 ≠≠ ≠≠

ET00830 Generator Cycle - Sine Curve FD AT

ET00830 0140 0144 ≠≠ 02 00 1 ≠≠

ET00830 0150 0244 ≠≠ 09 01 2 ≠≠

ET00830 0151 0281 ≠≠ 09 01 2 ≠≠

ET00830 0155 0095 ≠≠ 09 00 1 ≠≠

ET00830 0100 0667 ≠≠ 09 01 1 ≠≠

ET00830 0095 0394 ≠≠ 09 01 1 ≠≠

ET00830 0375 0589, 0665 ≠≠ 03 01 3 ≠≠ ≠≠

DETAILED REFERRALS
GENERATOR ACTION .

ET00840 Basic Construction ED

ET00840 0140 0143 ≠≠ 02 00 1 ≠≠

ET00840 0150 0243 ≠≠ 09 01 1 ≠≠

ET00840 0151 0281 ≠≠ 09 01 1 ≠≠

ET00840 0155 0093 ≠≠ 09 00 1 ≠≠

ET00840 0100 0668 ≠≠ 09 01 1 ≠≠

ET00840 0095 0406 ≠≠ 09 01 1 ≠≠

ET00840 0375 0665 ≠≠ 03 01 1 ≠≠ ≠≠

ET00850 Commutator Action ED ET

ET00850 0140 0149 ≠≠ 02 00 1 ≠≠

ET00850 0095 0406 ≠≠ 09 01 1 ≠≠

ET00850 0375 0722 ≠≠ 03 01 3 ≠≠ ≠≠

DETAILED REFERRALS
Fundamentals of A-C and AC Resistive Circuits

ET00860	CURRENT DIRECTION						LW	
ET00860	0140	0177	#	02	00	1	#	
ET00860	0150	0244	#	09	01	1	#	
ET00860	0155	0094	#	09	00	1	#	
ET00860	0125	7001	#	02	01	1	#	
ET00860	0175	0004	#	13	01	1	#	
ET00860	0375	0585	#	03	01	1	#	
ET00860	0151	0281	#	09	01	1	#	#
ET00870	FREQUENCY, PERIOD, WAVELENGTH, OF AMPLITUDE							
ET00870	0140	0178	#	02	00	2	#	
ET00870	0150	0251	#	09	01	1	#	
ET00870	0155	0095, 0102	#	09	00	1	#	
ET00870	0125	7003	#	02	01	1	#	
ET00870	0375	0589	#	03	01	1	#	
ET00870	0145	0046	#	11	01	1	#	
ET00870	0105	0197	#	12	01	1	#	
ET00870	0151	0290	#	09	01	1	#	#
ET00910	PHASE			LW	DF			
ET00910	0140	0186, 0199, 0244	#	02	00	1		
ET00910	0155	0096, 0103	#	09	00	1	#	
ET00910	0125	7101	#	02	01	1	#	
ET00910	0100	0730	#	09	01	2	#	
ET00910	0175	0022	#	13	01	1	#	
ET00910	0105	0197	#	12	01	1	#	#

DETAILED REFERRALS ET5011
Fundamentals of A-C and AC Resistive Circuits

ET00920	PHASE DIFFERENCES						PE	
ET00920	0140	0187	#	02	00	1	#	
ET00920	0095	0427	#	09	01	1	#	
ET00920	0175	0022	#	13	01	1	#	#
ET00930	VOLTAGE - CURRENT RELATIONSHIPS						PE	LW
ET00930	0140	0199	#	09	00	1	#	
ET00930	0125	0071	#	02	01	2	#	
ET00930	0100	0730	#	09	01	1	#	
ET00930	0095	0427	#	09	01	1	#	
ET00930	0175	0011,0022	#	13	01	2	#	#
ET00940	NON SINUSOIDAL WAVES;HARMONICS						PE	LW
ET00940	0155	0101	#	09	01	2	#	
ET00940	0375	0626	#	03	01	1	#	#
ET00950	INSTANTEOUS AND PEAK VALUES OF SINE WAVE						AT	LW
ET00950	0140	0189	#	02	00	1	#	
ET00950	0150	0250	#	09	01	1	#	
ET00950	0155	0097	#	09	00	1	#	
ET00950	0100	0729	#	09	01	1	#	
ET00950	0375	0626	#	03	01	1	#	
ET00950	0105	0197	#	12	01	1	#	
ET00950	0151	0287	#	09	01	1	#	#

ET5011

DETAILED REFERRALS
Fundamentals of A-C and AC Resistive Circuits

ET00960	AVERAGE VALUE OF SINE WAVE						AT	LW
ET00960	0150	0259	#	09	01	1	#	
ET00960	0175	0013	#	13	01	1	#	
ET00960	0375	0626	#	03	01	1	#	
ET00960	0151	0296	#	09	01	1	#	#
ET00970	EFFECTIVE EMF						LW	PE
ET00970	0140	0192	#	02	00	1	#	
ET00970	0100	0728	#	09	01	1	#	
ET00970	0095	0426	#	09	01	1	#	
ET00970	0175	0016	#	13	01	1	#	
ET00970	0375	0626	#	03	01	1	#	
ET00970	0150	0258	#	09	01	1	#	
ET00970	0151	0296	#	09	01	1	#	#
ET00980	RESISTIVE POWER						PE	
ET00980	0140	0241	#	02	00	1	#	
ET00980	0150	0259	#	09	01	1	#	
ET00980	0155	0070, 0103	#	09	00	1	#	
ET00980	0100	0738	#	09	01	1	#	
ET00980	0175	0022	#	13	01	1	#	
ET00980	0105	0198	#	12	01	1	#	
ET00980	0151	0294	#	09	01	1	#	#

DETAILED REFERRALS
Fundamentals of A-C and AC Resistive Circuits

ET00981	INSTANTANEOUS RESISTIVE POWER						PE	LW
ET00981	0150	0257	#	09	01	1	#	
ET00981	0175	0596	#	03	01	1	#	#
ET00982	AVERAGE OR EFFECTIVE RESISTIVE POWER						PE	LW
ET00982	0140	0241	#	02	00	1	#	
ET00982	0150	0259	#	09	01	1	#	
ET00982	0155	0155	#	09	00	1	#	
ET00982	0100	0728	#	09	01	1	#	
ET00982	0375	0626	#	03	01	1	#	
ET00982	0151	0294	#	09	01	1	#	#
ET01000	INSTANTANEOUS RESISTIVE CURRENT						PE	
ET01000	0150	0255	#	09	01	1	#	
ET01000	0375	0596	#	03	01	1	#	
ET01000	0151	0293	#	09	01	1	#	#
ET01010	A-C RESISTIVE CIRCUITS						ED	
ET 01010	0140	0244	#	02	00	1	#	
ET01010	0175	0020	#	13	01	1	#	#

DETAILED REFERRALS

ET5011

Fundamentals of A-C and AC Resistive Circuits

ET01020 AC Power - General Treatment CP LW

ET01020 0140 0228 # 02 00 1 ET01190 ET01380 ET01385 #

ET01020 0150 0312 # 09 01 2 ET01190 ET01380 ET01385 #

ET01020 0151 0356 # 09 01 3 ET01190 ET01380 ET01385 #

ET01020 0155 0161 # 09 00 1 #

ET01020 0375 0626 # 0301 1 # #

DETAILED REFERRALS
INDUCTANCE

ET01050 SELF INDUCTANCE LW CP

ET01050	0140	0134,0196	#	02	00	2	#
ET01050	0150	0177	#	09	02	1	#
ET01050	0151	0207	#	09	02	1	#
ET01050	0155	0127	#	09	00	1	#
ET01050	0125	7201	#	02	01	1	#
ET01050	0100	0706	#	09	01	1	#
ET01050	0095	0404	#	09	01	1	#
ET01050	0185	0022	#	13	01	1	#
ET01050	0145	0053	#	11	00	1	#
ET01050	0105	0190	#	12	01	1	#
ET01050	0375	0453	#	03	01	1	# #

ET01060 UNITS OF MEASUREMENT FD D

ET01060	0140	0198	#	02	00	1	#
ET01060	0150	0178	#	09	02	1	#
ET01060	0151	0209	#	09	02	1	#
ET01060	0155	0128	#	09	00	1	#
ET01060	0125	7203	#	02	01	1	#
ET01060	0100	0706	#	09	01	1	#
ET01060	0095	0405	#	09	01	1	#
ET01060	0185	0022	#	13	01	1	#
ET01060	0145	0053	#	11	00	1	#
ET01060	0375	0457,0890	#	03	01	1	# #

DETAILED REFERRALS
INDUCTANCE

ET5011

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ET01070      Q                               DF    CP

ET01070     0140      0288       #     02    00    1    #

ET01070     0150      0360       #     09    01    2    #

ET01070     0151      0410       #     09    01    2    #

ET01070     0155      0163       #     09    00    1    #

ET01070     0145      0053       #     11    00    1    #

ET01070     0375      1050       #     03    01    1    #  #


ET01080     INDUCTORS   IN   SERIES          ED

ET01080     0140      0196       #     02    00    1    #

ET01080     0150      0180       #     09    02    1    #

ET01080     0151      0211       #     09    02    1    #

ET01080     0155      0137,0143  #     09    00    1    #

ET01080     0185      0026       #     13    01    1    #

ET01080     0375      0924,0983  #     03    01    2    #  #


ET01090     FACTORS   GOVERNING   INDUCTANCE   FD

ET01090     0150      0178       #     09    02    1    #

ET01090     0151      0209       #     09    02    1    #

ET01090     0375      0918       #     03    01    3    #  #


ET01100     TIME   CONSTANT   AND   INSTANTANEOUS   CURRENT  LW   CP

ET01100     0150      0187       #     09    02    2    #

ET01100     0151      0218       #     09    02    2    #

ET01100     0100      0708       #     09    01    1    #  #
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DETAILED REFERRALS
INDUCTANCE

ET01110 INDUCTORS IN PARALLEL ED

ET01110	0151	0211	#	09	02	1	#
ET01110	0155	0138,0143	#	09	00	1	#
ET01110	0185	0027	#	13	01	1	#
ET01110	0145	0057	#	11	00	1	#
ET01110	0375	0983	#	03	01	1	# #

ET01120 ENERGY STORED BY AN INDUCTOR CP LW

ET01120	0150	0194	#	09	02	2	#
ET01120	0151	0226	#	09	02	2	#
ET01120	0100	0710	#	09	01	2	#
ET01120	0095	0405	#	09	01	1	#
ET01120	0105	0190	#	12	01	1	#
ET01120	0375	0996	#	03	01	1	# #

ET01140 INDUCTIVE EFFECT ON CURRENT LW

ET01140	0140	0202	#	02	00	1	#
ET01140	0151	0229	#	09	01	2	#
ET01140	0150	0197	#	09	01	2	#
ET01140	0375	0937,0948	#	03	01	3	# #

ET01150 SERIES - PARALLEL CONNECTIONS ED

ET01150	0155	0138	#	09	00	2	#
ET01150	0185	0027	#	13	01	1	#
ET01150	0145	0057	#	11	00	1	#
ET01150	0375	0983	#	03	01	1	# #

DETAILED REFERRALS
INDUCTANCE

ET01160 I - E PHASE RELATIONS - PURE INDUCTANCE LW

ET01160	0140	0199	#	02	00	1	#
ET01160	0155	0145	#	09	00	1	#
ET01160	0125	7301	#	02	01	1	#
ET01160	0185	0022	#	13	01	1	#
ET01160	0375	0948	#	03	01	1	# #

ET01170 INDUCTIVE REACTANCE AT CP

ET01170	0140	0201	#	02	00	1	#
ET01170	0151	0304	#	09	01	2	#
ET01170	0150	0267	#	09	01	2	#
ET01170	0155	0141	#	09	00	1	#
ET01170	0125	7205	#	02	01	1	#
ET01170	0185	0004,0025	#	13	01	1	#
ET01170	0145	0053	#	11	00	1	#
ET01170	0375	0948	#	03	01	1	# #

ET01180 PRACTICAL INDUCTORS ED

ET01180	0140	0231	#	02	00	2	#
ET01180	0150	0299	#	09	01	1	#
ET01180	0151	0340	#	09	01	1	#
ET01180	0150	0184	#	09	02	2	#
ET01180	0151	0215	#	09	02	2	#
ET01180	0375	1014	#	03	01	2	# #

DETAILED REFERRALS
INDUCTANCE

ET01190 POWER FACTOR DF

ET01190	0140	0269	#	02	00	1	#
ET01190	0150	0313,0321	#	09	02	3	#
ET01190	0105	0198	#	12	01	1	#
ET01190	0151	0358,0367	#	09	01	3	# #

ET01200 R - L CIRCUITS ED

ET01200	0140	0249	#	02	00	3	#
ET01200	0150	0294	#	09	01	2	#
ET01200	0151	0336	#	09	01	2	#
ET01200	0155	0147,0151	#	09	00	1	#
ET01200	0125	7401	#	02	01	2	#
ET01200	0100	0708	#	09	01	1	#
ET01200	0145	0053	#	11	00	2	#
ET01200	0375	0529,1425	#	03	01	4	# #

ET01210 PHASE AND R - L PHASE DIAGRAMS AT LW

ET01210	0140	0249	#	02	00	2	#
ET01210	0150	0294	#	09	01	2	#
ET01210	0151	0336	#	09	01	2	#
ET01210	0155	0148	#	09	00	1	#
ET01210	0105	0197	#	12	01	1	#
ET01210	0100	0728	#	09	01	1	#
ET01210	0375	0529,1425	#	03	01	3	# #

T5011

```
ET01220       IMPEDANCE     LW   AT   CP

ET01220       0140      0255          #     02     00     1     #

ET01220       0150      0294          #     09     01     3     #

ET01220       0151      0336          #     09     01     3     #

ET01220       0155      0147          #     09     00     2     #

ET01220       0100      0727          #     09     01     1     #

ET01220       0105      0198          #     12     01     1     #

ET01220       0375      0550,1425     #     03     01     3     # #
```

DETAILED REFERRALS
TRANSFORMERS

```
ET01240   TRANSFORMER ACTION   CP   LW

ET01240   0140   0226   #  02  00  1   #
ET01240   0150   0379   #  09  01  2   #
ET01240   0151   0431   #  09  01  2   #
ET01240   0125   8201   #  02  01  1   #
ET01240   0375   1478   #  03  01  1   #
ET01240   0145   0060   #  11  01  1   #
ET01240   0105   0198   #  12  01  1   #
ET01240   0100   0740   #  09  01  1   # #


ET01243   Lenz's Law    LW

ET01243   0140   0121   #  02  00  1   #
ET01243   0150   0175   #  09  01  1   #
ET01243   0151   0204, 0213  #  0901  1  #
ET01243   0125   6901   #  02  01  1   #
ET01243   0100   0663   #  09  01  1   #
ET01243   0095   0392   #  09  01  1   #
ET01243   0375   1464   #  03  01  1   #  #

ET01246   Inducing a Current   LW   CP

ET01246   0140   0124   #  02  00  1  #
ET01246   0125   3601   #  02  01  3  #
ET01246   0100   0657   #  09  01  1  #
ET01246   0095   0390   #  09  01  1  #
ET01246   0375   0890,1464  #  03  01  2  #
ET01246   0105   0190   #  11  01  1 #  #
```

DETAILED REFERRALS

ET01249 Counter EMF CP LW

ET01249 0150 0177 # 09 01 1 #

ET01249 0151 0206 # 09 01 1 #

ET01249 0375 1464 # 03 01 1 # #

ET01252 Self-Inductance CP LW

ET01252 0140 0134 # 02 00 1 #

ET01252 0150 0177 # 09 01 1 #

ET01252 0151 0206 # 09 01 1 #

ET01252 0125 7201 # 02 01 1 #

ET01252 0095 0404 # 09 01 1 #

ET01252 0100 0706 # 09 01 1 #

ET01252 0375 0918, 1472 # 03 01 2 #

ET01252 0105 0190 # 12 01 1 # #

ET01255 Mutual Inductance CP LW

ET01255 0140 0128 # 02 00 1 #

ET01255 0150 0390 # 09 01 1 #

ET01255 0151 0204, 0431 # 09 01 1 #

ET01255 0155 0168 # 09 00 1 #

ET01255 0095 0405 # 09 01 1 #

ET01255 0375 0924, 1481 # 03 01 2 # #

ET01258 Coupling and Coupling Coefficient LW DF

ET01258 0150 0389 # 09 01 1 #

ET01258 0151 0459 # 09 01 1 #

ET01258 0155 0169 # 09 00 1 # #

DETAILED REFERRALS

ET01261 Types of Transformers ED

ET01261 0140 0237 # 02 00 1 #

ET01261 0150 0381, 0388, 0394 # 09 01 2 #

ET01261 0151 0434, 0442, # 09 01 2 #

ET01261 0155 0171, 0180 # 09 00 1 #

ET01261 0100 0741 # 09 01 1 #

ET01261 0375 1531 # 03 01 1 # #

ET01264 Impedance Ratio DF LW

ET01264 0150 0382 # 09 01 1 #

ET01264 0151 0434 # 09 01 1 #

ET01264 0375 1551 # 03 01 1 # #

ET01265 Impedance Matching AT CP

ET01265 0150 0383, 0388 # 09 01 1 #

ET01265 0151 0436, 0443 # 09 01 1 #

ET01265 0155 0174 # 09 00 1 # #

ET01267 Voltage and Current Ratios DF LW

ET01267 0150 0382 # 09 01 1 #

ET01267 0151 0434 # 09 01 1 #

ET01267 0375 1531 # 03 01 1 # #

DETAILED REFERRALS
TRANSFORMERS

ET01270 Phase Angle CP LW
ET01270 0375 1566 # 03 01 1 # #

ET01273 Transformer Losses ET, LW, AT
ET01273 0150 0385 # 09 01 1 #
ET01273 0151 0439 # 09 01 1 #
ET01273 0375 1576 # 03 01 1 # #

ET01276 Ideal/ Practical Transformers ED
ET01276 0140 0231 # 02 00 1 # #

ET01279 Transformer Applications ED ET
ET01279 0150 0384 # 09 01 2 #
ET01279 0151 0438 # 09 01 3 #
ET01279 0155 0172 # 09 00 2 #
ET01279 0375 1603 # 03 01 1 # #

ET01282 Testing a Transformer ET
ET01282 0150 0385 # 09 01 1 #
ET01282 0151 0439 # 09 01 1 #
ET01282 0375 1645 # 03 01 1 # #

DETAILED REFERRALS
TRANSFORMERS

ET01285 Power and Efficiency CP DF

ET01285 0125 8205 # 02 01 1 #

ET01285 0145 0060 # 11 00 2 #

ET01285 0105 0200 # 12 01 1 # #

ET01286 Power Transformer Color Code ED

ET01286 0375 1672 # 03 01 2 # #

ET01288 Vector Techniques AT

ET01288 0140 0251 # 02 00 2 #

ET01288 0150 0276 # 09 01 3 #

ET01288 0151 0320 # 09 01 3 #

ET01288 0125 7403 # 02 01 2 # #

DETAILED REFERRALS
CAPACITANCE

ET01290 CHARGE AND DISCHARGE CP

ET01290	0140	0208	#	02	00	1	#	
ET01290	0150	0223	#	09	02	2	#	
ET01290	0151	0258	#	09	02	2	#	
ET01290	0155	0106,0116	#	09	00	2	#	
ET01290	0100	0715	#	09	01	1	#	
ET01290	0095	0419	#	09	01	1	#	
ET01290	0186	0010,0019	#	13	01	3	#	
ET01290	0375	1143	#	03	01	1	#	#

ET01295 TIME CONSTANT CP AT

ET01295	0150	0225	#	09	01	1	#	
ET01295	0151	0260	#	09	01	1	#	#

ET01300 DIELECTRICS ED

ET01300	0140	0206	#	02	00	1	#	
ET01300	0150	0212,0221	#	09	01	1	#	
ET01300	0151	0247	#	09	01	1	#	
ET01300	0155	0109	#	09	01	2	#	
ET01300	0125	1601	#	02	01	1	#	
ET01300	0100	0523	#	09	01	3	#	
ET01300	0095	0417	#	09	01	2	#	
ET01300	0160	0040	#	13	01	1	#	
ET01300	0375	1170,1230	#	03	01	1	#	#

```
ET01310    UNITS OF MEASUREMENT          FD

ET01310    0140     0213     #     02     00     1     #

ET01310    0150     0216     #     09     01     1     #

ET01310    0151     0250     #     09     01     1     #

ET01310    0155     0107     #     09     00     1     #

ET01310    0125     1703     #     02     01     1     #

ET01310    0095     0416     #     09     01     1     #

ET01310    0160     0051     #     13     01     1     #

ET01310    0145     0066     #     11     00     1     #

ET01310    0375     1162     #     03     01     1     #     #


ET01320    FORMULAS FOR CAPACITOR DESIGN       FD

ET01320    0140     0206     #     02     00     2     #

ET01320    0150     0214     #     09     01     2     #

ET01320    0151     0248     #     09     01     2     #

ET01320    0155     0105     #     09     00     2     #

ET01320    0125     1701     #     02     01     1     #

ET01320    0100     0516     #     09     01     2     #

ET01320    0105     0138     #     12     01     1     #

ET01320    0375     1170     #     03     01     1     #     [illegible]


ET01330    VOLTAGE, CHARGE RELATIONS           LW

ET01330    0150     0216,0236     #     09     01     2     #

ET01330    0151     0250,0272     #     09     01     2     #
ET01330    0100     0515    #   09    01    1    #
ET01330    0095     0415    #   09    01    1    #
ET01330    0186     0005    #   13    01    1    #
ET01330   0105      0137    #   12    01    1    #
ET01330   0375      1162    #   03    01    1    #    #
```

```
ET01340   PHASE RELATIONS        LW

ET01340   0140    0216     #    02     00     1    #

ET01340   0150    0235     #    09     01     1    #

ET01340   0151    0272     #    09     01     1    #

ET01340   0155    0146     #    09     00     1    #

ET01340   0100    0729,0736     #     09     01    1    #

ET01340   0095    0430     #    09     01     1    #

ET01340   0375    1245     #    03     01     2    #    #


ET01350   SERIES/PARALLEL CONNECTIONS        LW, ED

ET01350   0140    0219     #    02     00     1    #

ET01350   0150    0221     #    09     01     1    #

ET01350   0151    0256     #    09     01     1    #

ET01350   0155    0112,0122     #     09     00    2    #

ET01350   0095    0418     #    09     01     1    #

ET01350   0175    0032     #    13     01     1    #

ET01350   0145    0072     #    11     00     1    #

ET01350   0105    0138     #    12     01     1    #

ET01350   0375    1317     #    03     01     2    #    #


ET01360   CAPACITIVE REACTANCE DF, AT, LW

ET01360   0140    0217     #    02     00     1    #

ET01360   0150    0271     #    09     01     1    #

ET01360   0151    0311     #    09     00     1    #
ET01360   0155    0116     #   09      00     1    #
ET01360   0100    0728     #   09      00     1    #
ET01360   0095    0430     #   09      01     1    #
ET01360   0175    0028     #   13      01     2    #
ET01360   0105    0197     #   13      00     1    #
ET01360  0375    1307      #   03     01     1    #   #
```

ET01380	ENERGY	CP	LW					
ET01380	0140	0221	#	02	00	1	#	
ET01380	0151	0270	#	09	01	1	#	
ET01380	0150	0234	#	09	01	1	#	
ET01380	0095	0420	#	09	01	1	#	
ET01380	0160	0051	#	13	01	1	#	#
ET01385	POWER	CP	LW					
ET01385	0150	0315	#	09	01	1	#	
ET01385	0151	0360	#	09	01	1	#	#
ET01390	VOLTAGE RATINGS			FD				
ET01390	0140	0223	#	02	00	1	#	#
ET01400	PRACTICAL CAPACITORS				ED			
ET01400	0155	0105	#	09	00	2	#	
ET01400	0095	0417	#	09	01	1	#	
ET01400	0145	0065	#	11	00	1	#	#
ET01410	R-C CIRCUITS		ED					
ET01410	0140	0274	#	02	00	1	#	
ET01410	0150	0224	#	09	01	1	#	
ET01410	0151	0259	#	09	01	1	#	
ET01410	0155	0153	#	09	00	1	#	
ET01410	0100	0714	#	09	01	1	#	
ET01410	0095	0430	#	09	01	1	#	
ET01410	0186	0024	#	13	01	1	#	
ET01410	0145	0070	#	11	00	1	#	
ET01410	0105	0198	#	12	00	1	#	
ET01410	0375	0231, 1215	#	03	01	4	#	#

```
ET01420   PHASE  DIAGRAMS   ED    CP

ET01420   0140     0217#     02    00    1     #

ET01420   0150     0318#     09    01    1     #

ET01420   0151     0362#     09    01    1     #

ET01420   0100     0728#     09    01    1     #

ET01420   0095     0430#     09    01    1     #

ET01420   0186     0026#     13    01    1     #

ET01420   0105     0199#     12    00    1     #

ET01420   0375     0262,1232#      03    01    3     #    #


ET01430   COLOR  CODE       ED

ET01430   0140     0315#     02    00    2     #

ET01430   0145     0063#     11    00    1     #    #
```

DETAILED REFERRALS
RCL AND RESONANCE

ET01440 RCL PHASE RELATIONSHIPS AT LW

ET01440 0140 0279 # 02 00 1 #

ET01440 0155 0159 # 09 00 1 #

ET01440 0150 0278 # 09 01 1 #

ET01440 0151 0344 # 09 01 1 #

ET01440 0125 7801 # 02 01 1 #

ET01440 0100 0732 # 09 01 1 #

ET01440 0145 0086 # 11 00 1 #

ET01440 0185 0010, 0032 # 13 01 1 #

ET01440 0375 1010, 1677, 1856 # 03 01 3 # #

ET01450 IMPEDANCE DF AT CP

ET01450 0140 0284 # 02 00 1 #

ET01450 0155 0158 # 09 00 1 #

ET01450 0150 0335 # 09 01 2 #

ET01450 0151 0409 # 09 01 1 #

ET01450 0125 8002 # 02 01 1 #

ET01450 0100 0733 # 09 01 1 #

ET01450 0095 0429 # 09 01 1 #

ET01450 0145 0079 # 11 00 1 #

ET01450 0185 0009, 0024 # 13 01 1 #

ET01450 0105 0198 # 12 01 1 #

ET01450 0375 1677, 1856 # 03 01 3 # #

DETAILED REFERRALS
RCL AND RESONANCE

ET01460 CONDITION FOR MINIMUM Z AT CP LW

ET01460	0140	0284	#	02	00	1	#	
ET01460	0155	0154	#	09	00	1	#	
ET01460	0150	0359	#	09	01	1	#	
ET01460	0151	0410	#	09	01	1	#	
ET01460	0125	8002	#	02	01	1	#	
ET01460	0100	0733	#	09	01	1	#	
ET01460	0095	0429	#	09	01	1	#	
ET01460	0145	0079	#	11	00	1	#	
ET01460	0185	0009	#	13	01	1	#	
ET01460	0375	0862	#	03	01	1	#	#

ET01470 RESONANCE CP

ET01470	0140	0283	#	02	00	1	#	
ET01470	0150	0370	#	09	01	1	#	
ET01470	0151	0411	#	09	01	1	#	
ET01470	0185	0004	#	13	01	1	#	
ET01470	0105	0198	#	12	01	1	#	
ET01470	0375	1022	#	03	01	2	#	#

DETAILED REFERRALS
RCL AND RESONANCE

```
ET01490  RESONANCE CURVE   ED   AT

ET01490  0140  0291  #  02  00  1  #

ET01490  0155  0156  #  09  00  1  #

ET01490  0150  0361  #  09  01  1  #

ET01490  0151  0410  #  09  01  1  #

ET01490  0100  0736  #  09  01  1  #

ET01490  0095  0433  #  09  01  1  #

ET01490  0145  0088  #  11  00  1  #

ET01490  0185  0037, 0040# 13  01  1  #

ET01490  0375  1044, 1723  #  03  01  2  #  #


ET01510  SELECTIVITY   DF  AT

ET01510  0150  0367  #  09  01  1  #

ET01510  0151  0417  #  09  01  1  #

ET01510  0145  0080  #  11  00  1  #

ET01510  0185  0015, 0033, 0048, 0056  #  13  01 2  #  #


ET01530       Q    . DF  AT

ET01530  0140  0290  #  02  00  1  #

ET01530  0155  0163  #  09  00  1  #

ET01530  0150  0363  #  09  01  1  #

ET01530  0151  0413, 0420 #  09  01  2  #

ET01530  0145  0079  #  11  00  1  #

ET01530  0185  0013, 0027, 0048  #  13  01  3  #

ET01530  0375  1050, 1876  #  03  01  2  #  #
```

DETAILED REFERRALS
RCL AND RESONANCE

ET01540 TIME CONSTANT CP AT

ET01540 0155 0160 # 09 00 1 # #

ET01550 SERIES RESONANCE CP LW

ET01550 0140 0288 # 02 00 1 #

ET01550 0155 0154 # 09 00 1 #

ET01550 0150 0361 # 09 01 1 #

ET01550 0151 0411 # 09 01 1 #

ET01550 0100 0737 # 09 01 1 #

ET01550 0145 0078 # 11 00 1 #

ET01550 0185 0007 # 13 01 3 #

ET01550 0375 0846 # 03 01 2 # #

ET01560 PARALLEL RESONANCE CP LW

ET01560 0155 0156 # 09 00 1 W

ET01560 0150 0369 # 09 01 1 #

ET01560 0151 0418 # 09 01 1 #

ET01560 0145 0085 # 11 00 1 #

ET01560 0185 0019 # 13 01 3 #

ET01560 0375 1722 ## 03 01 1 ## ##

ET01570 BANDWIDTH CP DF

ET01570 0140 0293 # 02 00 1 #

ET01570 0151 0417 # 09 01 1 #

ET01570 0150 0370 # 09 01 1 #

ET01570 0185 0015, 0033 13 01 1 #

ET01570 0375 1050, 1825, 1890 # 03 01 3 # #

DETAILED REFERRALS
RCL AND RESONANCE

```
ET01580  1/2 POWER POINTS   DF  CP

ET01580  0140  0292  #  02  00  1  #

ET01580  0150  0368  #  09  01  1  #

ET01580  0151  0418  #  09  01  1  #

ET01580  0375  1076, 1890  #  03  01  2  #  #


ET01584  RESISTIVE AND REACTIVE POWER  CP  LW

ET01584 0150  0318  #  09  01  2  #

ET01584 0151  0361  #  09  01  1  #

ET01584  0375  1900  #  03  01  2  #  #


ET01585  POWER FACTOR  DF  AT

ET01585  0150  0321  #  09  01  3  #

ET01585  0151  0367  #  09  01  2  #  #


ET01590  PRACTICAL APPLICATIONS  ED

ET01590  0150  0370  #  09  01  1  #

ET01590  0151  0420  #  09  01  1  #

ET01590  0145  0078, 0085  #  11  00  1  #

ET01590  0185  0064  #  13  01  1  #

ET01590  0375  1120, 1894  #  03  01  2  #  #
```

DETAILED REFERRALS
Measuring Instruments

ET01600 BASIC METER MOVEMENTS IN

ET01600 0150 0154, 0167 # 09 01 1 #

ET01600 0151 0179 # 09 01 1 #

ET01600 0155 0348 # 09 00 1 #

ET01600 0125 6301 # 02 01 1 #

ET01600 0100 0548 # 09 01 1 #

ET01600 0095 0366 # 09 01 1 #

ET01600 0165 0034 # 13 01 1 #

ET01600 0105 0185 # 12 01 1 # #

ET01601 D'ARSONVAL MOVEMENT IN

ET01601 0140 0154 # 02 00 2 #

ET01601 0151 0179 # 09 01 1 #

ET01601 0150 0153 # 09 01 1 #

ET01601 0155 0349 # 09 00 1 #

ET01601 0125 6301 # 02 01 2 #

ET01601 0375 0724 # 03 01 2 # #

DETAILED REFERRALS
Measuring Instruments

ET01610 AMMETERS IN

ET01610 0140 0155, 0158 # 02 00 2 #

ET01610 0150 0154 # 09 01 2 #

ET01610 0151 0180 # 09 01 2 #

ET01610 0155 0348, 0054, 0061 # 09 00 3 #

ET01610 0125 064-1 # 02 01 2 #

ET01610 0100 0548, 0632 # 09 01 2 #

ET01610 0095 0370 # 09 01 1 #

ET01610 0165 0036 # 13 01 1 #

ET01610 0105 0147, 0185 # 12 01 2 #

ET01610 0145 0007 # 11 00 1 #

ET01610 0375 0749 # 03 01 3 # #

ET01620 SHUNT DESIGN AT

ET01620 0140 0158 # 02 00 1 #

ET01620 0150 0155 # 09 01 1 #

ET01620 0151 0182 # 09 01 1 #

ET01620 0155 0351 # 09 00 1 #

ET01620 0125 6402 # 02 01 1 #

ET01620 0100 0623 # 09 01 1 #

ET01620 0095 0371 # 09 01 1 #

ET01620 0145 0038 # 11 00 1 #

ET01620 0105 0185 # 12 01 1 #

ET01620 0375 0749 # 03 01 2 # #

```
ET01630     VOLTMETERS    IN

ET01630     0140   0154, 0161  #  02   00   2   #

ET01630     0150   0158  #  09   01   1  #

ET01630     0151   0184  #  09   01   1  #

ET01630     0155   0354  #  09   00   1  #

ET01630     0125   6403  #  02   01   1  #

ET01630     0100   0550, 0632  #  09   01   1  #

ET01630     0095   0370  #  09   01   1  #

ET01630     0165   0034  #  13   01   1  #

ET01630     0145   0010, 0035, 0043  #  11   00   2   #

ET01630     0105   0147, 0185  #  12   01   1 #

ET01630     0375   0790  #  03   01   3  #  #


ET01640     MULTIPLIER DESIGN    AT

ET01640     0140   0161  #  02   00   1  #

ET01640     0150   0158  #  09   01   1  #

ET01640     0151   0184  #  09   01   1  #

ET01640     0155   0358  #  09   00   1  #

ET01640     0125   6403  #  02   01   1  #  #


ET01650     VOLTMETER AS AN OHMMETER    IN

ET01650     0150   0163  #  09   01   1  #

ET01650     0151   0191  #  09   01   1  #  #
```

DETAILED REFERRALS
Measuring Instruments

```
ET01660    WHEATSTONE BRIDGE   IN

ET01660    0150   0163   #  09   01   1   #

ET01660    0151   0124,  0192,  0397   #   09   01   2   #

ET01660    0155   0367   #  09   00   1   #

ET01660    0100   0549   #  09   01   1   #

ET01660    0095   0330,  0335   #   09   01   2   #

ET01660    0165   0063   #  13   01   2   #

ET01660    0105   0161   #  12   01   1   #

ET01660    0375   2782   #  03   01   2   #   #


ET01670    OHMMETER   IN

ET01670    0140   0164   #  02   00   1   #

ET01670    0150   0160   #  09   01   1   #

ET01670    0151   0188   #  09   01   1   #

ET01670    0155   0365   #  09   00   2   #

ET01670    0145   0041   #  11   00   1   #

ET01670    0375   0815   #  03   01   1   #   #


ET01671    OHMMETER CALIBRATION    ET

ET01671    0140   0164   #  02   00   1   #

ET01671    0150   0162   #  09   01   1   #

ET01671    0151   0190   #  09   01   1   #

ET01671    0375   0815   #  03   01   1   #   #
```

DETAILED REFERRALS
Measuring Instruments

```
ET01680    AC METERS    IN

ET01680    0140   0167   #   02   00   1   #

ET01680    0150   0164   #   09   01   1   #

ET01680    0151   0192   #   09   01   1   #

ET01680    0155   0354, 0373   #   09   00   1   #

ET01680    0100   0634   #   09   01   1   #

ET01680    0375   0850   #   03   01   2   #   #


ET01690    MULTIMETERS    IN

ET01690    0155   0354   #   09   00   3   #

ET01690    0100   0579   #   09   01   1   #

ET01690    0375   0826, 0887   #   03   01   3   #


ET01691    WATTMETER    IN

ET01691    0140   0154   #   02   00   1   #

ET01691    0150   0167   #   09   01   1   #

ET01691    0151   0196   #   09   01   1   #

ET01691    0155   0362   #   09   00   2   #

ET01691    0100   0579, 0634   #   09   01   1   #

ET01691    0095   0371   #   09   01   1   #   #
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DETAILED REFERRALS
Measuring Instruments

ET5011

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ET01700   METER SENSITIVITY AND ACCURACY   IN

ET01700   0140  0163  #  02  00  1  #

ET01700   0151  0184  #  09  01  1  #

ET01700   0100  0367  #  09  01  1  #

ET01700   0375  0740  #  03  01  1  #  #


ET01720   OSCILLOSCOPE   IN

ET01720   0155  0378  #  09  00  3  #

ET01720   0095  0448, 0551  #  09  01  1 #

ET01720   0145  0046  #  11  00  1  #

ET01720   0375  0001  #  03  01  5  #  #


ET01730   WAVE FORM GENERATORS   IN

ET01730   0095  0307, 0400, 0409  #  09  01  2  #  #


ET01740   TIME/FREQUENCY MEASUREMENT   IN

ET01740   0155  0375  #  09  00  1  #  #


ET01750   POWER FACTOR   DF

ET01750   0155  0376  #  09  00  1  #

ET01750   0125  8103  #  02  01  1  #

ET01750   0165  0038  #  13  01  3  #  #
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DETAILED REFERRALS
Measuring Instruments

ET01760 POTENTIOMETERS AND VOLTAGE DIVIDER ED

ET01760 0140 0102 # 02 00 2 #

ET01760 0150 0083, 0211 # 09 01 1 #

ET01760 0151 0187 # 09 01 1 #

ET01760 0165 0038 # 13 01 2 #

ET01760 0375 2751 # 03 01 2 # #

ET01780 CIRCUIT LOADING EFFECTS LW

ET01780 0140 0168 # 02 00 2 #

ET01780 0145 0032, 0044 # 11 00 1 #

ET01780 0375 0872 # 03 01 1 # #

NEW YORK INSTITUTE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY

5011

DIAGNOSTIC QUESTIONS

Book III

NEW YORK INSTITUTE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY

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Project Coordinator and Author	John Luther Assistant Professor of Educational Research and Electrical Technology

COMPUTER CURRICULUM ANALYSIS
NYIT PRESS

ET00010
1.
If Hg. changes from a gas weighing 32 grams, to a solid, how many grams will Hg. weigh when it is in its solid phase?

1) 45 gms.

2) 64 gms.

3) 32 gms.

4) 48 gms.

ET00020
2.
The core or nucleus of an atom consists of ______________, which have ______________ and ______________ charges respectively.

1) Protrons and neutrons; positive zero.

2) Positron and a neutron; positive zero.

3) Positron and an electron; positive negative.

4) Protron and a positron; positive positive.

ET00030
3.
In the Millikan experiment, the oil drop presumably obtained its negative charge via:

1) The electric field.

2) Induction.

3) Friction.

4) Heating.

ET00040
4.
A Substance that cannot be broken down into simpler substances is called a (an):

1) Molecule.

2) Element.

3) Compound.

ET00050
5.
A Material which will not make a good permanent magnet is:

1) Steel.

2) Nickel.

3) Cobalt.

4) Soft iron.

ET00060 A positive charge may be created by the removal of __________.

6.

1) Protons.

2) Electrons.

3) Neutrons.

4) Mesons.

ET00070 Which of the following could not be considered an ion?

7.

1) A neutron.

2) A positron.

3) A negatively charged atom.

4) A positively charged atom.

ET00080 If the charge on one body is multiplied by 7 and the charge on a second body is halved, what is the change in the force between them when the distance is doubled?

8.

1) 0.414 units.

2) 0.875 units.

3) 0.916 units.

4) 1.22 units.

ET00090 The diagram below shows a cross section of a hollow metal body. Where is the greatest charge density?

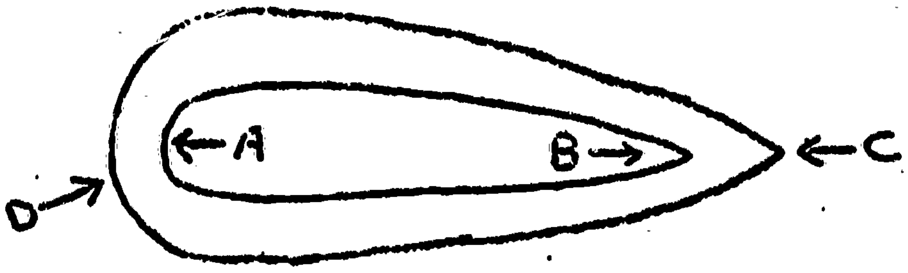
9.

1) A

2) B

3) C

4) D



ET00100 A neutral electroscope is charged by bringing it into contact with a positively charged rod. What charge will appear on the leaves of the electroscope?

10.

1) Negative.

2) Positive.

3) Neutral.

9/65

ET00110 1. What is the maximum number of electrons in an atom which can have the same specific energy?

1) one

2) two

3) four

4) eight

ET00120 2. At a certain point in space an electric field has an intensity of 3.0 n/c. If a body with a charge of 20 coulombs is introduced into this field, what force would be exerted on it?

1) 27 new.

2) 60 new.

3) 78 new.

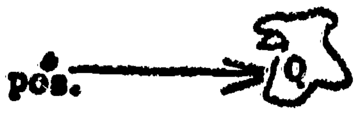
4) 104 new.

ET00130 3. A unit positive charge is placed near body Q. From the direction of the resulting electric field shown below, determine the charge on Q.

1) positive

2) negative

3) none



ET00140 4. The net positive charge within a sphere is +4. What is the number of lines of force leaving the sphere?

1) 10

2) 8

3) 4

4) 2

ET00150 5. Which of the following is not a unit for resistance, emf, current or power?

1) ohm

2) volt

3) micro amp

4) gauss

5) megawatt

ET00160 Mica is a (an) ______________ conductor of electricity.

1\.

1) Excellent

2) Good

3) Poor

ET00180 In a schematic diagram, the positive terminal of a battery is shown as a:

2\.

1) +

2) ———

3) -

4) 0

ET00190 The Daniell cell has ____________ and ___________ electrodes.

3\.

1) Zinc and Copper

2) Lead and Copper

3) Carbon and Lead

4) Carbon and Zinc

ET00200 The resistance of a conductor is 100 ohm. If its diameter was doubled, the new resistance would be:

4\.

1) 200 ohms

2) 400 ohms

3) 50 ohms

4) 25 ohms

ET00210 The resistance of a copper conductor is _____________ its temperature coefficient.

5\.

1) Inversely proportional to

2) Directly proportional to

3) Independent of

4) Equal to

ET00220
00230 Electrical potential is measured in units of:

6.

1) Volts

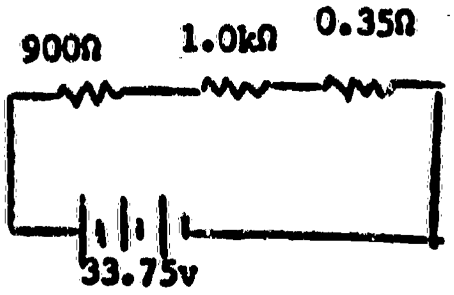
2) Amps

3) Ohms

4) Mhos

ET00240 What is the voltage drop across the 1.okΩ resistor?

7.



1) 3.75v

2) 1.50v

3) 15.0v

4) 13.4v

5) 5.35v

ET00250 Find the maximum potential which can be applied to a spherical conductor in air, having a radius of 2.5 m.

8.

1) 75 megavolts

2) 7.5 megavolts

3) 680 kv.

4) 480 kv.

ET00260 In going through resistance wire, 20 coulombs of electrons are transferred from one side of the wire to the other side of the wire. 75 joules of energy are dissipated. Find the voltage across the wire.

9.

1) 1.74 volts

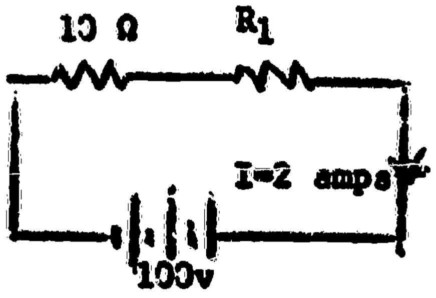
2) 3.14 volts

3) 3.75 volts

4) 5.21 volts

ET00270 In the circuit shown below, what is the value of R_1

10.



1) 200 Ω

2) 20 Ω

3) 40 Ω

4) 400 Ω

ET00280 If the flow of electrons in a wire whose cross sectional area is 0.001 sq. in. is found to be 0.21 c.f.s., what is the velocity of the electrons?

1\.

1) 10,277 f/s

2) 15,314 f/s

3) 30,250 f/s

4) 25,500 f/s

ET00291 6.3×10^{18} electrons constitutes

2\.

1) 1 coulomb.

2) 1 ampere.

3) 1 volt.

4) 1 watt.

ET00300 Which of these is <u>not</u> a source of EMF?

3\.

1) wet cell

2) dry cell

3) rotary generator

4) charged body

ET00310 What is the terminal voltage in this circuit?

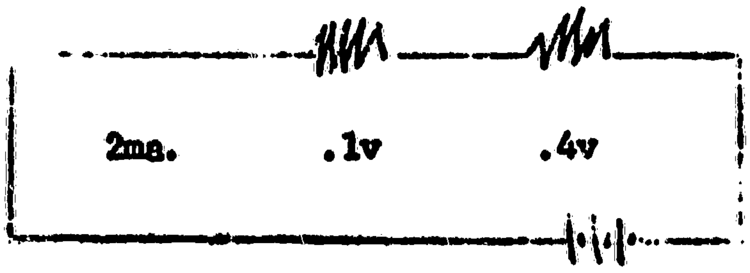
4\.

1) 25 volts

2) 2.5 volts

3) .25 volts

4) .025 volts



ET00320 A device consisting of two different metals maintained at different temperatures and which produces an e.m.f. under these conditions is called

5\.

1) thermo-cell.

2) thermo-couple.

3) thermo-pile.

4) thermo-generator.

ET00330 The symbol for a battery is

6.

1) 

2) 

3) 

4) 

ET00340 In the circuit shown below, the potential at point "e" is the same as the potential at point

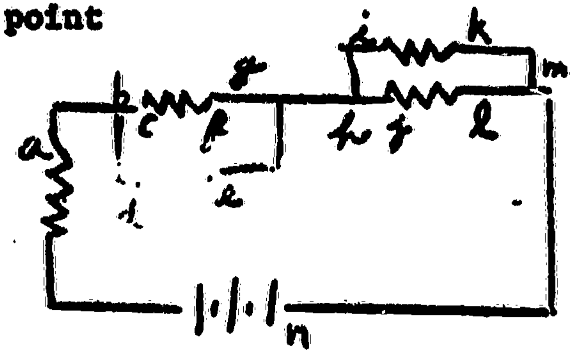
7.

1) a.

2) d.

3) i.

4) l.



ET00350 A device is rated at 0.15 amp at 30 volts. If the only available voltage source is 60 volts, what value of series resistor must be added to insure proper operation?

8.

1) 20 Ω

2) 200 Ω

3) 40 Ω

4) 400 Ω

ET00360 What is the current in the circuit shown below?

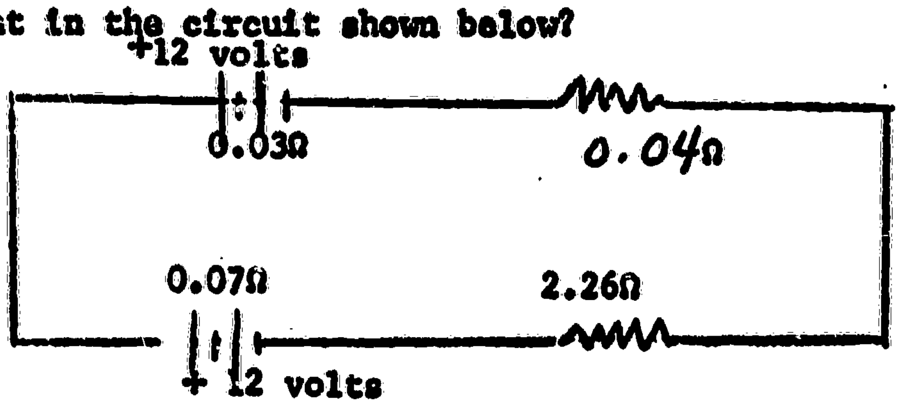
9.

1) .1 amp

2) 5 amp

3) 10 amp

4) .5 amp



ET00370 Four resistors, R_1 = 7.2 ohms, R_2 = 1 ohm, R_3 = 3.4 ohms, and a resistor of unknown value, R_4, are connected in series across a 16 volt battery whose internal resistance is 0.4 ohms. If a current of 1.09/ampere flows in the circuit, what is the value of R_4?

10.

1) 7 Ω

2) 4 Ω

3) 6.2 Ω

4) 10.18 Ω

ET00370
00380
1\. A storage battery has an open circuit emf of 6 volts and an internal resistance of 0.05 ohms. What is the terminal voltage of the battery when a 0.2 ohm load is connected across it?

1) 6 volts

2) 4.8 volts

3) 3.7 volts

4) 1.2 volts

ET00390
2\. A series circuit consisting of 20 ohm, 10 ohm and 30 ohm resistances is connected to a 45 volt source of emf. What is the current in the 20 ohm resistor?

1) 4.44 ma

2) 750 ma

3) 2.25a

4) 44.4 ma

ET00400
3\. Determine the equivalent resistance of three resistors, 10,44 and 28 ohm, connected in parallel.

1) 5 Ω

2) 6.3 Ω

3) 82 Ω

4) 4.4 Ω

ET00410
4\. The total current passed by a 10 kilohm, a 15 kilohm and a 20 kilohm resistor in parallel is 20 ma. What is the current in the 10 kilohm branch?

1) 9.25 ma.

2) 20 ma.

3) 7.5 ma.

4) 15.2 ma.

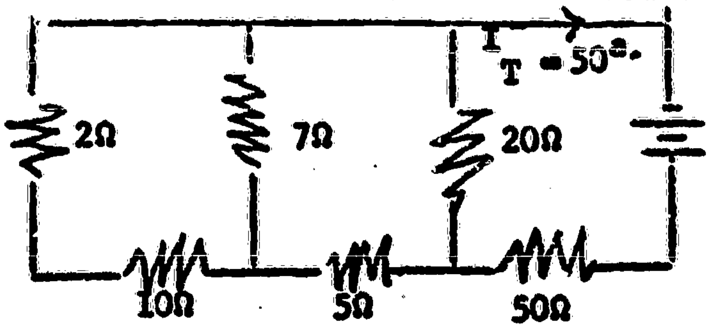
ET00411
5\. What is the total conductance in the circuit shown below?

1) 5.64 Ω

2) 56.4 Ω

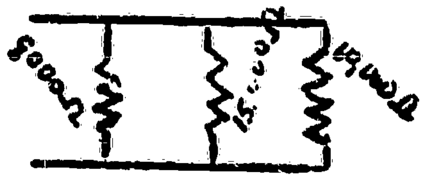
3) .0178 ℧

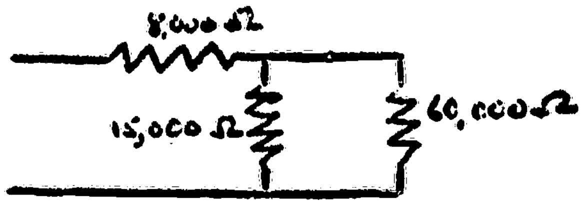
4) 1.78 ℧

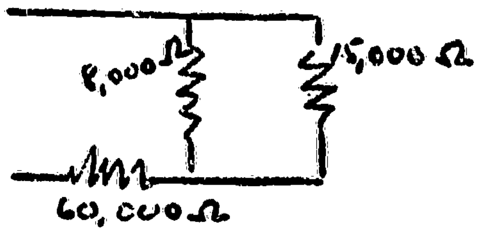


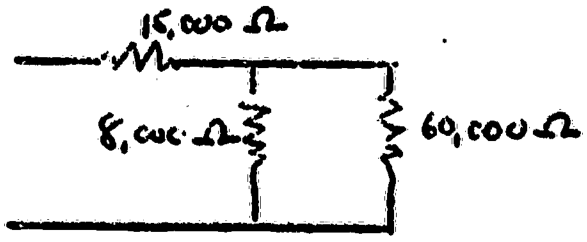
ET00420 Three resistors of 60,000 ohms, 15,000 ohms and 8,000 ohms respectively, are available. A value of 20,000 ohms is desired. Which is the correct method of connection?

6.

1) 

2) 

3) 

4) 

ET00430 A resistor constructed of manganin and mounted in a metal case filled with oil is called a (an) ______ resistor.

7.

1) international

2) absolute

3) standard

ET00450 A resistor is shown below. What is the value of its resistance?

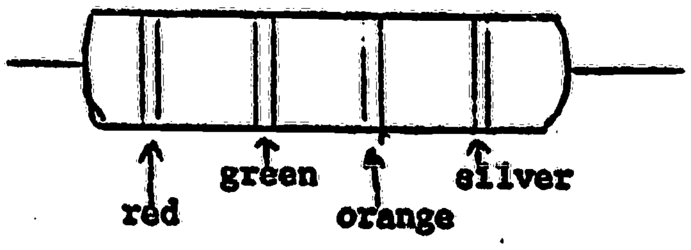
8.

1) 15k ± 5%

2) 25k ± 10%

3) 14k ± 10%

4) 26k ± 5%



ET00460 Which of the following resistors has a power rating of 2.5 watts?

9.

1) a 1/2megohm resistor with 5 ma.

2) a 500 ohm resistor with .2 amps.

3) a 25,000 ohm resistor with 10 ma.

ET00461 Efficiency is defined as the ratio of:

10.

1) input power to output power

2) output power to input power

3) actual output power to apparent output power

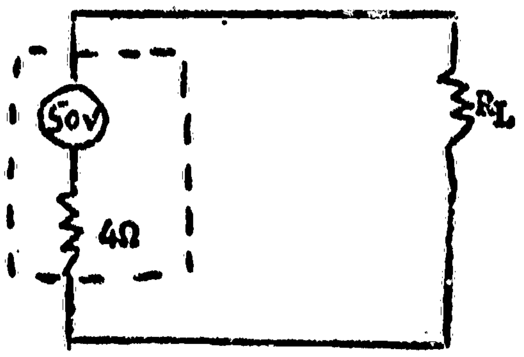
4) apparent output power to actual output power

9/55

ET00470

1\. Maximum power transfer to R_L will occur when the resistance of R_L is:

1) 12Ω
2) 4Ω
3) 8Ω
4) 16Ω



ET00480

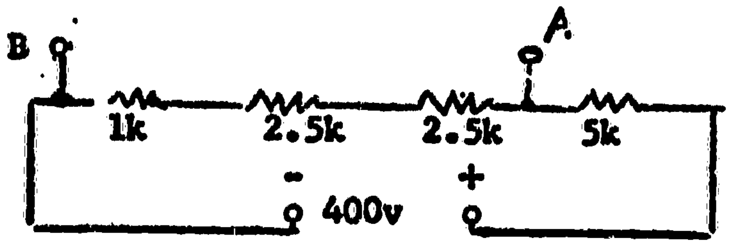
2\. A 10Ω resistor is connected to a 40 volt generator. Find the heat dissipated by the resistor.

1) 140 J/S
2) 160 J/S
3) 170 J/S
4) 172 J/S
5) 181 J/S

ET00490

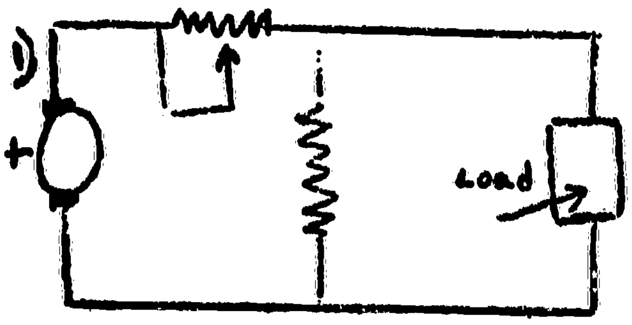
3\. Determine the voltage between taps A & B.

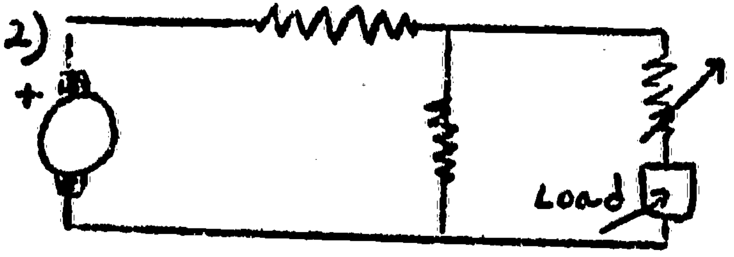
1) 18.2 volts
2) 21.8 volts
3) 218 volts
4) 182 volts

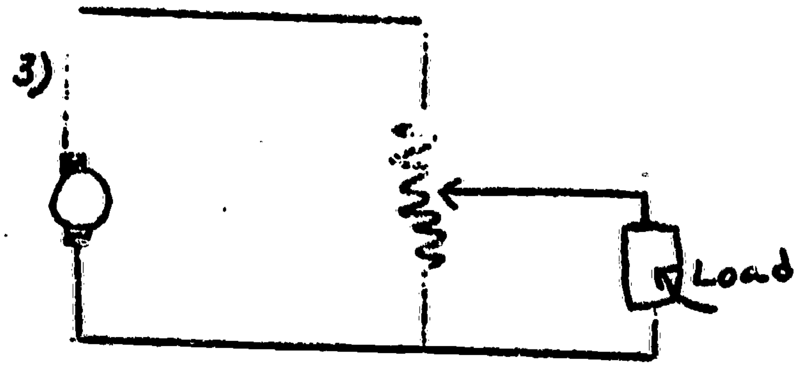


ET00500

4\. Which circuit contains a potentiometer?



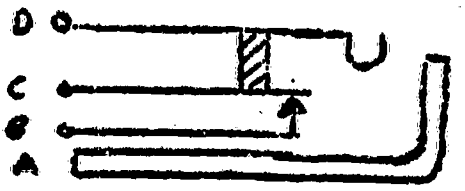




ET00510

5\. When a plug is inserted into the jack shown below, the connection between B and C is:

1) Maintained
2) Broken



9/65

ET00520 What is the smallest fuse that will not be blown when S_1 is closed, for either position of S_2?

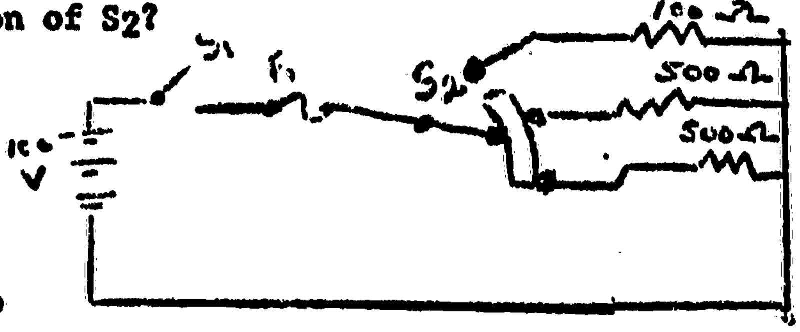
6.

1) 0.20 amp

2) 1.42 amp

3) 1.21 amp

4) 0.166 amp



ET00530 Which of the following is not a rule of magnetic attraction or repulsion?

7.

1) Like poles repel each other.

2) Unlike poles attract each other.

3) Lines of force in the same direction repel each other.

4) Lines of force in the same direction attract each other.

ET00540 8 amperes flow through a 4 turn coil. What is its m.m.f.?

8.

1) 128 $a\text{-}t^2$

2) 32 a-t

3) 2 a/t

4) 1/2 t/a

ET00550 A material which is slightly attracted to a magnetic field is called a ______ type material.

9.

1) ferromagnetic

2) paramagnetic

3) diamagnetic

ET00560 With the magnetic field and current as shown, what is the direction of the force exerted on the wire?

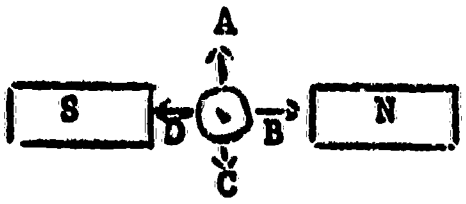
10.

1) A

2) B

3) C

4) D



ET00570 The purpose of the cyclotron is to:

1.
1) Obtain a beam of high speed charged atomic particles.
2) Obtain a beam of low speed charged atomic particles.
3) Obtain a beam of low speed deuterons.
4) Obtain a beam of high speed deuterons.

ET00580 Magnetic lines of force always form:

2.
1) Elliptical Shapes
2) Straight lines
3) Discontinuous Loops
4) Closed loops

ET00590 Permeability is:

3.
1) The ratio of magnetomotive force to the flux.
2) The ability of a material to permit the setting up of magnetic lines of force.
3) The ability of a magnetic circuit to permit the setting up of magnetic lines of force.

ET00600 A law which expresses the intensity of a magnetic field around a wire carrying a steady current is called _________ law.

4.
1) Oersted's
2) Ampere's
3) Biot's
4) Savart's

ET00610 Magnetic poles are:

5.
1) Regions where most lines of induction enter or leave.
2) Regions where few lines of induction enter or leave.
3) Regions where no lines of induction enter or leave.
4) Regions where all lines of induction enter or leave.

ET00620

6\. In ____________ materials the electronic currents are in the opposite direction of those in the magnetizing winding.

1) Paramagnetic
2) Ferromagnetic
3) Diamagnetic

ET00630

7\. Hysteresis loss is greater if:

1) The magnetization frequency is lower.
2) The magnetization frequency is higher.
3) The magnetization current is lower.
4) The magnetization current is higher.

ET00640

8\. Using the electron current convention, what is the direction of the lines of force around a conductor carrying a current as shown in the diagram?

1) c.w.
2) c.c.w.

ET00650

9\. A magnetic analog to resistance is:

1) Reluctance
2) Permeability
3) Electromotive force
4) Ampere turn

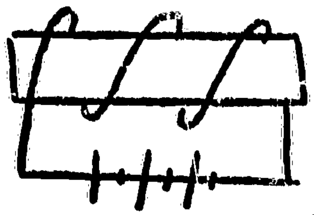
ET00660

10\. A magnetic shield is:

1) Used to minimize eddy current losses.
2) Used to minimize hysteresis losses.
3) Used to minimize stray fields in a certain place.
4) Used to minimize copper losses in a certain place.

ET00670 In the picture below, which side of the solenoid is the north pole?

1.



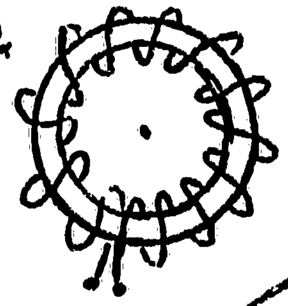
1) Right

2) Left

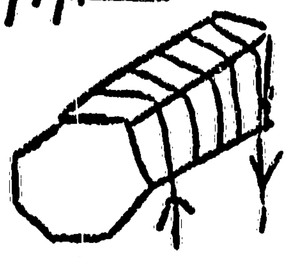
00680 A Trorid coil is pictured as:

2.

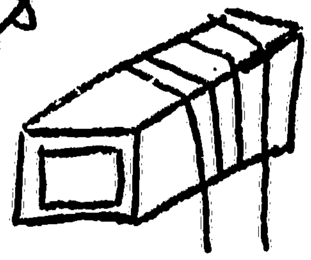
1)



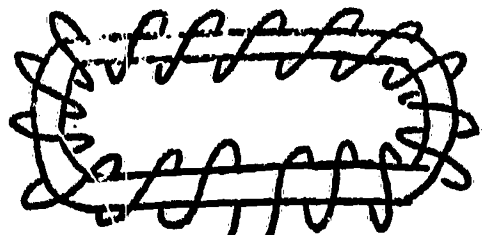
2)



3)



4)



ET00690 The ratio between the total developed flux and the useful flux in a magnetic circuit is called the:

3.

1) Flux factor

2) Magnetic circuit factor

3) Leakage factor

4) Field factor

ET00720 A phenomenon which occurs at the air gap in a magnet is:

4.

1) Crowding

2) Ringing

3) Fringing

ET00740 The amount of voltage induced into a conductor by a moving magnet doesn't depend upon:

5.

1) Length of wire

2) Resistance of wire

3) Speed of magnet

4) Reluctance of magnet

9/65

ET00750 "The ability of a circuit or component to develop an induced voltage when the current flowing through the circuit is changing" best defines:

6.

1) Self-Inductance

2) Mutual Inductance

3) Transformer action

4) Motor Action

ET00760 The MKS unit for magnetomotive force is the:

7.

1) ampere-turn

2) ampere-weber

3) voltage-turn

4) voltage weber

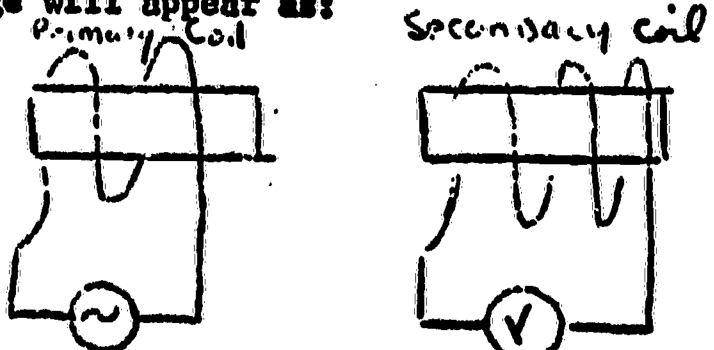
ET00770 If an alternating current is placed on the primary coil, as shown below, the secondary coil voltage will appear as:

8.

1) pulsating voltage

2) alternating voltage

3) direct voltage



ET00780 Which law states that the magnitude of the induced emf. in a coil is directly proportional to the rate of charge of current through the coil?

9.

1) Kirchhoff's law

2) Lenz's law

3) Faraday's law

4) Hartley's law

ET00790 Find the permeability of a coil which has a flux density of 30 webers per square meter and a magnetizing force of 11.0 ampere turns/meter.

10.

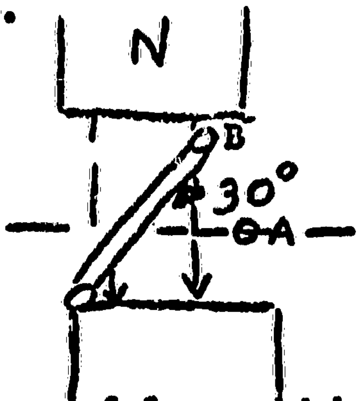
1) 1.4 w/a-t

2) 3.8 w/a-t

3) 6.1 w/a-t

4) 2.7 w/a-t

ET00810
1. A conductor has moved from position A to B. Find the voltage on the conductor if the maximum voltage which could appear on the conductor is 15.0 volts.



1) 4.5

2) 5.0

3) 7.5

4) 8.5

ET00820
2. A conductor ___________ lines of force which go in the opposite direction to its Oersted lines of force.

1) Will not be effected by

2) Will be attracted by

3) Will be repelled by

ET00840
3. The brushes of an a.c. generator are made of:

1) graphite and zinc

2) Graphite and carbon

3) Lead and carbon

4) Lead and graphite

ET00850
4. _____________ are soldered to the commutator segments.

1) Brushes

2) End Wires

3) Split Rings

ET00860
5. A current which flows from the negative side of the power supply to the load and from the load back to the positive side of the power supply is called:

1) Conventional current

2) Electron current

3) Alternating current

4) Pulsating current

ET00870

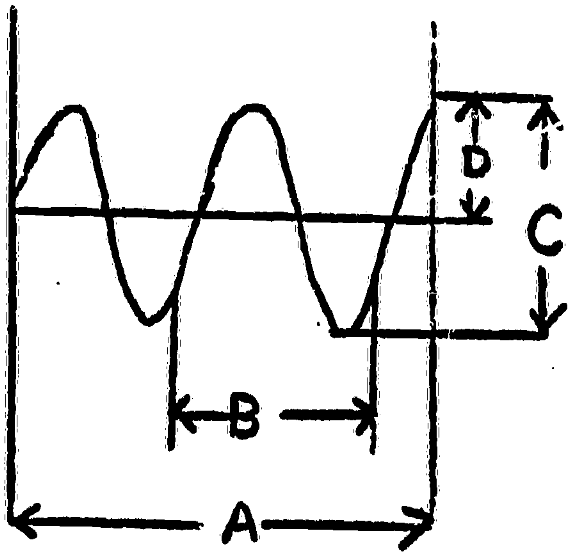
6\. The period of an ac voltage is 125 usec. What is its frequency?

1) 125 cps
2) 8000 cps
3) 8×10^6 cps
4) 125×10^{-6} cps

ET00880

7\. Which letter describes the wavelength of the pattern shown below?

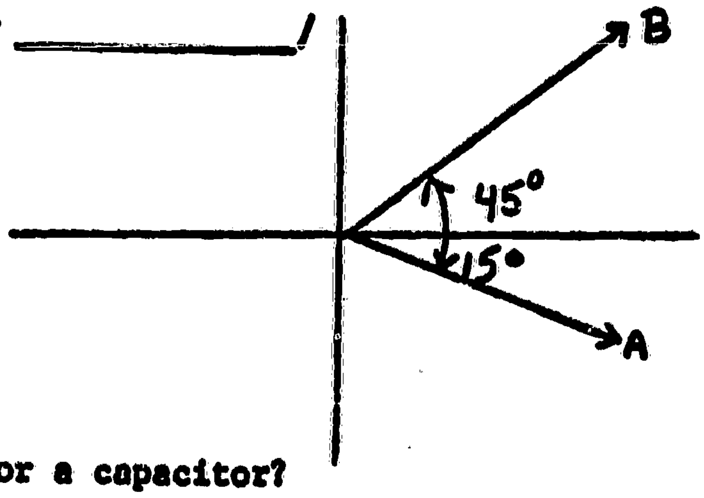
1) A
2) B
3) C
4) D



ET00920

8\. Vector A _____ Vector B by __________

1) Lags 30°
2) Lags 60°
3) Leads 30°
4) Leads 60°



ET00930

9\. Which statement holds true for a capacitor?

1) The voltage across it leads the current by 90°.
2) The voltage across it is in phase with the current.
3) The voltage across it lags the current by 90°.

ET00940

NON SINUSOIDAL WAVES AND HARMONICS

10\. The second harmonic of 400 cycles is:

1) 1600 cycles
2) 1200 cycles
3) 600 cycles
4) 800 cycles

ET00950 The symbol for peak value of current of a sine wave is:

1.

1) ip

2) I_M

3) Im

4) ip

ET00960 An a.c. voltage has a peak value of 71 v. The average value of the voltage is:

2.

1) 45.2 volts

2) 35.5 volts

3) 50.2 volts

4) 22.5 volts

ET00970 The a.c. effective value in electricity is defined from a d.c.:

3.

1) cooling effect

2) heating effect

3) voltage effect

4) current effect

ET00980 A current of 3.2 amps r.m.s. flows through a 20 Kilohm resistor. Find the power dissipated by the resistor.

4.

1) 217.4 W.

2) 321.6 W.

3) 204.8 W.

4) 310.2 W.

ET00982 A generator has an output of 14.4 volts. What is the power dissipation of a 20 ohm resistor connected across its output?

5.

1) 288 watts

2) 7.2 watts

3) 10.3 watts

4) 200 watts

ET01060 The unit of inductance is the:

6.

1) Hooke

2) Faraday

3) Henry

4) Franklin

ET01080 A 2.0 h. coil is placed in series with a 5.0 h. coil. Neglecting mutual inductance between the coils, find the total inductance of the network.

7.

1) 7.0 h.

2) 1.4 h.

3) 0.7 h.

4) 7.7 h.

ET01100 In an R-L circuit, doubling the inductance ______________ the time necessary for the circuit to reach steady state current.

8.

1) Doubles

2) Triples

3) Quadruples

4) Sextuples

ET01110 Two inductances of 6 henries each are in parallel across a circuit. What is their effective inductance?

9.

1) 12 h

2) 3 h

3) 6 h

4) 36 h

ET01010 A resistor is connected across a 40 volt rms a.c. generator. Find its resistance if 3.0 amps rms are drawn from the generator.

1.

1) 16.7Ω

2) 13.3Ω

3) 12.1Ω

4) 11.9Ω

ET01020 The power utilized by a pure induction is:

2.

1) True power

2) Reactive power

3) Average power

ET01060 The symbol for inductance is:

3.

1) S

2) F

3) H

4) L

ET01070 In a series RLC circuit at resonance there is 750 volts across the coil and 30 volts across the resistance. What is the Q of the coil?

4.

1) 25

2) 0.04

3) 22,500

4) 0.675

ET01080 Find the total inductance of the circuit below. The mutual inductance is 0.5 h.

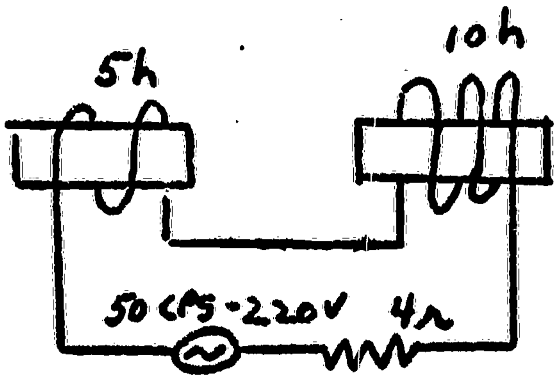
5.

1) 2.8 h.

2) 15.5 h.

3) 3.8 h.

4) 14.5 h.



9/65

ET01090 Doubling the turns of a coil:

6.

1) Doubles the inductance value of that coil.

2) Triples the inductance value of that coil.

3) Quadruples the inductance value of that coil.

4) Sextuples the inductance value of that coil.

ET01100 How long does it take for the circuit current to reach the steady-state value? See circuit below.

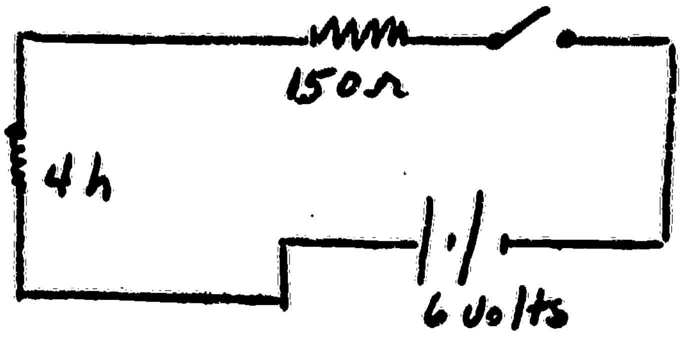
7.

1) 0.133 sec

2) 0.266 sec

3) 0.399 sec

4) 0.532 sec



ET01120 A 2.0 h. coil has a resistance of 0.9 ohms and is connected to a 50 volt battery. What is the energy stored in its magnetic field?

8.

1) 3080 joules

2) 555 joules

3) 1050 joules

4) 61,600 joules

ET01130
01140 What is the voltage across the switch contacts at the instant that the switch is opened?

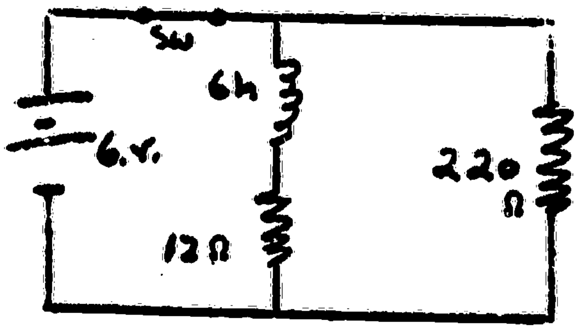
9.

1) 104 volts

2) 116 volts

3) 110 volts

4) 98 volts



ET01150 Find the total inductance of the network below:

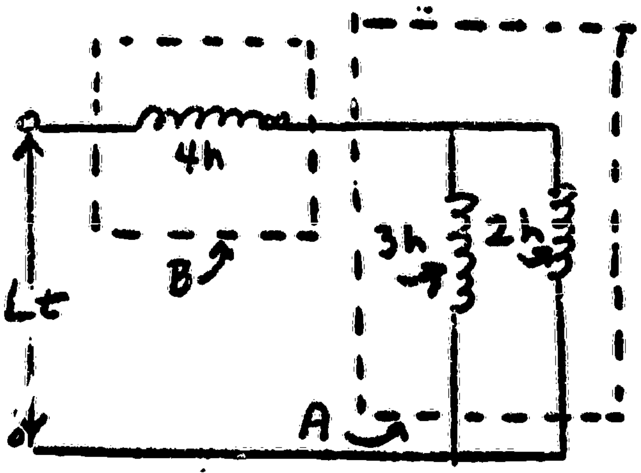
10.

1) 1.6 h.

2) 2.2 h.

3) 5.2 h.

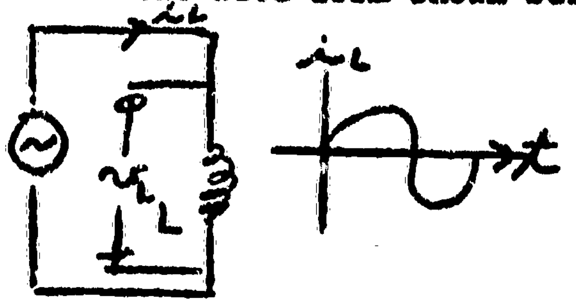
4) 2.0 h.

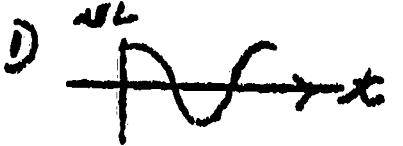


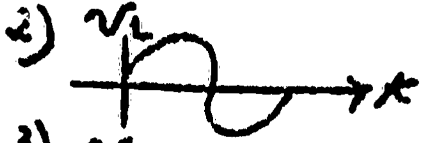
9/65

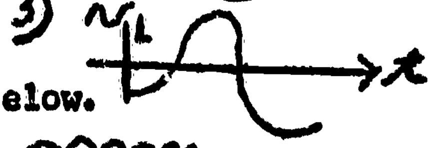
ET01160 Choose the voltage wave form corresponding to the circuit and current wave form shown below.

1.









ET01170 Find the value of L in the circuit below.

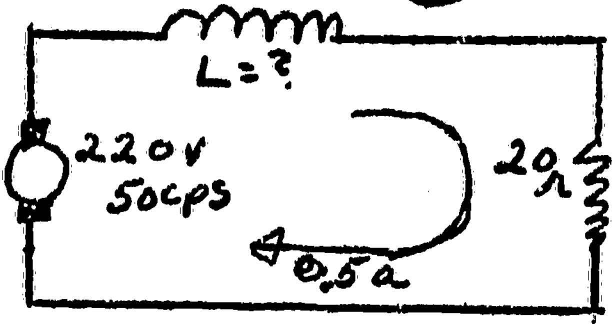
2.

1) 0.714 h.

2) 1.33 h.

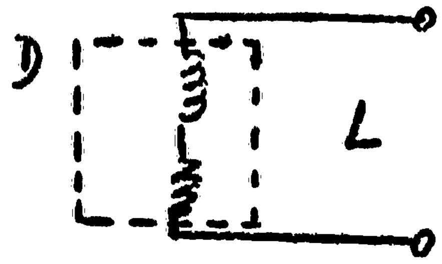
3) 5.12 h.

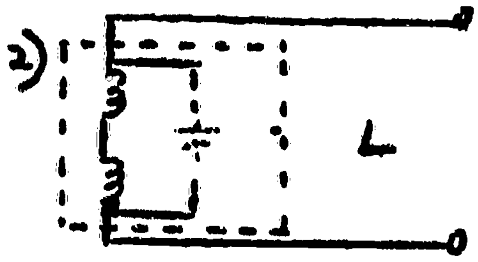
4) 2.11 h.

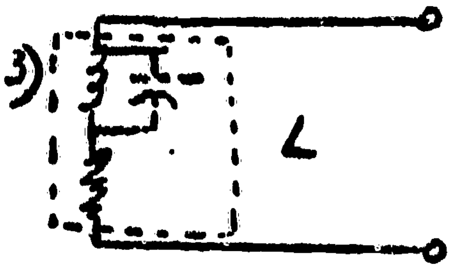


ET01180 The diagram of a practical inductance is shown in:

3.







ET01190 The closer the power factor is to unity, the:

4.

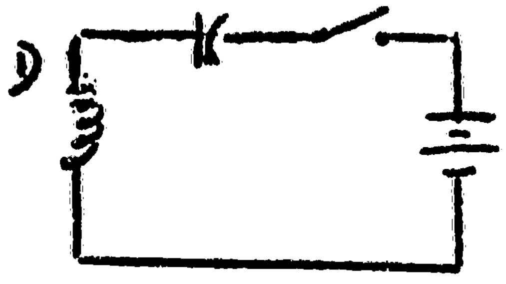
1) More inductive the circuit is.

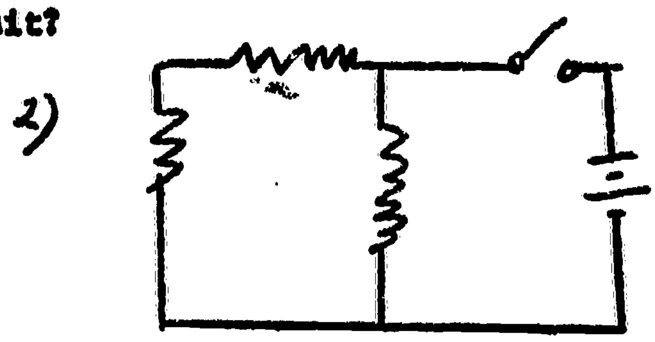
2) More conductive the circuit is.

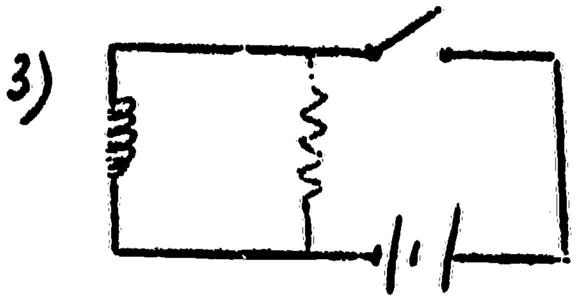
3) More resistive the circuit is.

ET01200 Which circuit is an RL circuit?

5.



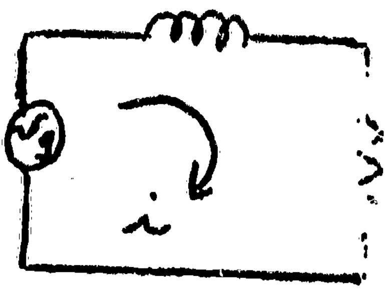




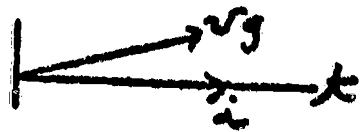
ET5011

ET01210

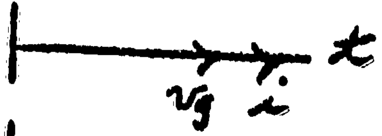
6. Choose the proper phase diagram for the circuit shown below:



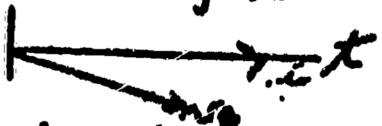
1)



2)



3)



ET01220

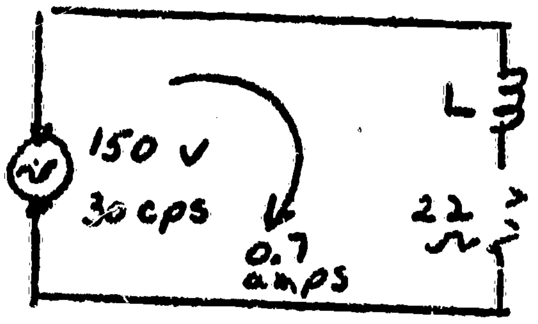
7. For this circuit, express the total impedance in rectangular form.

1) 22 + j92 ohms

2) 22 + j213 ohms

3) 22 + j251 ohms

4) 22 + j34 ohms



ET01240

8. A 50 c.p.s. transformer has 80.0 turns on its primary. If the maximum flux which the primary can produce is 0.004 weber, what voltage rating would be given to the primary coil?

1) 64 volts

2) 71 volts

3) 81 volts

4) 115 volts

ET01250

9. A transformer has a 350 turn secondary rated at 500 volts. The primary coil has 125 turns. What is the primary coil voltage rating?

1) 179 v.

2) 1400 v.

3) 88 v.

4) 8750 v.

ET01260

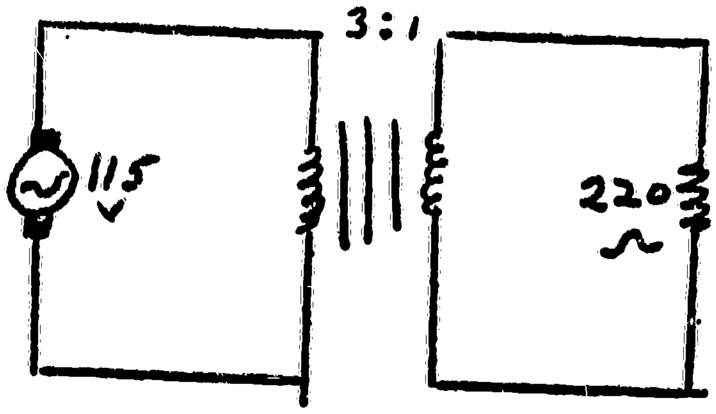
10. An ideal transformer has a 3:1 turns ratio as shown below. Find the power developed in the 220Ω resistor.

1) 6.67 w.

2) 31.8 w.

3) 148 w.

4) 541 w.



ET01270
1. The disadvantage of an autotransformer as compared to a regular two-part transformer is:

1) Heavier weight

2) Harder to manufacture

3) No isolation

4) Uses more wire

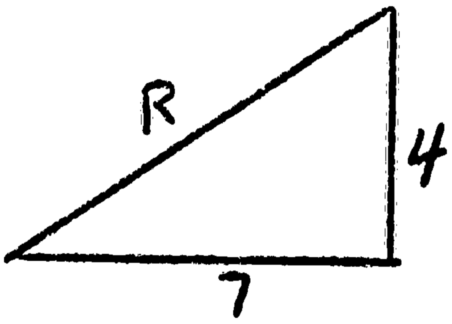
ET01280
2. Find the side "R" from the diagram below:

1) 8.06

2) 9.14

3) 8.01

4) 11.0



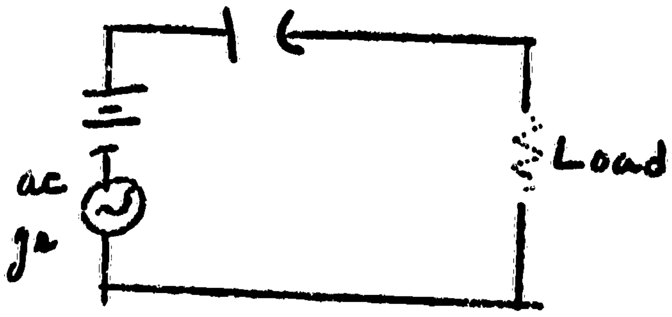
ET01290
3. What type of current is in the load resistor in the circuit below?

1) None

2) Alternating

3) Pulsating d.c.

4) a.c. and d.c.



ET01295
4. In a series RC circuit having a battery, doubling the resistance:

1) Doesn't change the amount of time it takes the capacitor to charge up to the battery voltage.

2) Doubles the time it takes for the capacitor to charge up to the battery voltage.

3) Triples the time it takes for the capacitor to charge up to the battery voltage.

4) Quadruples the time it takes for the capacitor to charge up to the battery voltage.

ET01300
5. The phenomenon of displaced electrons in each atom of a dielectric when an electrical field is applied to the dielectric is called:

1) Distortion

2) Polarization

3) Field transmission

4) Orbital breakdown

ET01310
6. 10^{-12} farads is called one:

1) Dekafarad

2) Microfarad

3) Picofarad

4) Nanofarad

ET01320
7. A parallel plate capacitor has a dielectric of Teflon. The plates are spaced 1.0 m.m. apart and have an area of 25 sq. -m.m. each. Find the capacitance of the capacitor. (Dielectric constant of Teflon = 1,500 volts/mil)

1) 13 p.f.

2) 205 p.f.

3) 443 p.f.

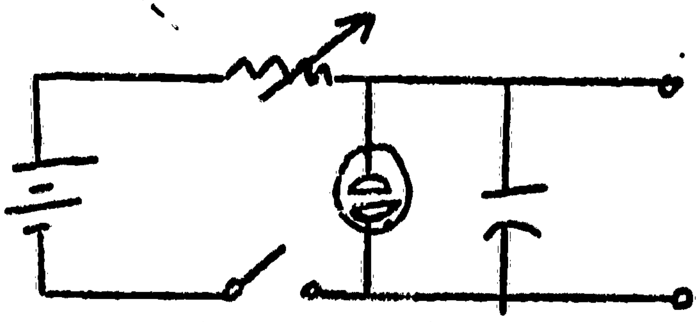
4) 511 p.f.

ET01330
8. This circuit is a:

1) d.c. pulse generator

2) Triangular generator

3) Sawtooth generator



ET01340
9. If an ideal voltage generator is connected to an ideal capacitor, it is found that:

1) Generator voltage is in phase with generator current

2) Generator voltage lags generator current by 90°.

3) Generator voltage leads generator current by 90°.

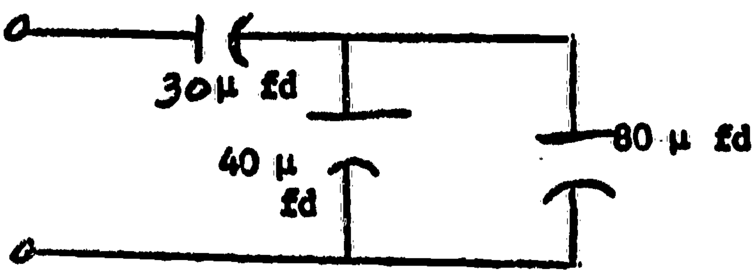
ET01350
10. Find the total capacitance of this circuit.

1) 71 uf.

2) 31.4 uf.

3) 56.6 uf.

4) 24 uf.



9/65

ET01360

1\. A capacitor has a reactance of 200 ohms at 100 kc. What is its capacitance?

1) 79.5 x 10^{-9} farads
2) 7.95 x 10^{-9} farads
3) 795 μμ farads
4) 25 x 10^{-9} farads

ET01380

2\. An energy loss which is due to the retention of charges by a dielectric is called:

1) Leakage loss
2) Dielectric-absorption loss
3) Dielectric-hysteresis loss

ET01385

3\. What is the value of capacitance that when connected to a 50 volt, 60 c.p.s. source absorbs 100 vars?

1) 27 ufd.
2) 49 ufd.
3) 82 ufd.
4) 106 ufd.

ET01390

4\. A capacitor is rated at 300 d.c. WV. It can be connected to a d.c. voltage of:

1) 300 volts for 24 hours
2) 300 volts indefinitely
3) 423 volts for 5 minutes
4) 423 volts for 24 hours

ET01400

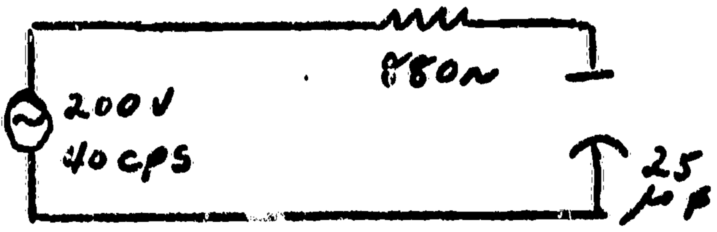
5\. A __________ type capacitor has two short sheets of tin or aluminum foil separated by thin paper impregnated with wax on oil.

1) Tubular
2) Film
3) Stacked
4) Electrolytic

ET01410 Calculate the power factor of the circuit shown below.

6.

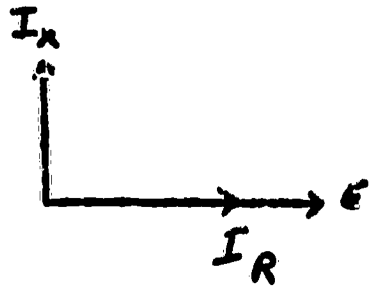
1) 0.614
2) 0.771
3) 0.886
4) 0.911



ET01420 The phase diagram below depicts the relations in a:

7.

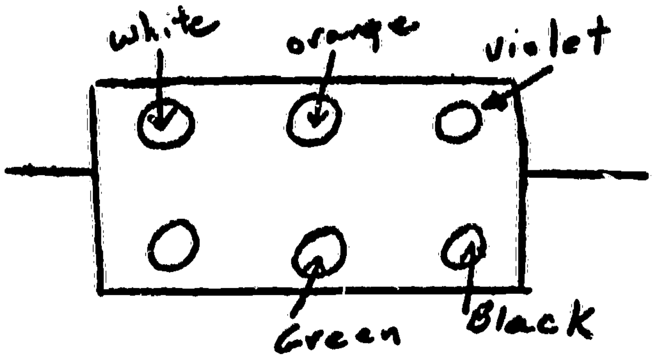
1) Series RC circuit
2) Parallel RL circuit
3) Parallel RC circuit
4) Series RL circuit



ET01430 What is the value of the EIA type capacitor given below?

8.

1) 470 p.f. ± 2%
2) 32 p.f. ± 20%
3) 670 p.f. ± 10%
4) 37 p.f. ± 5%



ET01440 In a series RCL circuit, the a.c. voltage across the resistor is 32 v., across the capacitor is 41 v., and across the inductor is 15 v. Find the source voltage.

9.

1) 36.9 v.
2) 84.1 v.
3) 41.2 v.
4) 61.2 v.

ET01450 A sinusoidal signal is applied to an R-C circuit. The impedance of the circuit is a function of the signal's:

10.

1) Phase
2) Frequency
3) Amplitude
4) All of the above

ET01460
1. In a series RLC circuit, X_L is greater than Xc. To achieve resonance the:

1) Frequency should be decreased
2) Inductance should be increased
3) Capacitance should be increased
4) Resistance should be decreased

ET01470
2. Resonance for a parallel RLC circuit:

1) Occurs when the circuit admittance is maximum
2) Occurs when the circuit admittance is minimum
3) Occurs when the impedance of the circuit equals the total reactance of the inductance
4) Occurs when the circuit is inductive

ET01480
3. What is the energy stored in a 50 ufd. capacitor when a voltage of 1500 volts is applied across it?

1) 22.5 joules
2) 37.4 joules
3) 56.3 joules
4) 113 joules

ET01490
4. On a series RLC resonance curve, the resonance point is:

1) At the minimum of the curve.
2) At the maximum of the curve.
3) Where the current is at the average value of its peak value.
4) Where the current is at the effective value of its peak value.

ET01510
01520
5. Sensitivity is related to:

1) How much filtering the circuit can give to an exciting waveform.
2) The excitation voltage of the resonant circuit (series RLC)
3) The excitation current of the resonant circuit (series RLC)
4) The output voltage of the resonant circuit.

ET01530 A higher circuit Q could mean:

6.

1) A lower selectivity in an RLC series circuit.

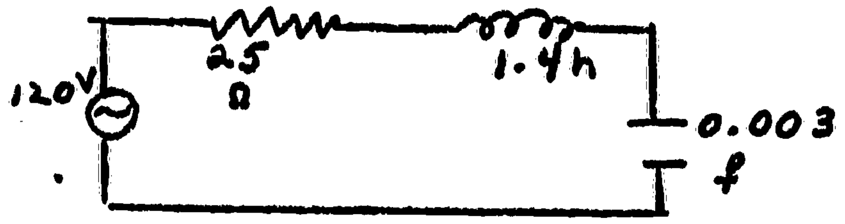
2) A higher true power in an RLC series circuit (with reactive power being constant)

3) A lower sensitivity in an RLC series circuit.

4) A lower capacitance of a series RLC circuit with R and L constant.

ET01550 Find the resonant frequency of this circuit

7.



1) 2.46 CPS

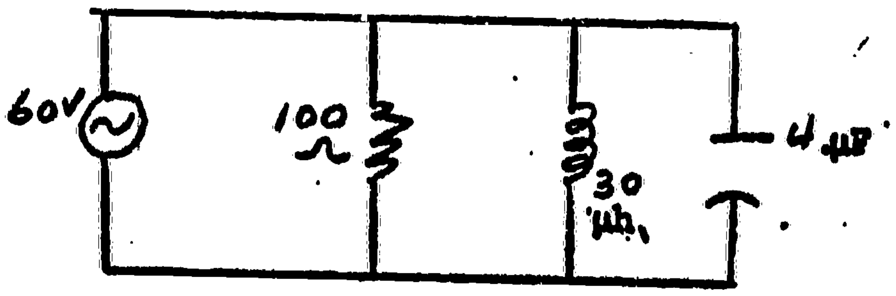
2) 8.1 CPS

3) 7.1 CPS

4) 15.3 CPS

ET01560 Find the resonant frequency of this circuit

8.



1) 14.5 K CPS

2) 1.2 M CPS

3) 6.87 K CPS

4) 4.3 K CPS

ET01570
01580

1. The half power points:

1) Indicate how much loss in the output of a resonant circuit.

2) Indicate the useful range of signals which can be passed through the resonant circuit.

3) Indicate the range of signals which cannot be passed by a resonant circuit.

4) Indicate ideal filter operation.

ET01584

2. In a parallel a.c. generator-inductor circuit we find that the:

1) Average power in the circuit is negative.

2) Average power in the circuit is positive.

3) Average power in the circuit is zero.

4) Average power in the circuit is imaginary.

ET01600

3. Balance springs in a Weston movement do not:

1) Zero adjust the pointer.

2) Negate temperature effects in the restoring force of the pointer.

3) Serve as a resistance wire in carrying current from the meter terminals to the moving coil.

4) Serve as conductors to carry current from the meter terminals to the moving coil.

ET01601

4. In the D'Arsonval movement, the ends of the coil shaft are used for:

1) Ball bearings

2) Needle bearings

3) As a part for conduction of electricity

4) As a part for insulation of electricity

ET01610

5. A basic meter movement may be converted into an ammeter by connecting a __________ resistor to its terminals.

1) Multiplier type

2) Divider type

3) Shunt

4) Series

ET01620
01610

6. A microammeter requires 2.1 milli volts to read 15 microamperes full deflection. What is the value of shunt resistance needed to measure 150 microamps.

1) 15.5 ohms

2) 195 ohms

3) 2.4 ohms

4) 24 ohms

ET01630

7. In a multirange voltmeter, as you select a higher voltage range:

1) The internal resistance of the voltmeter decreases.

2) The internal resistance of the voltmeter increases.

3) The internal resistance of the voltmeter remains the same.

ET01640

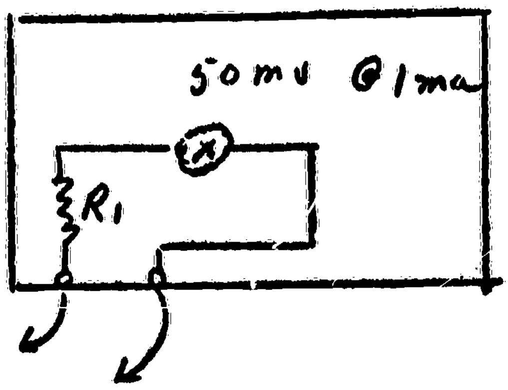
8. What value of R_1 will permit meter measurements of up to 1.0 volts?

1) 50Ω

2) 9.5KΩ

3) 950Ω

4) 500Ω



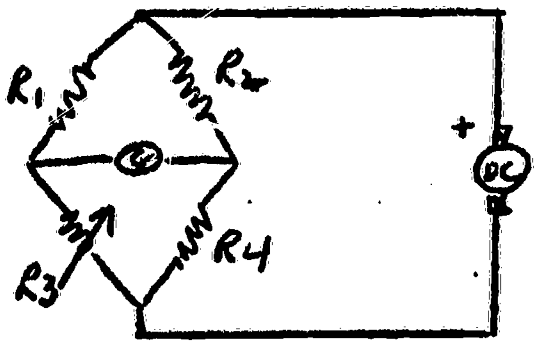
ET01660

9. For balance

1) $\frac{R_1}{R_3} = \frac{R_2}{R_4}$

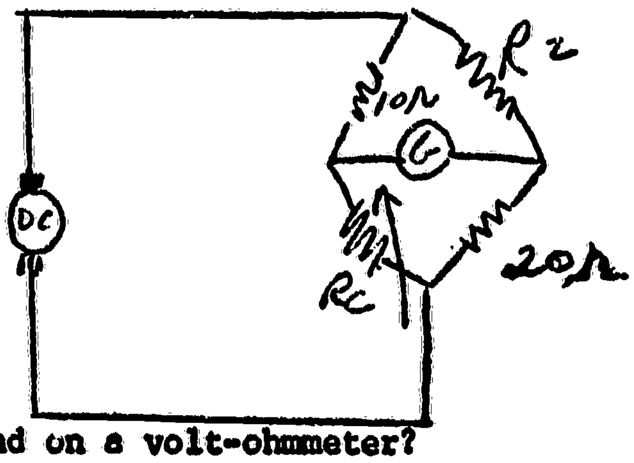
2) $\frac{R_3}{R_4} = \frac{R_2}{R_1}$

3) $\frac{R_3}{R_2} = \frac{R_4}{R_1}$



ET01670 If Rc is 14.0 ohms when the meter is at balance, find Rz (in ohms).

1.



1) 7.15 ohms

2) 28.0 ohms

3) 14.3 ohms

4) 7.1 ohms

ET01671 Which control is never found on a volt-ohmmeter?

2.

1) Function control

2) Balance adjustment

3) Zero adjustment

4) a.c.-d.c. switch

ET01680 Which meter can be used for a.c. or any other type of current?

3.

1) Moving vane type

2) Electrodynamometer type

3) Rectifier type

4) Thermocouple type

ET01590 An electrodynamometer wattmeter with a multiplier resistor reads:

4.

1) Apparent power

2) Effective power

3) Reactive power

ET01700 Meter loading of an electrical circuit is caused by:

5.

1) A damaged multiplier resistor

2) A shorted meter movement

3) Not enough internal resistance in the meter

4) Not enough current capacity in the meter-movement

ET01720 In an oscilloscope, which control selects internal or external application of the time base signal?

6.

1) Horizontal phase

2) Horizontal frequency vernier

3) Sync. Selector

4) Horizontal freq. selector

ET01730 When using a square wave generator with an amplifier and oscilloscope, a poor high frequency response is seen on the oscilloscope as:

7.

1) A waveform having a short rise time.

2) A waveform having a short fall time.

3) A waveform having a long rise time.

ET01750 Power factor is:

8.

1) The angle between apparent and true power.

2) The ratio of true to apparent power.

3) The angle between apparent and reactive power.

4) The ratio between reactive to true power.

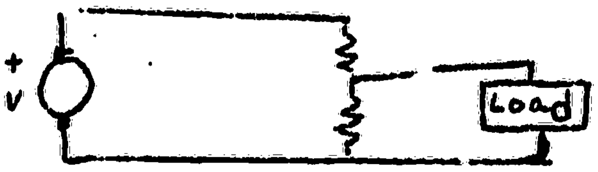
ET01760 A voltage divider is shown in:

9.

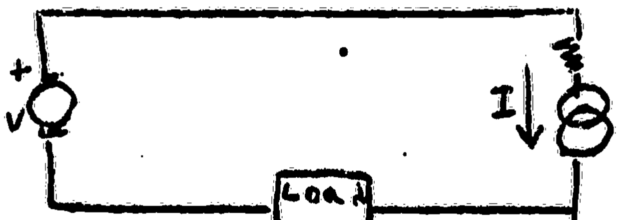
1)

2)

3)



4)



ET01700 A 1K.ohm/v. meter (on its 100 v. range) is placed in the circuit
01780 as shown. What is the difference in voltage Vbc before and after the meter is placed in the circuit?

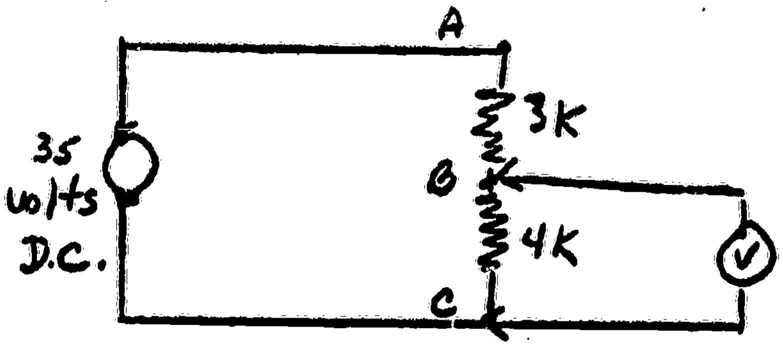
10.

1) 0.56 volts

2) 0.35 volts

3) 1.35 volts

4) 0.65 volts



NEW YORK INSTITUTE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY
5011

DIAGNOSTIC EXAMINATION ANSWERS

Book IV

NEW YORK INSTITUTE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY

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COMPUTER CURRICULUM ANALYSIS
NYIT PRESS

Figure 4 DIAGNOSTIC ANSWERS

ET5011

ET00010
1.
If Hg. changes from a gas weighing 32 grams, to a solid, how many grams will Hg. weigh when it is in its solid phase?

3) 32 gms.

ET00020
2.
The core or nucleus of an atom consists of ___________, which have ___________ and ___________ charges respectively.

1) Protrons, and neutrons; positive zero

ET00030
3.
In the Millikan experiment, the oil drop presumably obtained its negative charge via:

3) Friction

ET00040
4.
A substance that cannot be broken down into simpler substances is called a:

2) Element

ET00050
5.
A material which will not make a good permanent magnet is:

4) Soft Iron

ET00060
6.
A positive charge may be created by the removal of _________.

2) Electrons

ET00070
7.
Which of the following could not be considered an ion?

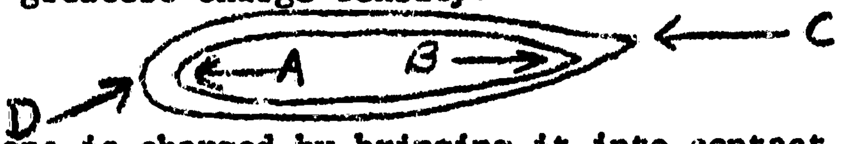
2) A positron

ET00080
8.
If the charge on one body is increased by 7 and the charge on a second body is halved, what is the change in the force between them when the distance is doubled?

2) 0.875 units

ET00090
9.
The diagram below shows a cross section of a hollow metal body. Where is the greatest charge density?

3) C



ET00100
10.
A neutral electroscope is charged by bringing it into contact with a positively charged rod. What charge will appear on the leaves of the electroscope?

2) Positive

ET00110
1. What is the maximum number of electrons in an atom which can have the same specific energy?

2) Two

ET00120
2. At a certain point in space an electric field has an intensity of 3.0 n/c. If a body with a charge of 20 coulombs is introduced into this field, what force would be exerted on it?

2) 60 new.

ET00130
3. A unit positive charge is placed near body Q. From the direction of the resulting electric field shown below, determine the charge on Q.

2) negative

ET00140
4. The net positive charge within a sphere is +4. What is the number of lines of force leaving the sphere?

3) 4

ET00150
5. Which of the following is not a unit for resistance, emf, current or power?

4) gauss

ET00160
1.
Mica is a (an) ____________conductor of electricity.

3) poor

ET00180
2.
In a schematic diagram, the positive terminal of a battery is shown as a:

2) ________

ET00190
3.
The Daniell cell has________ and _________ electrodes.

1) Zinc and Copper

ET00200
4.
The resistance of a conductor is 100 ohm. If its diameter was doubled, the new resistance would be:

4) 25 ohms

ET00210
5.
The resistance of a copper conductor is____________its temperature coefficient.

2) Directly proportional to

ET00220
00230
6.
Electrical potential is measured in units of:

1) Volts

ET00240
7.
What is the voltage drop across the 1.okΩ resistor?

3) 15.0v

ET00250
8.
Find the maximum potential which can be applied to a spherical conductor in air, having a radius of 2.5m.

2) 7.5 megavolts

ET00260
9.
In going through resistance wire, 20 coulombs of electrons are transferred from one side of the wire to the other side of the wire. 75 joules of energy are dissipated. Find the voltage across the wire.

3) 3.75 volts

ET00270
10.
In the circuit shown below, what is the value of R_1?

3) 40Ω

ET00280
1\. If the flow of electrons in a wire whose cross sectional area is 0.001 sq. in. is found to be 0.21 c.f.s., what is the velocity of the electrons?

3) 30,250 f/s

ET00291
2\. 6.3 x 10^{18} electrons constitutes

1) 1 coulomb

ET00300
3\. Which of these is <u>not</u> a source of EMF?

4) charged body

ET00310
4\. What is the terminal voltage in this circuit?

4) .025 volts

ET00320
5\. A device consisting of two different metals maintained at different temperatures and which produces an e.m.f. under these conditions is called

2) thermo-couple

ET00330
6\. The symbol for a battery is

2) 

ET00340
7\. In the circuit shown below, the potential at point "e" is the same as the potential at point

3) i

ET00350
8\. A device is rated at 0.15 amp at 30 volts. If the only available voltage source is 60 volts, what value of series resistor must be added to insure proper operation?

2) 200Ω

ET00360
9\. What is the current in the circuit shown below?

3) 10 amp

ET00370
10\. Four resistors, $R_1 = 7.2$ ohms, $R_2 = 1$ ohm, $R_3 = 3.4$ ohms, and a resistor of unknown value, R_4, are connected in series across a 16 volt battery whose internal resistance is 0.4 ohms, If a current of 1.09/ampere flows in the circuit, what is the value of R_4?

2) 4Ω

ET00370
00380

1. A storage battery has an open circuit emf of 6 volts and an internal resistance of 0.05 ohms. What is the terminal voltage of the battery when a 0.2 ohm load is connected across it?

2) 4.8 volts

ET00390

2. A series circuit consisting of 20 ohm, 10 ohm and 30 ohm resistances is connected to a 45 volt source of emf. What is the current in the 20 ohm resistor

2) 750 ma

ET00400

3. Determine the equivalent resistance of three resistors, 10, 44 and 28 ohm, connected in parallel.

2) 6.3 Ω

ET00410

4. The total current passed by a 10 kilohm, a 15 kilohm and a 20 kilohm resistor in parallel is 20 ma. What is the current in the 10 kilohm branch?

1) 9.25 ma

ET00411

5. What is the total conductance in the circuit shown below?

3) .0178 ℧

ET00420

6. Three resistors of 60,000 ohms, 15,000 ohms and 8,000 ohms respectively, are available. A value of 20,000 ohms is desired. Which is the correct method of connection?

2)

ET00430

7. A resistor constructed of manganin and mounted in a metal case filled with oil is called a (an) ________ resistor.

3) standard

ET00450

8. A resistor is shown below. What is the value of its resistance?

2) 25k ± 10%

ET00460

9. Which of the following resistors has a power rating of 2.5 watts?

3) a 25,000 ohm resistor with 10 ma.

ET00461

10. Efficiency is defined as the ratio of:

2) output power to input power

ET5011
05010
5A

ET00470 Maximum power transfer to R_L will occur when the resistance of R_L is:

1.

2) 4 Ω

ET00480 A 10 Ω resistor is connected to a 40 volt generator. Find the heat dissipated by the resistor.

2.

2) 160 J/S

ET00490 Determine the voltage between taps A and B.

3. 3) 218 volts

ET00500 Which circuit contains a potentiometer?

4. 3)

ET00510 When a plug is inserted into the jack shown below, the connection between B and C is:

5.

2)

ET00520 What is the smallest fuse that will not be blown when S_1 is closed, for either position of S_2?

6.

3) 1.21 amp

ET00530 Which of the following is not a rule of magnetic attraction or repulsion

7. 4) Lines of force in the same direction attract each other.

ET00540 8 amperes flow through a 4 turn coil. What is its m.m.f.?

8. 2) 32 a-t

ET00550 A material which is slightly attracted to a magnetic field is called a ______ type material.

9.

2) paramagnetic

ET00560 With the magnetic field and current as shown, what is the direction of the force exerted on the wire?

10.

3)

ET00570 The purpose of the cyclotron is to:

1\. 1) Obtain a beam of high speed charged atomic particles.

ET00580 Magnetic lines of force always form:

2\. 4) Closed loops

ET00590 Permeability is:

3\. 2) The ability of a material to permit the setting up of magnetic lines of force.

ET00600 A law which expresses the intensity of a magnetic field around a wire carrying a steady current is called _______ law.

4\. 3) Biot's

ET00610 Magnetic poles are:

5\. 1) Regions where most lines of induction enter or leave.

ET00620 In _______ materials the electronic currents are in the opposite direction of those in the magnetizing winding.

6\. 3) Diamagnetic

ET00630 Hysteresis loss is greater if:

7\. 2) The magnetization frequency is higher

ET00640 Using the electron current convention, what is the direction of the lines of force around a conductor carrying a current as shown in the diagram?

8\. 2) c.c.w.

ET00650 A magnetic analog to resistance is:

9\. 1) reluctance

ET00660 A magnetic shield is:

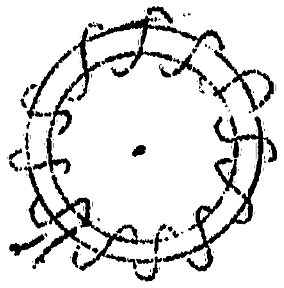
10\. 3) Used to minimize stray fields in a certain place.

ET00670 In the picture below, which side of the solenoid is the north pole?

1. 2) Left

ET00680 A Trorid coil is pictured as:

2. 1)



ET00690 The ratio between the total develeloped flux and the useful flux in a magnetic circuit is called the:

3. 3) Leakage factor

ET00720 A phenomenon which occurs at the air gap in a magnet is:

4. 3) Fringing

ET00740 The amount of voltage induced into a conductor by a moving magnet doesn't depend upon:

5. 4) Reluctance of magnet

ET00750 "The ability of a circuit or component to develop an induced voltage when the current flowing through the circuit is changing" best defines:

6. 1) Self-Inductance

ET00760 The MKS unit for magnetomotive force is the:

7. 1) ampere-turn

ET00770 If an alternating current is placed on the primary coil, as shown below, the secondary coil voltage will appear as:

8. 2) alternating voltage

ET00780 Which law states that the magnitude of the induced emf. in a coil is directly proportional to the rate of charge of current through the coil?

9. 3) Faraday's law

ET00790 Find the permeability of a coil which has a flux density of 30 webers per square meter and a magnetizing force of 11.0 ampere turns/meter.

10. 4) 2.7 w/a-t

ET00810 A conductor has moved from position A to B. Find the voltage on the conductor if the maximum voltage which could appear on the conductor is 15.0 volts.

1.

3) 7.5

ET00820 A conductor ________ lines of force which go in the opposite direction to its Oersted lines of force.

2.

3) Will be repelled by

ET00840 The brushes of an a.c. generator are made of:

3.

2) Graphite and carbon

ET00850 __________ are soldered to the commutator segments.

4.

2) End Wires

ET00860 A current which flows from the negative side of the power supply to the load and from the load back to the positive side of the power supply is called:

5.

2) Electron current.

ET00870 The period of an ac voltage is 125 usec. What is it frequency?

6.

2) 8000 cps

ET00880 Which letter describes the wavelength of the pattern shown below?

7.

2) B

ET00920 Vector A______ Vector B by______

8.

2) Lags 60°

ET00930 Which statement holds true for a capacitor?

9.

3) The voltage across it lags the current by 90°.

ET00940 The second harmonic of 400 cycles is:

10.

4) 800 cycles.

ET5011
09010
9A

ET00950 The symbol for peak value of current of a sine wave is:

1. 3) Im

ET00960 An a.c voltage has a peak value of 71 v. The average value of the voltage is:

2. 1) 45.2 volts

ET00970 The a.c. effective value in electricity is defined from a d.c.:

3. 2) heating effect

ET00980 A current of 3.2 amps r.m.s. flows through a 20 Kilohm resistor. Find the power dissipated by the resistor.

4. 3) 204.8 W.

ET00982 A generator has an output of 14.4 volts. What is the power dissipation of a 20 ohn resistor connected across its output?

5. 3) 10.3 watts

ET01060 The unit of inductance is the:

6. 3) Henry

ET01080 A 2.0 h. coil is placed in series with a 5.0 h. coil. Neglecting mutual inductance between the coils, find the total inductance of the network.

7. 1) 7.0 h.

ET01100 In an R-L circuit, doubling the inductance ________ the time necessary for the circuit to reach steady state current.

8. 1) Doubles

ET01110 Two inductances of 6 henries each are in parallel across a circuit. What is their effective inductance?

9. 2) 3 h

ET01010 A resistor is connected across a 40 volt rms a.c. generator. Find its resistance if 3.0 amps rms are drawn from the generator.

1.

2) 13.3 Ω

ET01020 The power utilized by a pure induction is:

2.

2) Reactive power

ET01060 The symbol for inductance is:

3.

4) L

ET01070 In a series RLC circuit at resonance there is 750 volts across the coil and 30 volts across the resistance. What is the Q of the coil?

4.

1) 25

ET01080 Find the total inductance of the circuit below. The mutual inductance is 0.5 h.

5.

4) 14.5 h.

ET01090 Doubling the turns of a coil:

6.

3) Quadruples the inductance value of that coil.

ET01100 How long does it take for the circuit current to reach the steady-state value? See circuit below.

7.

1) 0.133 sec.

ET01120 A 2.0 h. coil has a resistance of 0.9 ohms and is connected to a 50 volt battery. What is the energy stored in its magnetic field?

8.

1) 3080 joules

ET01130
01140 What is the voltage across the switch contacts at the instant that the switch is opened?

9.

2) 116 volts

ET01150 Find the total inductance of the network below:

10.

3) 5.2 h.

ET01160 Choose the voltage wave form corresponding to the circuit and current wave form shown below.

1\.

1) 

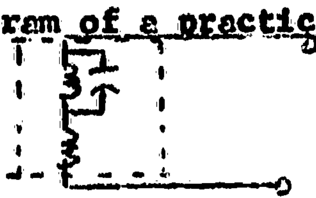
ET01170 Find the value of L in the circuit shown below.

2\.

2) 1.33 h.

ET01180 The diagram of a practical inductance is shown in:

3\.

3) 

ET01190 The closer the power factor is the unity, the:

4\.

3) More resistive the circuit is.

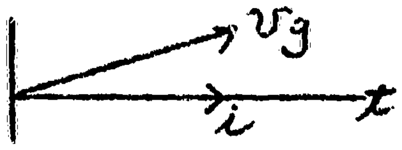
ET01200 Which circuit is an RL circuit?

5\.

3) 

ET01210 Choose the proper phase diagram for the circuit shown below:

6\.

1) 

ET01220 For this circuit, express the total impedance in rectangular form.

7\.

2) 22 + j92 ohms

ET01240 A 50 c.p.s. transformer has 80.0 turns on its primary. If the maximum flux which the primary can produce is 0.004 weber, what voltage rating would be given to the primary coil?

8\.

2) 71 volts

ET01250 A transformer has a 350 turn secondary rated at 500 volts. The primary coil has 125 turns. What is the primary coil voltage rating?

9\.

1) 179 v.

ET01260 An ideal transformer has a 3:1 turns ratio as shown below. Find the power developed in the 220Ω resistor.

10\.

1) 6.67W.

ET01270 The disadvantage of an autotransformer as compared to a regular two-part transformer is:

1. 3) No isolation

ET01280 Find the side "R" from the diagram below:

2. 1) 3.06

ET01290 What type of current is in the load resistor in the circuit below?

3. 2) Alternating

ET01295 In a series RC circuit having a battery,doubling the resistance:

4. 2) Doubles the time it takes for the capacitor to charge up to the battery voltage.

ET01300 The phenomenon of displaced electrons in each atom of a dielectric when an electrical field is applied to the dielectric is called:

5. 2) Polarization

ET01310 10^{-12} farads is called one:

6. 3) Picofarad

ET01320 A parallel plate capacitor has a dielectric of Teflon. The plates are spaced 1.0 m.m. apart and have an area of 25 sq. -m.m. each. Find the capacitance of the capacitor. (Dielectric constant of Teflon = 1,500 volts/mil)

7. 3) 443 p.f.

ET01330 This circuit is a:

8. 3) Sawtooth generator

ET01340 If an ideal voltage generator is connected to an ideal capacitor it is found that:

9. 2) Generator voltage lags generator current by 90°.

ET01350 Find the total capacitance of this circuit.

10. 4) 24 uf.

ET01360
1. A capacitor has a reactance of 200 ohms at 100 kc. What is its capacitance?

2) 7.95 x 10^{-9} farads

ET01380
2. An energy loss which is due to the retention of charges by a dielectric is called:

2) Dielectric-absorption loss

ET01385
3. What is the value of capactiance that when connected to a 50 volt, 60 c.p.s. source absorbs 100 vars?

4) 106 ufd.

ET01390
4. A capacitor is rated at 300 d.c. WV. It can be connected to a d.c. voltage of:

2) 300 volts indefinitely

ET01400
5. A __________ type capacitor has two short sheets of tin or aluminum foil separated by thin paper impregnated with wax on oil.

2) film

ET01410
6. Calculate the power factor of the circuit shown below:

3) 0.886

ET01420
7. The phase diagram below depicts the relations in a:

3) Parallel RC circuit

ET01430
8. What is the value of the EIA type capacitor given below?

4) 37 p.f ± 5%

ET01440
9. In a series RCL circuit, the a.c. voltage across the resistor is 32 v., across the capacitor is 41 v., and across the inductor is 15 v. Find the source voltage.

3) 41.2 v.

ET01450
10. A sinusoidal signal is applied to an R-C circuit. The impedance of the circuit is a function of the signal's:

2) Frequency

ET01460 In a series RLC circuit, X_L is greater than Xc. To achieve resonance the:

1\. 2) Inductance should be increased

ET01470 Resonance for a parallel RLC circuit:

2\. 2) Occurs when the circuit admittance is minimum

ET01480 What is the energy stored in a 50 ufd. capacitor when a voltage of 1500 volts is applied across it?

3\. 3) 56.3 joules

ET01490 On a series RLC resonance curve, the resonance point is:

4\. 2) At the maximum curve.

ET01510
01520 Sensitivity is related to:

5\. 4) The output voltage of the resonant circuit.

ET01530 A higher circuit Q could mean:

6\. 2) A higher true power in an RLC series circuit (with reactive power being constant)

ET01550 Find the resonant frequency of this circuit

7\. 1) 2.46 CPS

ET01560 Find the resonant frequency of this circuit

8\. 1) 14.5 K CPS

ET01570
01560 The half power points:

1. 2) Indicate the useful range of signals which can be passed through the resonant circuit.

ET01584 In a parallel a.c. generator-inductor circuit we find that the:

2. 3) Average power in the circuit is zero.

ET01600 Balance springs in a Weston movement do not:

3. 3) Serve as a resistance wire in carrying current from the meter terminals to the moving coil.

ET01601 In the D'Arsonval movement, the ends of the coil shaft are used for:

4. 2) Needle bearings.

ET01610 A basic meter movement may be converted into an ammeter by connecting a ________ resistor to its terminals.

5. 3) Shunt

ET01620
01610 A microammeter requires 2.1 milli volts to read 15 microamperes full deflection. What is the value of shunt resistance needed to measure 150 microamps.

1) 15.5 ohms

ET01630 In a multirange voltmeter, as you select a higher voltage range:

7. 2) The internal resistance of the voltmeter increases.

ET01640 What value of R_1 will permit meter measurements of up to 1.0 volts?

8. 3) 950Ω

ET01660 For balance

9. 1) $\frac{R_1}{R_3} = \frac{R_2}{R_4}$

ET01670 If Rc is 14.0 ohms when the meter is at balance, find Rz (in ohms).

1. 3) 14.3 ohms.

ET01671 Which control is never found on a volt-ohmmeter?

2. 2) Balance adjustment

ET01680 Which meter can be used for a.c. or any other type of current?

3. 4) Thermocouple type

ET01690 An electrodynamometer wattmeter with a multiplier resistor reads:

4. 2) Effective power

ET01700 Meter loading of an electrical circuit is caused by:

5. 3) Not enough internal resistance in the meter.

ET01720 In an oscilloscope, which control selects internal or external application of the time base signal?

6. 3) Sync. Selector

ET01730 When using a square wave generator with an amplifier and oscilloscope, a poor high frequency response is seen on the oscilloscope as:

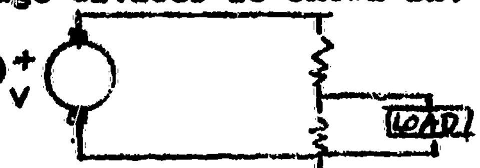
7. 3) A waveform having a long rise time.

ET01750 Power factor is:

8. 2) The ratio of true to apparant powerμ

ET01760 A voltage divider is shown in:

9. 3)



ET01700
01730
10. A 1K.ohm/v. meter (on its 100v. range) is placed in the circuit as shown. What is the difference in voltage Vbc before and after the meter is placed in the circuit?

2) 0.35 volts

NEW YORK INSTITUTE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY 5030

ITEM ANALYSIS

and

SOURCE REFERENCES

Book I

9/65

NEW YORK INSTITUTE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY

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ET5030 SOURCE REFERENCES

Ref.No.	Source Title	Author	Year	Publisher	Mt Pr
0190	BASIC ELECTRONICS	NYIT	1964	McGraw-Hill	02
0200	RCA RECEIVING TUBE MANUAL	RCA	1964	RCA	11
0205	BASIC ELECTRONICS (Laboratory manual)	Zbar and Schildkraut	1958	McGraw-Hill	11
0206	ELECTRONIC INSTRUMENTS AND MEASUREMENTS	Zbar	1956	McGraw-Hill	11
0210	VACUUM TUBE RECTIFIERS	Schure	1958	Rider	13
0215	LIMITERS AND CLIPPERS	Schure	1955	Rider	13
0220	FILTERS AND ATTENUATORS	Schure	1964	Rider	13
0225	AMPLITUDE MODULATION	Schure	1956	Rider	13
0230	CRYSTAL OSCILLATORS	Schure	1955	Rider	13
0235	A.M. DETECTORS	Schure		Rider	13
0240	VACUUM TUBE CHARACTERISTICS	Schure	1963	Rider	13
0241	LOW FREQUENCY AMPLIFIERS	Schure		Rider	13
0245	INDUSTRIAL ELECTRONICS AND CONTROL	Kloeffler	1963	Wiley	09
0255	ESSENTIALS OF RADIO ELECTRONICS	Slurzberg & Osterheld	1961	McGraw-Hill	09
0379	FIRST YEAR ELECTRONICS (Autotutor)	U.S. Industries		U.S.Industries	03

COURSE ET5030 SUBJECT Electron Emission-Diodes Page 1 of 2

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ET01830	Plate Ckt.	3						Re210 13,15,18				
ET01840	Diode Uses			36	32	126-7		Re210 2-3	245-7			
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ET01861	Diode, Gas	11	227									
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ET01880	Rectifier, Half Wave	5-7	225;9	15,16	37	114-16 124	5-7	Re210 11-14	638-53			
ET01890	Rectifier Ckt.	10,6,5				124	5	Re210 13,15				

COURSE ET5030 SUBJECT Electron Emission-Diodes Pg. 2 of 2

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ET01971	Characteristics	22						Re240 15-20				

COURSE ET5030 SUBJECT Triodes and Basic Triode Action Page 1 of 2

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COURSE ET5030 SUBJECT Basic Power Supplies

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ET02400	Construction (Pentode)	104-5	53	93	59	1554-77						
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COURSE ET5030 **SUBJECT** Tetrodes: Pentodes **Page 2 of 2**

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COURSE ET5030 **SUBJECT** Power Amplifiers

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COURSE ET5030 SUBJECT Wideband and R-F Amplifiers

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COURSE ET5030 **SUBJECT** Oscillators

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COURSE ET5030 SUBJECT Oscillators

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COURSE ET5030 SUBJECT Modulation, Detection

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NEW YORK INSTITUTE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY 5030

DETAILED REFERRALS

and

CODING INFORMATION

Book II

COMPUTER CURRICULUM ANALYSIS
NYIT PRESS

NEW YORK INSTITUTE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY

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SOURCE REFERENCES

Ref.No.	Source Title	Author	Year	Publisher	Mt Pr
0190	BASIC ELECTRONICS	NYIT	1964	McGraw-Hill	02
0200	RCA RECEIVING TUBE MANUAL	RCA	1964	RCA	11
0205	BASIC ELECTRONICS (Laboratory manual)	Zbar and Schildkraut	1958	McGraw-Hill	11
0206	ELECTRONIC INSTRUMENTS AND MEASUREMENTS	Zbar	1956	McGraw-Hill	11
0210	VACUUM TUBE RECTIFIERS	Schure	1958	Rider	13
0215	LIMITERS AND CLIPPERS	Schure	1955	Rider	13
0220	FILTERS AND ATTENUATORS	Schure	1964	Rider	13
0225	AMPLITUDE MODULATION	Schure	1956	Rider	13
0230	CRYSTAL OSCILLATORS	Schure	1955	Rider	13
0235	A.M. DETECTORS	Schure		Rider	13
0240	VACUUM TUBE CHARACTERISTICS	Schure	1963	Rider	13
0241	LOW FREQUENCY AMPLIFIERS	Schure		Rider	13
0245	INDUSTRIAL ELECTRONICS AND CONTROL	Kloeffler	1963	Wiley	09
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CURRICULUM ANALYSIS AND DEVELOPMENT

Coding Information

Sample Title Line

Topic Number	Topic Title	Information Categories
ET01790	Thermionic Emission	LW

Sample Detailed Referral Lines

Topic Number	Source Reference Number	Page Number	Method of Presentation	Academic Level	Extent of Treatment	Prerequisite
ET01790	0190	0001≠	02	02	1 ≠	
ET01790	0195	0009≠	13	02	1 ≠	
ET01790	0255	0032≠	09	04	1 ≠	
ET01790	0245	0094≠	09	04	1 ≠	
ET-1790	0375	0248≠	03	02	2 ≠ ≠	

Note: The ≠ symbol is used for computer purposes only.

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TABLE OF ABBREVIATIONS AND CODE DESIGNATIONS

A. Method of Presentation

01	CP	Class Presentation
02	PT	Programmed Text
03	MP	Machine Presented Program
04	FL	Film
05	LK	Lecture
06	VT	Video Tape
07	AT	Audio Tape
08	CN	Course Notes
09	NT	Normal Text
10	ST	Self-study (self-taught)
11	LM	Laboratory Manual
12	WK	Theory and/or Problem Workbook
13	BT	Abridged Textbook

(99 such designations may be permitted)

B. Academic Level

00	High School
01	1st Semester College
12	12th Semester College

(09-12 are graduate level)

C. Information Categories

AT	Analytical Technique	pencil and paper operation
BG	Background, general information	

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CP	Concept	a mental construct - an idea not based upon sensory perceptions alone
DF	Definition	statement or meaning of a term
ED	Engineering Device	circuit or physical object designed and/or built
ET	Experimental technique	operation in lab or shop
FA	Fact	experimentally verified theory
FD	Factual data	units, constants, constraints and properties of materials as needed to effect a design of an instrument or an engineering device
IN	Instrument	a device used primarily for making an observation or a measurement
LW	Law	a statement summarizing a body of experiences or a logical deduction from basic principles
PE	Percept	phenomenon we become acquainted with through the senses
PR	Principle	plays the role of axiom or postulate and cannot be derived
SI	Special Illustration	item presented in class as an illustration of a topic already discussed
TH	Theory	
PF	Proof	rigorous mathematical or logical proof

DETAILED REFERRALS
Electron Emission-Diodes

ET01790 Thermionic Emission LW

ET01790 0190 0001 ≠ 02 02 1 ≠

ET01790 0195 0009 ≠ 13 02 1 ≠

ET01790 0255 0032 ≠ 09 04 1 ≠

ET01790 0245 0094 ≠ 09 04 1 ≠

ET01790 0205 0001 ≠ 11 02 1 ≠

ET01790 0210 0003 ≠ 13 02 3 ≠

ET01790 0240 0005 ≠ 13 02 2 ≠

ET01790 0375 0248 ≠ 03 02 2 ≠ ≠

ET01800 Secondary Emission LW

ET01800 0190 0002 ≠ 02 02 1 ≠

ET01800 0245 0107 ≠ 09 04 1 ≠

ET01800 0240 0005 ≠ 13 02 1 ≠ ≠

ET01810 Filament Materials FD ED

ET01810 0190 0001,0007 ≠ 02 02 1 ≠

ET01810 0195 0010,0013 ≠ 13 02 1 ≠

ET01810 0255 0032 ≠ 09 04 1 ≠

ET01810 0245 0101 ≠ 09 04 1 ≠

ET01810 0240 0005 ≠ 13 02 1 ≠ ≠

ET01820 Filament Curcuit ED

ET01820 0190 0002 ≠ 02 02 1 ≠

ET01820 0210 0017 ≠ 13 02 1 ≠

ET01820 0375 0704 ≠ 03 02 1 ≠ ≠

ET01830 Plate Circuit ED
ET01830 0190 0003 ≠ 02 02 1 ≠
ET01830 0210 0013 ≠ 13 02 2 ≠ ≠

ET01840 Diode Uses E T
ET01840 0195 0036 ≠ 13 02 1 ≠
ET01840 0255 0032 ≠ 09 04 1 ≠
ET01840 0245 0126 ≠ 09 04 1 ≠
ET01840 0210 0002 ≠ 13 02 1 ≠
ET01840 0375 0245 ≠ 03 02 1 ≠ ≠

ET01850 Diode Types E D
ET01850 0195 0036 ≠ 13 02 1 ≠
ET01850 0255 0032 ≠ 09 04 1 ≠
ET01850 0245 0126 ≠ 09 04 1 ≠ ≠

ET01860 Vacuum Diode E D
ET01860 0190 0003 ≠ 02 02 1 ≠
ET01860 0155 0225, 0279 ≠ 09 00 1 ≠
ET01860 0195 0034 ≠ 13 02 2 ≠
ET01860 0255 0035 ≠ 09 04 1 ≠ ≠

ET01861 Gas Diode ED
ET01861 0190 0011 ≠ 02 02 1 ≠
ET01861 0155 0227 ≠ 09 00 1 ≠ ≠

DETAILED REFERRALS
Electron Emission-Diodes

ET5030

ET01870 Full Wave Rectifier ED

ET01870 0190 0005 ≠ 02 02 1 ≠

ET01870 0155 0225 ≠ 09 00 1 ≠

ET01870 0195 0015 ≠ 13 02 1 ≠

ET01870 0245 0114,0123 ≠ 09 04 1 ≠

ET01870 0205 0005 ≠ 11 03 1 ≠

ET01870 0210 0014 ≠ 13 02 2 ≠

ET01870 0375 0654 ≠ 03 02 3 ≠ ≠

ET01880 Half Wave Rectifier ED

ET01880 0190 0005 ≠ 02 02 1 ≠

ET01880 0155 0225 ≠ 09 00 1 ≠

ET01880 0195 0015 ≠ 13 02 1 ≠

ET01880 0255 0037 ≠ 09 04 1 ≠

ET01880 0245 0114 ≠ 09 04 2 ≠

ET01880 0205 0005 ≠ 11 02 1 ≠

ET01880 0210 0011 ≠ 13 02 2 ≠

ET01880 0375 0638 ≠ 03 02 2 ≠ ≠

ET01890 Rectifier Circuits ED

ET01890 0190 0005 ≠ 02 02 1 ≠

ET01890 0245 0124 ≠ 09 02 1 ≠

ET01890 0205 0005 ≠ 11 02 1 ≠

ET01890 0210 0013 ≠ 13 02 1 ≠ ≠

ET01900 Work Function LW, D

ET01900 0190 0007 ≠ 02 02 1 ≠ ≠

DETAILED REFERRALS
Electron Emission Diodes

ET01910 Heater Element ED

ET01910 0190 0003 ≠ 02 02 1 ≠

ET01910 0155 0227, 0280≠ 09 00 1 ≠

ET01910 0195 0019 ≠ 13 02 2 ≠

ET01910 0255 0033 ≠ 09 04 1 ≠

ET01910 0205 0002 ≠ 11 02 1 ≠ ≠

ET01920 Space Charge CP

ET01920 0190 0012 ≠ 02 02 1 ≠

ET01920 0195 0020 ≠ 13 02 2 ≠

ET01920 0245 0117 ≠ 09 04 1 ≠

ET01920 0210 0003, 0008 ≠ 13 02 1 ≠

ET01920 0240 0009 ≠ 13 02 2 ≠

ET01920 0375 0274 ≠ 03 02 2 ≠ ≠

ET01930 Characteristic Curve (I_b vs Filament Voltage) AT

ET01930 0190 0013 ≠ 02 02 1 ≠

ET01930 0155 0226 ≠ 09 00 1 ≠

ET01930 0195 0028 ≠ 13 02 1 ≠ ≠

ET01940 Characteristic Curve (I_b vs E_b) AT

ET01940 0190 0016 ≠ 02 02 1 ≠

ET01940 0195 0024 ≠ 13 02 1 ≠

ET01940 0255 0038 ≠ 09 04 1 ≠

ET01940 0245 0121 ≠ 09 04 1 ≠

ET01940 0205 0003 ≠ 11 02 1 ≠

ET01940 0240 0013 ≠ 13 02 1 ≠

ET01940 0375 0287 ≠ 03 02 2 ≠ ≠

ET5030

DETAILED REFERRALS
Electron Emission Diodes

ET01950 D-C Plate Resistance LW AT

ET01950 0190 0018 ≠ 02 02 1 ≠

ET01950 0195 0031 ≠ 13 02 1 ≠

ET01950 0245 0140 ≠ 09 04 1 ≠ ≠

ET01960 A-C Plate Resistance LW AT

ET01960 0195 0033 ≠ 13 02 1 ≠

ET01960 0245 0140 ≠ 09 02 1 ≠ ≠

ET01970 Crystal Diodes ED

ET01970 0190 0011, 0022 ≠ 02 02 1 ≠ ≠

ET01971 Crystal Diode Characteristics AT FD

ET01971 0190 0022 ≠ 02 02 1 ≠

ET01971 0240 0015 ≠ 13 02 2 ≠ ≠

DETAILED REFERRALS

ET5030

Triodes and Basic Triode Action

ET01980 Triode Components ED

ET01980 0190 0040 ≠ 02 02 1 ≠

ET01980 0225 0038 ≠ 13 02 2 ≠

ET01980 0195 0040 ≠ 13 02 2 ≠

ET01980 0245 0132,0145 ≠ 09 04 2 ≠

ET01980 0375 1056 ≠ 03 02 1 ≠

ET01980 0200 0007 ≠ 11 03 1 ≠ ≠

ET01990 Grid Action CP

ET01990 0190 0040 ≠ 02 02 1 ≠

ET01990 0225 0038 ≠ 13 02 1 ≠

ET01990 0195 0046 ≠ 13 02 1 ≠

ET01990 0240 0021 ≠ 13 02 1 ≠

ET01990 0205 0009 ≠ 11 02 1 ≠

ET01990 0375 1056 ≠ 03 02 1 ≠

ET01990 0200 0007 ≠ 11 03 1 ≠

ET01990 0241 0003, 0004 ≠ 13 02 1 ≠ ≠

ET02000 Grid Bias CP

ET02000 0190 0040 ≠ 02 02 1 ≠

ET02000 0225 0038 ≠ 13 02 1 ≠

ET02000 0195 0048 ≠ 13 02 1 ≠

ET02000 0375 1056,1076 ≠ 03 02 1 ≠

ET02000 0200 0064 ≠ 11 03 1 ≠

ET02000 0241 0010 ≠ 13 02 1 ≠ ≠

DETAILED REFERRALS
Triodes and Basic Triode Action

ET02010 Grid-Plate Relations AT, FD

ET02010 0190 0050 ≠ 02 02 2 ≠

ET02010 0225 0038 ≠ 13 02 2 ≠

ET02010 0240 0023 ≠ 13 02 1 ≠

ET02010 0195 0052 ≠ 13 02 2 ≠

ET02010 0205 0010 ≠ 11 02 1 ≠

ET02010 0245 0133 ≠ 09 04 1 ≠

ET02010 0375 1093 ≠ 03 02 1 ≠

ET02010 0200 0013 ≠ 11 03 1 ≠

ET02010 0241 0041 ≠ 13 02 1 ≠ ≠

ET02011 Grid-Plate Characteristic Curves AT FD

ET02011 0195 0054 ≠ 13 02 1 ≠

ET02011 0205 0017 ≠ 11 02 1 ≠

ET02011 0375 1078 ≠ 03 02 1 ≠

ET02011 0200 0013, 0020, 0022 ≠ 11 03 1 ≠

ET02011 0241 0038 ≠ 13 02 1 ≠ ≠

ET02020 Amplification Factor D LW

ET02020 0190 0056 ≠ 02 02 1 ≠

ET02020 0225 0043 ≠ 13 02 1 ≠

ET02020 0240 0026 ≠ 13 02 1 ≠

ET02020 0195 0060 ≠ 13 02 1 ≠

ET02020 0205 0010 ≠ 11 02 1 ≠

ET02020 0245 0137 ≠ 09 04 1 ≠

ET02020 0375 1148 ≠ 03 02 1 ≠

ET02020 0200 0013 ≠ 11 03 1 ≠

ET02020 0241 0032 ≠ 13 02 1 ≠ ≠

DETAILED REFERRALS
Triodes and Basic Triode Action

ET02030 DC Plate Resistance LW, AT

ET02030 0190 0064 ≠ 02, 02 1 ≠

ET02030 0225 0045 ≠ 13 02 1 ≠

ET02030 0195 0063 ≠ 13 02 1 ≠

ET02030 0205 0011 ≠ 11 02 1 ≠

ET02030 0375 1098 ≠ 03 02 1 ≠

ET02030 0200 ≠ 11 03 1 ≠

ET02030 0241 ≠ 13 02 1 ≠ ≠

ET02040 AC Plate Resistance LW, AT

ET02040 0190 0060 ≠ 02 02 1 ≠

ET02040 0225 0044 ≠ 13 02 1 ≠

ET02040 0240 0028 ≠ 13 02 1 ≠

ET02040 0195 0064 ≠ 13 02 1 ≠

ET02040 0205 0011 ≠ 11 02 1 ≠

ET02040 0245 0140 ≠ 09 04 1 ≠

ET02040 0375 1098 ≠ 03 02 1 ≠ ≠

ET02050 Transconductance D, LW

ET02050 0190 0056 ≠ 02 02 1 ≠

ET02050 0225 0045 ≠ 13 02 1 ≠

ET02050 0240 0031 ≠ 13 02 1 ≠

ET02050 0195 0065 ≠ 13 02 1 ≠

ET02050 0205 0011 ≠ 11 02 1 ≠

ET02050 0245 0139 ≠ 09 04 1 ≠

ET02050 0375 1148 ≠ 03 02 1 ≠

ET02050 0200 0014 ≠ 11 03 1 ≠

ET02050 0241 0033 ≠ 13 02 1 ≠ ≠

DETAILED REFERRALS
Triodes and Basic Triode Action

ET5030

ET02060 U; gm; rp Relationships AT LW

ET02060 0190 0061 ≠ 02 02 1 ≠

ET02060 0225 0046 ≠ 13 02 1 ≠

ET02060 0240 0067 ≠ 13 02 1 ≠

ET02060 0205 0011 ≠ 11 02 1 ≠

ET02060 0245 0140 ≠ 09 04 1 ≠

ET02060 0375 1148 ≠ 03 02 1 ≠

ET02060 0241 0032 ≠ 13 02 1 ≠ ≠

ET02070 E; I; R plate Circuit Relationships AT LW

ET02070 0190 0067 ≠ 02 02 1 ≠

ET02070 0240 0037 ≠ 13 02 1 ≠

ET02070 0195 0069 ≠ 13 02 1 ≠

ET02070 0205 0011 ≠ 11 02 1 ≠

ET02070 0245 0145 ≠ 09 04 1 ≠ ≠

ET02090 Phase CP AT LW

ET02090 0190 0068 ≠ 02 01 1 ≠

ET02090 0195 0121 ≠ 13 02 1 ≠

ET02090 0205 0017 ≠ 11 02 1 ≠

ET02090 0375 1155 ≠ 03 02 1 ≠

ET02090 0241 0004 ≠ 13 02 1 ≠ ≠

DETAILED REFERRALS
Triodes and Basic Triode Action

ET02100 Amplifier Action LW CP

ET02100 0190 0069 ≠ 02 02 1 ≠

ET02100 0240 0022 ≠ 13 02 1 ≠

ET02100 0195 0076 ≠ 13 02 1 ≠

ET02100 0205 0014 ≠ 11 02 1 ≠

ET02100 0375 1098 ≠ 03 02 1 ≠

ET02100 0200 0016 ≠ 11 03 1 ≠

ET02100 0241 0016 ≠ 13 02 1 ≠ ≠

ET02110 Load Line AT

ET02110 0190 0072 ≠ 02 02 1 ≠

ET02110 0240 0038 ≠ 13 02 2 ≠

ET02110 0195 0071 ≠ 13 02 1 ≠

ET02110 0205 0014 ≠ 11 02 1 ≠

ET02110 0245 0143 ≠ 09 04 1 ≠

ET02110 0375 1325 ≠ 03 02 1 ≠

ET02110 0200 0020, 0022 ≠ 11 03 1 ≠

ET02110 0241 0036 ≠ 13 02 1 ≠ ≠

ET02120 Gain D AT

ET02120 0190 0006, 0072 ≠ 02 02 1 ≠

ET02120 0225 0039 ≠ 13 02 1 ≠

ET02120 0195 0083 ≠ 13 02 1 ≠

ET02120 0205 0017 ≠ 11 02 1 ≠

ET02120 0375 1155 ≠ 03 02 1 ≠

ET02120 0241 0016 ≠ 11 02 1 ≠ ≠

ET02130 Biasing Methods ET

ET02130 0190 0079 ≠ 02 02 1 ≠

ET02130 0225 0039 ≠ 13 02 2 ≠

ET02130 0195 0081 ≠ 13 02 1 ≠

ET02130 0205 0017 ≠ 11 02 1 ≠

ET02130 0375 1367 ≠ 03 02 1 ≠

ET02130 0200 0064 ≠ 11 03 1 ≠

ET02130 0241 0010 ≠ 13 02 1 ≠ ≠

ET02140 Cathode Bias Circuit ED

ET02140 0190 0082 ≠ 02 02 1 ≠

ET02140 0375 1367 ≠ 03 02 1 ≠

ET02140 0200 0065 ≠ 11 03 1 ≠

ET02140 0241 0010 ≠ 13 02 1 ≠ ≠

ET02170 Grid Leak Biasing CP ED

ET02170 0190 0087 ≠ 02 02 1 ≠

ET02170 0375 1411 ≠ 03 02 1 ≠

ET02170 0200 0066 ≠ 11 03 1 ≠

ET02170 0241 0010 ≠ 13 02 1 ≠ ≠

ET02180 Interelectrode Capacitance CP LW PR

ET02180 0190 0088 ≠ 02 02 1 ≠

ET02180 0225 0050 ≠ 13 02 1 ≠

ET02180 0195 0081 ≠ 13 02 1 ≠

ET02180 0375 1523 ≠ 03 02 1 ≠

ET02180 0200 0078 ≠ 11 03 1 ≠ ≠

DETAILED REFERRALS
Basic Power Supplies

ET02190 Half Wave Rectifier CP ED

ET02190 0190 0380 ≠ 02 02 1 ≠

ET02190 0225 0324 ≠ 13 02 2 ≠

ET02190 0195 0005, 0145 ≠ 13 02 1 ≠

ET02190 0205 0005, 0034 ≠ 11 02 1 ≠

ET02190 0210 0002, 0011 ≠ 13 02 1 ≠

ET02190 0375 0638 ≠ 03 02 2 ≠ ≠

ET02200 Peak Inverse Voltage D LW

ET02200 0190 0384 ≠ 02 02 1 ≠

ET02200 0225 0328 ≠ 13 02 1 ≠

ET02200 0195 0140 ≠ 13 02 1 ≠

ET02200 0375 0680 ≠ 03 02 1 ≠ ≠

ET02210 Components ED

ET02210 0190 0380 ≠ 02 02 1 ≠

ET02210 0225 0352 ≠ 13 02 1 ≠

ET02210 0195 0015, 0144 ≠ 13 02 1 ≠

ET02210 0375 0778 ≠ 03 02 1 ≠ ≠

ET02220 Types of Half Wave Rectifiers ED

ET02220 0190 0380 ≠ 02 02 1 ≠

ET02220 0225 0326, 0338 ≠ 13 02 2 ≠

ET02220 0195 0005,0015,0144 ≠ 13 02 2 ≠

ET02220 0210 0056 ≠ 13 02 2 ≠

ET02220 0375 0778 ≠ 03 02 1 ≠ ≠

DETAILED REFERRALS
Basic Power Supplies

ET02230 Full Wave Rectifier ED CP

ET02230 0190 0386 ≠ 02 02 1 ≠

ET02230 0225 0329 ≠ 13 02 1 ≠

ET02230 0240 0005,0016,0146 ≠ 13 02 2 ≠

ET02230 0195 0015,0146 ≠ 13 02 1 ≠

ET02230 0210 0014 ≠ 13 02 1 ≠

ET02230 0205 0005,0065 ≠ 11 02 1 ≠

ET02230 0375 0654 ≠ 03 02 2 ≠ ≠

ET02240 Full Wave Bridge ED

ET02240 0225 0332 ≠ 13 02 1 ≠

ET02240 0210 0018 ≠ 13 02 1 ≠

ET02240 0375 0938 ≠ 03 02 2 ≠ ≠

ET02250 Ripple Frequency CP LW

ET02250 0190 0384 ≠ 02 02 1 ≠

ET02250 0225 0339 ≠ 13 02 1 ≠

ET02250 0375 0660 ≠ 03 02 2 ≠ ≠

ET02260 Transformer ED

ET02260 0190 0387 ≠ 02 02 1 ≠

ET02260 0225 0324 ≠ 13 02 1 ≠

ET02260 0195 0133 ≠ 13 02 1 ≠

ET02260 0180 0029 ≠ 13 02 2 ≠

ET02260 0375 0637 ≠ 03 02 1 ≠ ≠

DETAILED REFERRALS
Basic Power Supplies

ET02270 Diode Action CP LW

ET02270 0190 0390 ≠ 02 02 1 ≠

ET02270 0225 0326 ≠ 13 02 1 ≠

ET02270 0195 0015,0145 ≠ 13 02 1 ≠

ET02270 0205 0005 ≠ 11 02 1 ≠ ≠

ET02280 Filters ED CP

ET02280 0190 0390 ≠ 02 02 1 ≠

ET02280 0225 0338 ≠ 13 02 2 ≠

ET02280 0195 0144 ≠ 13 02 1 ≠

ET02280 0180 0031 ≠ 13 02 1 ≠

ET02280 0210 0040 ≠ 13 02 2 ≠

ET02280 0375 0708 ≠ 03 02 4 ≠ ≠

ET02290 Voltage Doubler ED CP

ET02290 0190 0392 ≠ 02 02 1 ≠

ET02290 0225 0333 ≠ 13 02 1 ≠

ET02290 0205 0037 ≠ 11 02 1 ≠

ET02290 0210 0021 ≠ 13 02 1 ≠

ET02290 0375 0928 ≠ 03 02 2 ≠ ≠

ET02300 Voltage Multiplier Circuits ED

ET02300 0225 0337 ≠ 13 02 1 ≠

ET02300 0195 0127 ≠ 13 02 1 ≠

ET02300 0210 0021 ≠ 13 02 2 ≠ ≠

ET02305 Voltage Divider Circuits ED

ET02305 0375 0773,0919 ≠ 03 02 2 ≠ ≠

DETAILED REFERRALS
Basic Power Supplies

ET02310 Voltage Regulation CP ED

ET02310 0200 0030 ≠ 11 03 1 ≠

ET02310 0375 0879,0956 ≠ 03 02 3 ≠ ≠

ET02320 Current Regulation CP ED

ET02320 0200 0031 ≠ 11 03 1 ≠ ≠

ET02330 Tetrode Components ED

ET02330 0190 0093 ≠ 02 02 1 ≠

ET02330 0255 0049 ≠ 09 04 1 ≠

ET02330 0195 0086 ≠ 13 02 1 ≠

ET02330 0240 0054 ≠ 13 02 1 ≠

ET02330 0375 1528 ≠ 03 02 1 ≠ ≠

ET02340 Interelectrode Capacitance CP LW

ET02340 0190 0093 ≠ 02 02 1 ≠

ET02340 0255 0049 ≠ 09 04 1 ≠

ET02340 0195 0086 ≠ 13 02 1 ≠

ET02340 0240 0054 ≠ 13 02 1 ≠

ET02340 0375 1523 ≠ 03 02 1 ≠ ≠

ET02350 Tetrode Circuit ED

ET02350 0190 0094 ≠ 02 02 1 ≠

ET02350 0255 0050 ≠ 09 04 1 ≠

ET02350 0195 0088 ≠ 13 02 1 ≠

ET02350 0240 0055 ≠ 13 02 1 ≠

ET02350 0375 1540 ≠ 03 02 1 ≠ ≠

ET02360 Screen Grid Action CP LW

ET02360 0190 0096 ≠ 02 02 1 ≠

ET02360 0255 0051 ≠ 09 04 1 ≠

ET02360 0240 0055 ≠ 13 02 1 ≠

ET02360 1375 1528 ≠ 03 02 1 ≠ ≠

ET02370 I_b - E_b Curve AT
ET02370 0190 0099, 0101 ≠ 02 02 1 ≠
ET02370 0255 0052 ≠ 09 04 1 ≠
ET02370 0195 0089 ≠ 13 02 1 ≠
ET02370 0140 0057 ≠ 13 02 1 ≠
ET02370 0375 1528 ≠ 03 02 1 ≠ ≠

ET02380 Secondary Emission PR LW CP
ET02380 0190 0100 ≠ 02 02 1 ≠
ET02380 0255 0052 ≠ 09 04 1 ≠
ET02380 0195 0090 ≠ 13 02 1 ≠
ET02380 0140 0057 ≠ 13 02 1 ≠
ET02380 0375 1528 ≠ 03 02 1 ≠ ≠

ET02390 Amplifying Action CP LW
ET02390 0190 0102 ≠ 02 02 1 ≠
ET02390 0255 0053 ≠ 09 04 1 ≠
ET02390 0195 0091 ≠ 13 02 1 ≠
ET02390 0240 0056 ≠ 13 02 1 ≠
ET02390 0375 1528 ≠ 03 02 1 ≠ ≠

ET02400 Pentode Construction ED ET
ET02400 0190 0104 ≠ 02 02 1 ≠
ET02400 0255 0053 ≠ 09 04 1 ≠
ET02400 0195 0093 ≠ 13 02 1 ≠
ET02400 0240 0059 ≠ 13 02 1 ≠
ET02400 0375 1554 ≠ 03 02 1 ≠ ≠

ET02410 Action of Suppressor Grid CP LW

ET02410 0190 0104 ≠ 02 02 1 ≠

ET02410 0255 0053 ≠ 09 04 1 ≠

ET02410 0195 0093 ≠ 13 02 1 ≠

ET02410 0240 0059 ≠ 13 02 1 ≠

ET02410 0375 1554 ≠ 03 02 1 ≠ ≠

ET02420 Dynatron ED

ET02420 0190 0105 ≠ 02 02 1 ≠

ET02420 0195 0095 ≠ 13 02 1 ≠ ≠

ET02430 $I_b - E_b$ (Pentrode) Curve AT

ET02430 0190 0106 ≠ 02 02 1 ≠

ET02430 0255 0054 ≠ 09 04 1 ≠

ET02430 0195 0095 ≠ 13 02 1 ≠

ET02430 0240 0060 ≠ 13 02 1 ≠

ET02430 0375 1554 ≠ 03 02 1 ≠ ≠

ET02440 Amplification (Pentode) CP LW

ET02440 0190 0108 ≠ 02 02 1 ≠

ET02440 0255 0055 ≠ 09 04 1 ≠

ET02440 0195 0096 ≠ 13 02 1 ≠

ET02440 0240 0061 ≠ 13 02 1 ≠

ET02440 0375 1554 ≠ 03 01 1 ≠ ≠

ET02450 Amplification (General) CP LW

ET02450 0190 0110 ≠ 02 02 1 ≠ ≠

DETAILED REFERRALS
Tetrodes; Pentodes

ET02460 Amplifier Circuit (Pentode) ED

ET02460 0190 0114 ≠ 02 02 1 ≠

ET02460 0195 0094 ≠ 13 02 1 ≠

ET02460 0375 1554 ≠ 03 02 1 ≠ ≠

ET02470 Cutoff Action CP LW

ET02470 0190 0119 ≠ 02 02 1 ≠

ET02470 0255 0056 ≠ 09 04 1 ≠

ET02470 0195 0099 ≠ 13 02 1 ≠ ≠

ET02480 Action as a Current Source LW CP

ET02480 0190 0120 ≠ 02 02 1 ≠ ≠

ET02490 Pentodes as Triodes ET

ET02490 0195 0103 ≠ 13 02 1 ≠ ≠

ET02500 Variable mu Tubes ED

ET02500 0255 0055 ≠ 09 04 1 ≠

ET02500 0195 0103 ≠ 13 02 1 ≠ ≠

ET02510 Beam Power Tube ED

ET02510 0255 0056 ≠ 09 04 1 ≠

ET02510 0195 0103 ≠ 13 02 1 ≠

ET02510 0240 0067 ≠ 13 02 1 ≠ ≠

ET02520 Power Amplifier Tubes ED
ET02520 0190 0124 ≠ 02 02 1 ≠
ET02520 0195 0127 ≠ 13 02 1 ≠
ET02520 0205 0015 ≠ 11 02 1 ≠
ET02520 0241 0045 ≠ 13 02 1 ≠ ≠

ET02530 Transducer ED CP
ET02530 0190 0124 ≠ 02 02 1 ≠ ≠

ET02540 Transfer Characteristics AT
ET02540 0190 0127 ≠ 02 02 3 ≠ ≠

ET02550 Distortion PE LW
ET02550 0190 0130 ≠ 02 02 2 ≠
ET02550 0255 0256 ≠ 09 04 2 ≠
ET02550 0195 0111 ≠ 13 02 1 ≠
ET02550 0205 0018 ≠ 11 02 1 ≠
ET02550 0241 0016 ≠ 13 02 1 ≠ ≠

ET02560 Clipped Peak Distortion CP LW
ET02560 0190 0132 ≠ 02 02 1 ≠
ET02560 0195 0115 ≠ 13 02 1 ≠ ≠

ET02570 Power Output AT CP LW
ET02570 0190 0137 ≠ 02 02 1 ≠
ET02570 0255 0246 ≠ 09 04 1 ≠
ET02570 0241 0016, 0054 ≠ 13 02 1 ≠ ≠

DETAILED REFERRALS
Power Amplifiers

ET02580 Matched Impedance D PF LW

ET02580 0190 0142 ≠ 02 02 1 ≠

ET02580 0255 0237 ≠ 09 04 1 ≠ ≠

ET02590 Power Sensitivity D CP

ET02590 0190 0145 ≠ 02 02 1 ≠

ET02590 0255 0250, 0264 ≠ 09 04 1 ≠ ≠

ET02600 Power Pentode ED

ET02600 0190 0147 ≠ 02 02 1 ≠

ET02600 0255 0253 ≠ 09 04 1 ≠

ET02600 0241 0054 ≠ 13 02 1 ≠ ≠

ET02610 I_b - E_b Curve (Power Pentode) AT

ET02610 0190 0149 ≠ 02 02 1 ≠

ET02610 0255 0254 ≠ 09 04 1 ≠ ≠

ET02620 Beam Power Tube ED

ET02620 0190 0150 ≠ 02 02 1 ≠

ET02620 0255 0262 ≠ 09 04 1 ≠ ≠

ET02630 I_b-E_b Curve (Beam Power Tube) AT

ET02630 0190 0151 ≠ 02 02 1 ≠

ET02630 0255 0266 ≠ 09 04 1 ≠ ≠

Power Amplifiers

ET02640 Class A1 Operation D AT
ET02640 0190 0130, 0135, 0156 02 02 2 ≠
ET02640 0255 0236, 0243, 0261 ≠ 09 04 2 ≠
ET02640 0195 0112 ≠ 13 02 1 ≠
ET02640 0205 0042 ≠ 11 02 1 ≠
ET02640 0241 0047 ≠ 13 02 1 ≠ ≠

ET02650 Cutoff Bias (A1) AT LW
ET02650 0190 0157 ≠ 02 02 1 ≠
ET02650 0255 0261 ≠ 09 04 1 ≠
ET02650 0195 0113 ≠ 13 02 1 ≠
ET02650 0205 0042 ≠ 11 02 1 ≠
ET02650 0241 0048 ≠ 13 02 1 ≠ ≠

ET02660 Class B Operation D AT
ET02660 0190 0158 ≠ 02 02 1 ≠
ET02660 0255 0236, 0276 ≠ 09 04 1 ≠
ET02660 0195 0112 ≠ 13 02 1 ≠
ET02660 0241 0047 ≠ 13 02 1 ≠ ≠

ET02670 Efficiency D AT
ET02670 0190 0160 ≠ 02 02 1 ≠
ET02670 0255 0248 ≠ 09 04 1 ≠
ET02670 0241 0055 ≠ 13 02 1 ≠ ≠

DETAILED REFERRALS
Power Amplifiers

ET5030

ET02680 Push-Pull Operation D ET
ET02680 0190 0162 ≠ 02 02 1 ≠
ET02680 0255 0237, 0268 ≠ 09 04 1 ≠
ET02680 0195 0116 ≠ 13 02 1 ≠
ET02680 0205 0065 ≠ 11 02 1 ≠
ET02680 0241 0057 ≠ 13 02 1 ≠ ≠

ET02690 Class C Operation AT D
ET02690 0190 0164 ≠ 02 02 1 ≠
ET02690 0255 0236 ≠ 09 04 1 ≠
ET02690 0195 0116, 0125 ≠ 13 02 1 ≠
ET02690 0241 0050 ≠ 13 02 1 ≠ ≠

ET02700 Cutoff Bias AT LW
ET02700 0190 0164 ≠ 02 02 1 ≠
ET02700 0195 0112 ≠ 13 02 1 ≠ ≠

ET02710 R - F Amplification CP
ET02710 0190 0166 ≠ 02 02 1 ≠ ≠

ET02720 Maximum Power Transfer LW PF
ET02720 0255 0244 ≠ 09 04 1 ≠ ≠

ET02730 AB Operation D AT
ET02730 0190 0156 ≠ 02 02 1 ≠
ET02730 0195 0114 ≠ 13 02 1 ≠ ≠

DETAILED REFERRALS

Power Amplifiers

ET02740 Phase Relations CP LW

ET02740 0190 0157 ≠ 02 02 1 ≠

ET02740 0195 0120 ≠ 13 02 1 ≠ ≠

DETAILED REFERRALS
Amplifier Classes

ET02750 Class A1 Amplifier ED AT

ET02750 0190 0156 ≠ 02 02 1 ≠

ET02750 0195 0112 ≠ 13 02 1 ≠

ET02750 0255 0129 ≠ 09 04 4 ≠

ET02750 0200 0015,0016 ≠ 11 03 3 ≠

ET02750 0205 0041 ≠ 11 02 2 ≠ ≠

ET02760 Class B Amplifier ED AT

ET02760 0190 0157 ≠ 02 02 1 ≠

ET02760 0195 0112 ≠ 12 02 1 ≠

ET02760 0255 0129 ≠ 09 04 1 ≠

ET02760 0200 0015, 0028 ≠ 11 03 2 ≠ ≠

ET02770 Class A and Class B Compared AT FD

ET02770 0190 0159 ≠ 02 02 2 ≠ ≠

ET02780 Class AB Amplifier ED AT

ET02780 0195 0114 ≠ 13 02 1 ≠

ET02780 0255 0129 ≠ 09 04 1 ≠

ET02780 0200 0015, 0024 ≠ 11 03 2 ≠ ≠

ET02790 Class B Push Pull Power Amp AT ED

ET02790 0190 0161 ≠ 02 02 2 ≠

ET02790 0195 0116 ≠ 13 02 2 ≠

ET02790 0255 0276 ≠ 09 04 2 ≠

ET02790 0205 0065 ≠ 11 02 1 ≠ ≠

DETAILED REFERRALS
Amplifier Classes

ET5030

ET02800 Class C Amplifier ED AT

ET02800 0190 0164 ≠ 02 02 1 ≠

ET02800 0195 0116 ≠ 13 02 1 ≠

ET02800 0255 0129 ≠ 09 04 1 ≠

ET02800 0200 0015 ≠ 11 03 1 ≠ ≠

DETAILED REFERRALS
Audio Amplifiers, Coupling and Controls

ET02810 R-C Coupling ED

ET02810 0190 0167, 0170 ≠ 02 02 2 ≠

ET02810 0195 0127 ≠ 13 02 2 ≠

ET02810 0255 0172 ≠ 09 04 3 ≠

ET02810 0205 0043 ≠ 11 02 1 ≠ ≠

ET02820 Impedance Coupling ED

ET02820 0190 0169 ≠ 02 02 1 ≠

ET02820 0195 0132 ≠ 13 02 1 ≠

ET02820 0255 0188 ≠ 09 04 2 ≠ ≠

ET02830 Transformer Coupling ED

ET02830 0190 0171 ≠ 02 02 1 ≠

ET02830 0195 0133 ≠ 13 02 1 ≠

ET02830 0255 0194 ≠ 09 04 2 ≠ ≠

ET02840 Volume Controls ED

ET02840 0190 0172 ≠ 02 02 2 ≠

ET02840 0205 0045 ≠ 11 02 1 ≠ ≠

ET02850 Potentiometer at input grid ED

ET02850 0190 0173 ≠ 02 02 1 ≠ ≠

ET02860 Cathode Bias Adjustment ED

ET02860 0190 0175 ≠ 02 02 1 ≠ ≠

ET02870 Screen Grid Voltage Control ED

ET02870 0190 0176 ≠ 02 02 1 ≠ ≠

Audio Amplifiers, Coupling and Controls

ET02880 Tone Controls ED

ET02880 0200 0036 ≠ 11 03 1 ≠ ≠

ET02890 Audio Frequency Range Defined DF, ET

ET02890 0190 0180 ≠ 02 02 1 ≠

ET02890 0255 0162 ≠ 09 04 1 ≠

ET02890 0205 0043, 0068 ≠ 11 03 2 ≠ ≠

ET02900 Frequency vs. Amplitude Curves AT

ET02900 0190 0181 ≠ 02 02 1 ≠

ET02900 0255 0187 ≠ 09 04 1 ≠ ≠

ET02910 Specifying Amplifier/Generator Response FD, AT

ET02910 0190 0182 ≠ 02 02 2 ≠

ET02910 0205 0068 ≠ 11 02 1 ≠ ≠

ET02920 Amplifier Equivalent Circuit ED AT

ET02920 0190 0187 ≠ 02 02 1 ≠

ET02920 0195 0130 ≠ 13 02 1 ≠

ET02920 0255 0173 ≠ 09 04 3 ≠

ET02920 0205 0044 ≠ 11 02 1 ≠ ≠

ET02930 Response Determining Elements FD, ET, AT

ET02930 0190 0188 ≠ 02 02 2 ≠

ET02930 0255 0174 ≠ 09 04 4 ≠ ≠

ET02940 Amp Response Compensation ET AT

ET02940 0190 0191 ≠ 02 02 1 ≠ ≠

DETAILED REFERRALS
Audio Amplifiers, Coupling and Controls ET5030

ET02950 Transformer Coupled Audio Amp ED

ET02950 0190 0193 ≠ 02 02 1 ≠

ET02950 0255 0194 ≠ 09 04 2 ≠ ≠

ET02960 Equivalent Circuit And Response Analysis ED, AT

ET02960 0190 0196 ≠ 02 02 2 ≠

ET02960 0195 0134 ≠ 13 02 1 ≠ ≠

DETAILED REFERRALS
Wideband and R-F Amplifiers

ET02970 Low Frequency Compensation AT, ET

ET02970 0190 0203 ≠ 02 02 2 ≠ ≠

ET02980 Compensation by Plate Load ET AT

ET02980 0190 0203 ≠ 02 02 1 ≠ ≠

ET02990 Compensation by Coupling Network ET AT

ET02990 0190 0204 ≠ 02 02 1 ≠ ≠

ET03100 Compensation by Cathode Circuit ET AT

ET03100 0190 0205 ≠ 02 02 1 ≠ ≠

ET03110 High Frequency Compensation ET AT

ET03110 0190 0206 ≠ 02 02 3 ≠ ≠

ET03120 Compensation by Shunt Peaking ET AT

ET03120 0190 0207 ≠ 02 02 1 ≠ ≠

ET03130 Compensation by Series Peaking ET AT

ET03130 0190 0208 ≠ 02 02 1 ≠ ≠

ET03140 Compensation by Combination Peaking ET AT

ET03140 0190 0210 ≠ 02 02 1 ≠ ≠

ET03150 R-F Spectrum DF

ET03150 0190 0214 ≠ 02 02 1 ≠ ≠

DETAILED REFERRALS
Wideband and R-F Amplifiers

ET5030

ET03160 Frequency Selection by Resonance Tuning ED

ET03160 0190 0216 ≠ 02 02 1 ≠ ≠

ET03170 R-F Transformer Coupling ED

ET03170 0190 0218 ≠ 02 02 1 ≠ ≠

ET03180 Selectivity and Q AT DF

ET03180 0190 0220 ≠ 02 02 1 ≠ ≠

ET03190 Bandwidth AT

ET03190 0190 0221 ≠ 02 02 1 ≠ ≠

ET03200 Carrier and Sidebands CP

ET03200 0190 0222 ≠ 02 02 1 ≠ ≠

ET03210 R-F Amp. Response Curves

ET03210 0190 0226 ≠ 02 02 1 ≠ ≠

ET03220 Adjusting Response Curves

ET03220 0190 0228 ≠ 02 02 ≠ ≠

DETAILED REFERRALS
Cathode Followers

ET03230 Low Impedance Matching ED

ET03230 0190 0234 ≠ 02 02 1 ≠

ET03230 0255 0206 ≠ 09 04 1 ≠

ET03230 0200 0032 ≠ 11 03 1 ≠ ≠

ET03240 For Isolation ED

ET03240 0200 0032 ≠ 11 03 1 ≠ ≠

ET03250 Voltage Gain AT ET

ET03250 0190 0236 ≠ 02 02 1 ≠

ET03250 0255 0202 ≠ 09 04 1 ≠

ET03250 0200 0032 ≠ 11 03 1 ≠ ≠

ET03260 Power Gain AT ET

ET03260 0190 0238 ≠ 02 02 1 ≠ ≠

ET03270 Phase Relations AT FD

ET03270 0190 0239 ≠ 02 02 2 ≠

ET03270 0255 0202 ≠ 09 04 1 ≠ ≠

DETAILED REFERRALS
Oscillators

ET03280 Mechanical Oscillation

ET03280 0190 0246, 0250 ≠ 0202 2 ≠

ET03280 0205 0080 ≠ 11 02 1 ≠ ≠

ET03290 Displacement Plotted vs Time AT

ET03290 0190 0248 ≠ 02 02 1 ≠ ≠

ET03300 Measurement of Energy AT ET

ET03300 0190 0251 ≠ 02 02 1 ≠

ET03300 0255 0304 ≠ 09 04 1 ≠ ≠

ET03310 Condition for Electrical Oscillation FD

ET03310 0190 0253 ≠ 02 02 1 ≠

ET03310 0255 0290 ≠ 09 04 1 ≠

ET03310 0205 0081 ≠ 11 02 1 ≠ ≠

ET03320 Sustained Oscillations ET, AT CP

ET03320 0190 0252 ≠ 02 02 1 ≠ ≠

ET03330 Use of Feedback ET AT

ET03330 0190 0252 ≠ 02 02 1 ≠ ≠

ET 03340 Oscillation in an L-C Circuit CP

ET03340 0190 0253 ≠ 02 02 2 ≠

ET03340 0195 0155 ≠ 13 02 1 ≠

ET03340 0255 0291 ≠ 09 04 1 ≠

ET03340 0205 0080 ≠ 11 02 1 ≠ ≠

Oscillators

ET03350 Feedback in the L-C Circuit ED, AT
ET03350 0190 0258 ≠ 02 02 2 ≠
ET03350 0195 0157 ≠ 13 02 1 ≠ ≠

ET03360 Tickler Coil ED
ET03360 0190 0260 ≠ 02 02 1 ≠
ET03360 0255 0294 ≠ 09 04 1 ≠ ≠

ET03370 Effects of Bias CP, ET, AT
ET03370 0190 0262 ≠ 02 02 1 ≠
ET03370 0255 0295 ≠ 09 04 2 ≠ ≠

ET03380 Armstrong (L-C Tickler Coil) Oscillator ED
ET03380 0190 0265 ≠ 02 02 3 ≠
ET03380 0195 0159 ≠ 13 02 1 ≠ ≠

ET03390 Shunt Fed Armstrong Oscillator ED
ET03390 0190 0267 ≠ 02 02 1 ≠ ≠

ET03410 Hartley Oscillator (Shunt and Series) ED
ET03410 0190 0268 ≠ 02 02 1 ≠
ET03410 0195 0160 ≠ 13 02 1 ≠
ET03410 0255 0297 ≠ 09 04 1 ≠
ET03410 0205 0080 ≠ 11 02 2 ≠ ≠

DETAILED REFERRALS
Oscillators

ET03420 Colpitts Oscillator ED

ET03420 0190 0272 ≠ 02 02 1 ≠

ET03420 0195 0160 ≠ 13 02 1 ≠

ET03420 0255 0299 ≠ 09 04 1 ≠ ≠

ET03430 Tuned Plate-Tuned Grid Oscillator ED

ET03430 0190 0274 ≠ 02 02 2 ≠

ET03430 0195 0160 ≠ 13 02 1 ≠

ET03430 0255 0300 ≠ 09 04 1 ≠ ≠

ET03440 Formula For Frequency of Oscillation AT

ET03440 0190 0277 ≠ 02 02 1 ≠

ET03440 0255 0303 ≠ 09 04 1 ≠

ET03440 0205 0081 ≠ 11 02 1 ≠ ≠

ET03450 Other Factors Affecting the Frequency F D

ET03450 0191 0278 ≠ 02 02 1 ≠

ET03450 0255 0308 ≠ 09 04 1 ≠ ≠

ET03460 Crystal Oscillators ED

ET03460 0190 0281 ≠ 02 02 3 ≠

ET03460 0195 0162 ≠ 13 02 1 ≠ ≠

ET03470 Piezo electric Effect CP LW

ET03470 0190 0281 ≠ 02 02 1 ≠

ET03470 0255 0310 ≠ 09 04 1 ≠ ≠

ET03480 Properties of Crystals FD, LW, CP

ET03480 0190 0282 ≠ 09 02 1 ≠ ≠

DETAILED REFERRALS
Oscillators

ET03490 Frequency, Cuts, Temp. Effects AT, FD

ET03490 0190 0283 ≠ 02 02 2 ≠

ET03490 0255 0310 ≠ 09 04 1 ≠ ≠

ET03500 Behavior of Crystals in Oscillator Circuits ET FD

ET03500 0190 0290 ≠ 02 02 1 ≠ ≠

ET03510 Equivalent Circuits ED AT

ET03510 0190 0290 ≠ 02 02 1 ≠ ≠

ET03520 Q of a Crystal DF CP

ET03520 0190 0293 ≠ 02 02 1 ≠ ≠

ET03530 Crystal Controlled Oscillator Circuits ED

ET03530 0190 0294 ≠ 02 02 1 ≠

ET03530 0255 0313 ≠ 09 04 3 ≠ ≠

ET03540 Elements of Communication BG, FD

ET03540 0190 0299 ≠ 02 02 1 ≠

ET03540 0195 0148 ≠ 13 02 1 ≠

ET03540 0255 0001 ≠ 09 04 1 ≠ ≠

ET03550 Transmitting Intelligence ET, BG

ET03550 0190 0300 ≠ 02 02 1 ≠

ET03550 0195 0149 ≠ 13 02 1 ≠

ET03550 0205 0075 ≠ 11 02 1 ≠

ET03550 0255 0013 ≠ 09 04 2 ≠ ≠

ET03560 Amplitude Modulation DF, CP AT

ET03560 0190 0302 ≠ 02 02 1 ≠

ET03560 0195 0150 ≠ 13 02 1 ≠

ET03560 0205 0075 ≠ 11 02 1 ≠

ET03560 0255 0008 ≠ 09 04 2 ≠ ≠

ET03570 Methods of Amplitude Modulating ET ED

ET03570 0190 0304 ≠ 02 02 2 ≠

ET03570 0205 0076 ≠ 11 02 1 ≠ ≠

ET03580 Circuits for Transmitting Intelligence. Problems ED, AT

ET03580 0190 0307 ≠ 02 02 1 ≠ ≠

ET03590 Oscillator - Amplifier Coupling ED

ET03590 0190 0309 ≠ 02 02 2 ≠ ≠

ET03600 Capacitance Coupling ED

ET03600 0190 0309 ≠ 02 02 1 ≠ ≠

DETAILED REFERRALS
Modulation and Detection

ET5030

ET03610 Inductive Coupling ED

ET03610 0190 0311 ≠ 02 02 1 ≠ ≠

ET03620 Link (Transmission Line) Coupling ED

ET03620 0190 0314 ≠ 02 02 1 ≠ ≠

ET03630 Description of Detection BG CP

ET03630 0190 0324 ≠ 02 02 1 ≠
ET03630 0195 0150 ≠ 13 02 1 ≠
ET03630 0205 0076 ≠ 11 02 1 ≠
ET03630 0200 0045 ≠ 11 03 1 ≠
ET03630 0255 0022, 0068 ≠ 09 04 1 ≠ ≠

ET03640 Detection Devices ED

ET03640 0190 0327 ≠ 02 02 4 ≠
ET03640 0195 0151 ≠ 13 02 2 ≠ ≠

ET03650 Diode Detectors ED

ET03650 0190 0327 ≠ 02 02 1 ≠
ET03650 0195 0151 ≠ 13 02 1 ≠
ET03650 0205 0076 ≠ 11 02 1 ≠
ET03650 0200 0045 ≠ 11 03 1 ≠
ET03650 0255 0069 ≠ 09 04 3 ≠ ≠

ET03660 Plate Detectors ED

ET03660 0190 0331 ≠ 02 02 1 ≠
ET03660 0195 0152 ≠ 13 02 1 ≠
ET03660 0255 0074 ≠ 09 04 3 ≠ ≠

DETAILED REFERRALS
Modulation and Detection

ET5030

ET03670 Grid Leak Detectors ED

ET03670 0190 0334 ≠ 02 02 1 ≠

ET03670 0195 0152 ≠ 13 02 1 ≠

ET03670 0200 0047 ≠ 11 03 1 ≠

ET03670 0255 0081 ≠ 09 04 2 ≠ ≠

NEW YORK INSTITUTE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY

5030

DIAGNOSTIC QUESTIONS

Book III

NEW YORK INSTITUTE OF TECHNOLOGY

ELECTRICAL TECHNOLOGY

Project Director	Bertram Spector, Ph.D. Dean of Academic Affairs
Project Coordinator and Author	John Luther Assistant Professor of Educational Research and Electrical Technology

COMPUTER CURRICULUM ANALYSIS
NYIT PRESS

ET01790 Thermionic emission will take place only if:

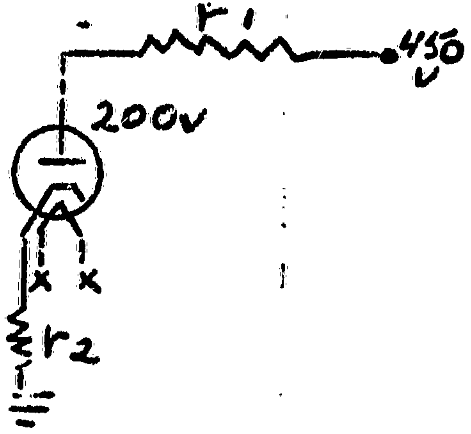
1.
1) there is a large potential difference between the plate and the cathode.
2) the cathode is heated.
3) there is a large positive voltage on the plate.

ET01810 One advantage of tungsten as a filament material is:

2.
1) it requires higher temperatures than other filament metals.
2) it has a high electron affinity.
3) it requires lower temperatures than other emitter metals.
4) it has a long life.

ET01830 Given the circuit below, and a plate current of 100 ma, find the value of r.

3.
1) 400Ω
2) 25.k
3) 2.5k
4) cannot be determined without the value of r_2.



ET01850 Which is not an advantage of a twin diode?

4.
1) only one tube is needed for full wave rectification.
2) they can handle more current than a similar single diode.
3) they can handle more voltage than a similar single diode.
4) they take up less space than two single diodes.

ET01861 Which statement best describes what happens in a gas-filled diode when the load current goes up?

5.
1) the output voltage goes up.
2) the output voltage goes down.
3) the output voltage remains constant.
4) the output voltage goes up and then down.

ET01880

6\. If the input voltage wave shape over 1 period in the circuit below looks like figure 1, then what does the wave shape of the current in R look like?

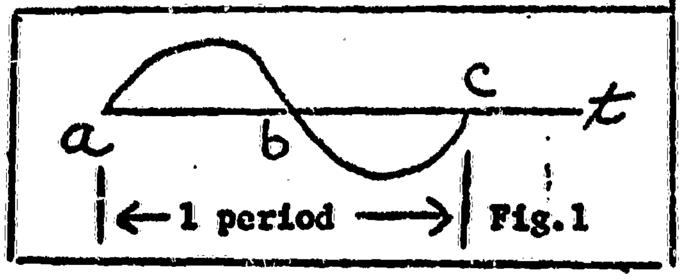
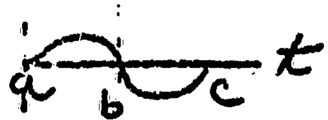
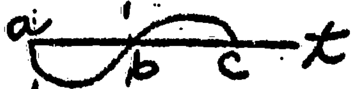


Fig.1

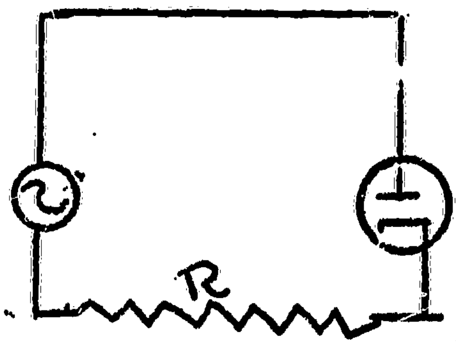
Input Voltage

1)


2)


3)


4)

ET01900

7\. A metal with a high work function will

1) emit electrons freely at relatively low temperatures.

2) will be a good thermionic emission material at all temperatures.

3) not emit electrons freely at relatively low temperatures.

4) will be a good thermionic emission material if it has a high melting and vaporization point.

ET01920

8\. Choose the answer that will make the statement correct. The cloud of electrons near the _____ is called the _______.

1) filament, positive charge.

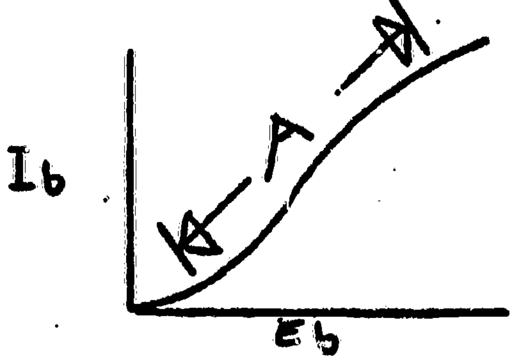
2) plate, space charge.

3) filament, space charge.

4) plate, field emission.

ET01940

9\.



Diode Characteristic

In the region labeled A the Plate current is limited by

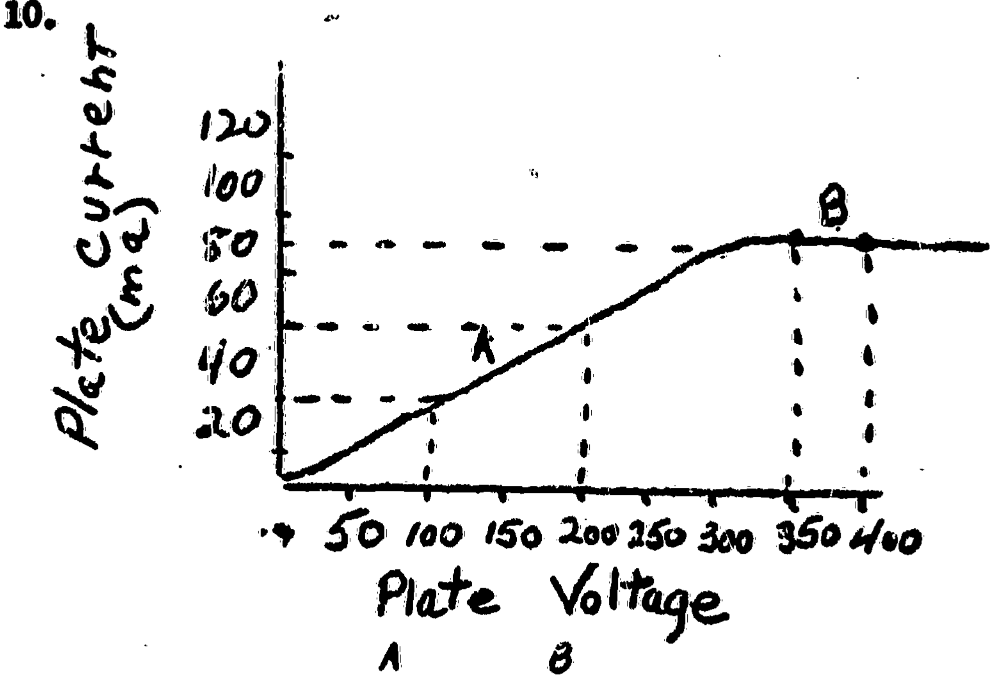
1) a negative space charge

2) emission saturation

3) secondary emission

ET01960 Find the AC Plate resistance in region A and B.

10.



	A	B
1)	500	625 Ω
2)	.5	0
3)	5k	∞
4)	5k	625Ω

ET01971 Zener diodes are:

11.

1) used with only high currents

2) used in place of triodes in radios

3) used to furnish a constant D.C. reference voltage

4) used because of their repeatable forward conduction characteristics

ET01800 Which is not a definition of secondary emission?

1.

1) The detaching of electrons from a body as a result of being bombarded from another source.

2) The emission of electrons that occurs due to a high potential difference between the plate and the cathode.

3) The emission of electrons due to the impact energy of light rays.

4) The imparting of sufficient energy to electrons within a metal to enable them to break through the potential barrier.

ET01820 When several filaments are connected in series

2.

1) the current rating of each must be the same

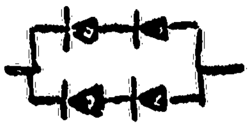
2) the voltage rating of each must be the same

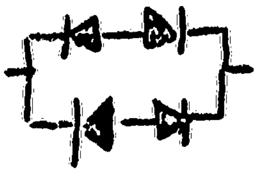
3) the power rating of each must be the same

ET01840 If one diode can rectify .5 amps at 100 volts, how would you connect 4 diodes to handle 200 volts at 1 amp?

3.

1) 

2) 

3) 

4) 

ET01860 Which statement best describes what happens in a high vacuum diode when the load current goes up?

4.

1) the plate voltage goes up

2) the plate voltage goes down

3) the plate voltage remains the same

4) the plate voltage goes up and then levels off

ET01870

5. A half-wave rectifier is connected across a 60 cps, 120 volts rms line. If there is zero voltage drop across the diode, and a resistive load, then the voltage measured across the load with a d-c meter is

1) 38.2

2) 53.5

3) 76.3

4) 107 v

ET01890

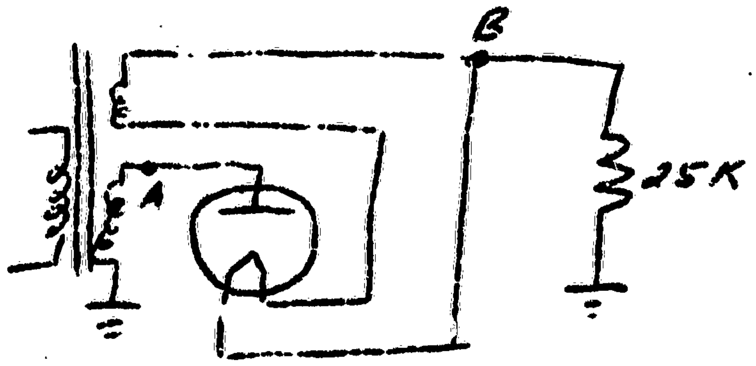
6. What are the polarities of points A and B with respect to ground when the tube conducts?

1) A+ B-

2) A- B+

3) A+ B+

4) A- B-



ET01910

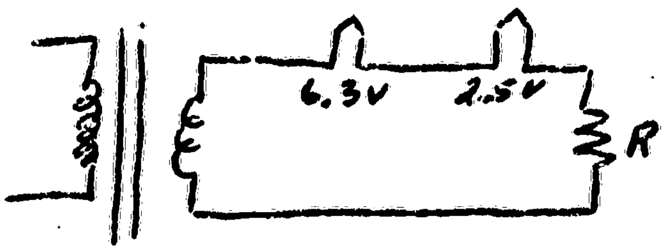
7. Given a current of 400 ma in the circuit below, find the value of R

1) 10.6 ohms

2) 9.5 ohms

3) 3.8 ohms

4) 2.5 ohms



Primary = 110 v
Secondary = 12.6 v

ET01930

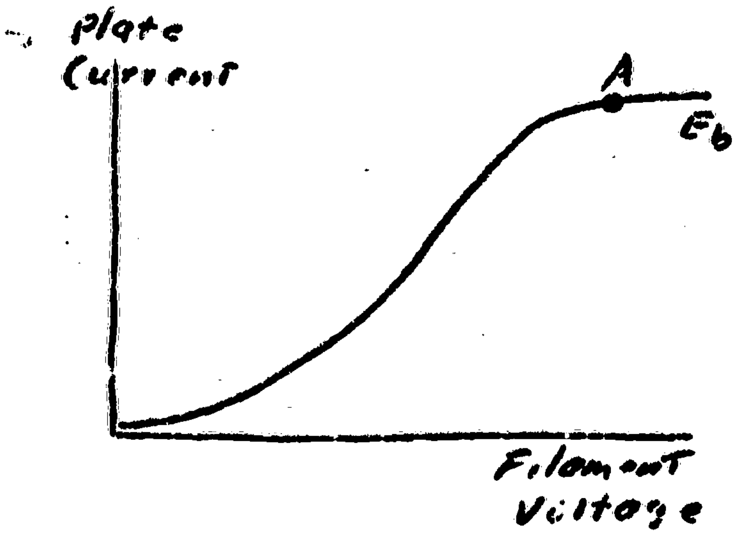
8. For the curve given below, what is the name given to the value of the current at point A?

1) Emission current

2) Quiescent current

3) Peak inverse current

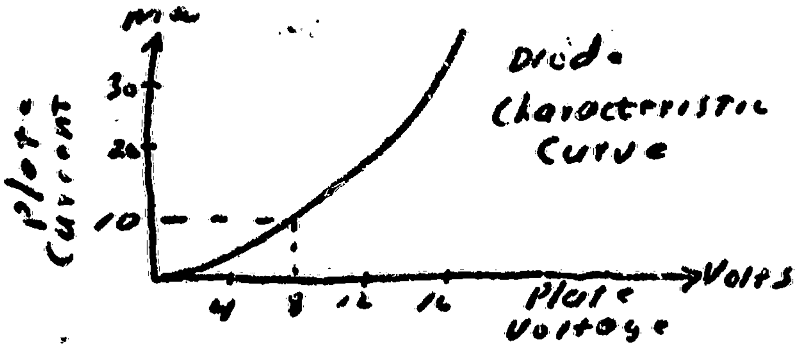
4) Saturation current



ET01950 Find the de plate resistance at point A

9.

1) -66 ohms
2) -8Ω
3) 800Ω
4) 666.6Ω



ET01970 The back resistance of a crystal diode is usually in the order of:

10.

1) 0Ω
2) 500Ω
3) 10,000Ω
4) 1,000,000Ω

ET01980 Metals commonly used for grids do not include:

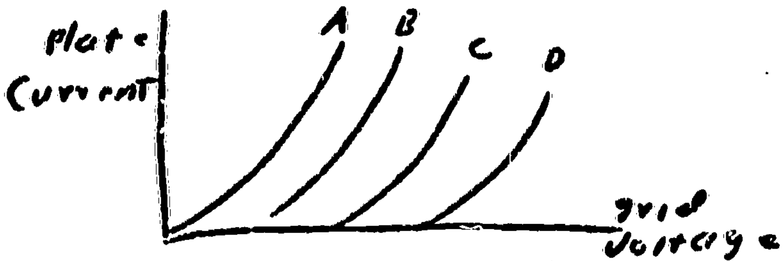
1.
1) nichrome
2) iron
3) copper
4) nickel
5) molybendum

ET02000 Current will flow in the grid circuit only ___

2.
1) if the grid is positive
2) if the grid is negative
3) if the grid is neutral

ET02011 Curves A, B, C and D correspond to different

3.
1) grid voltage
2) plate current
3) plate voltage



ET02040 The A-C plate resistance of a triode amplifier may be found using the:

4.
1) eg vs Eb curves
2) Ib vs Eb curves
3) Ib vs eg curves

ET02070 The plate voltage is equal to

5.
1) the value of the plate supply voltage minus the product of the plate current and the load resistance.
2) the value of the plate supply voltage plus the product of the plate voltage and the load resistance.
3) the value of the plate supply voltage minus the sum of the plate current plus the grid voltage.
4) the value of the plate supply voltage plus the product of the grid voltage

ET02090 The two waves below are:

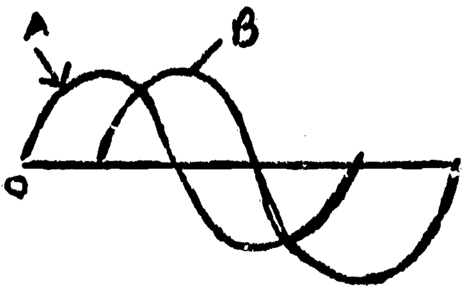
6.

1) in phase

2) out of phase by 45°

3) out of phase by 90°

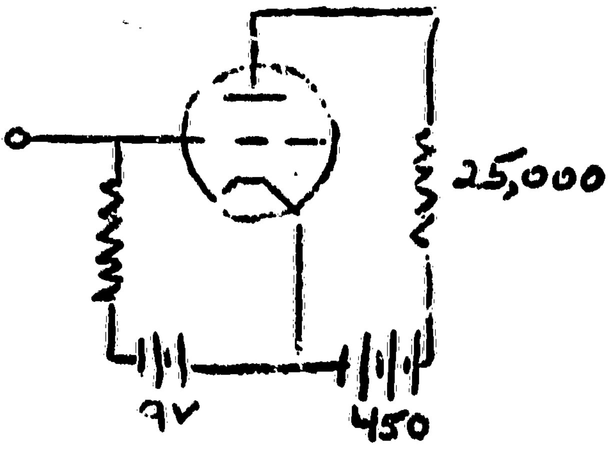
4) out of phase by 180°



ET02110 Draw the load line for a 6BF6 in the circuit below. What are the x (plate volts) y (plate current) intercepts of the load line?

7.

	x	y
1)	92.5 volts	9 ma
2)	180 volts	18 ma
3)	450 volts	18 ma
4)	555 volts	92.5 ma



ET02130 The grid bias of the circuit is

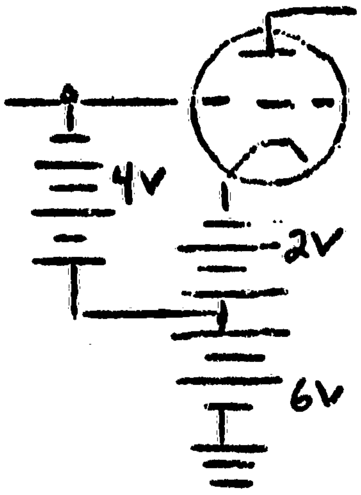
8.

1) +6 volts

2) +4 volts

3) - 2 volts

4) -8 volts



ET02170 If in the circuit below, the signal were removed the value of the grid bias would

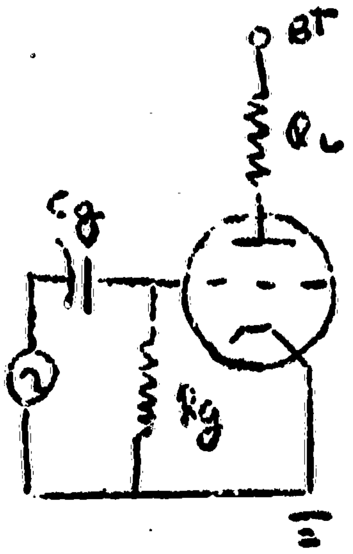
9.

1) go to maximum value

2) go to zero

3) remain the same

4) be somewhere between zero and maximum value



ET01990 When the grid is positive

1\.

1) no electrons reach the plate.
2) more electrons reach the plate.
3) fewer electrons reach the plate.
4) the triode stops working.

ET02010 In a triode amplifier, an _______ in signal voltage will produce a _______ in the output voltage

2\.

1) increase increase
2) increase decrease
3) decrease decrease

ET02020 $\mu =$:

3\.

1) $\frac{\Delta Ip}{\Delta eg}$; e_p const.
2) $\frac{\Delta eg}{\Delta ep}$; I_p const.
3) $\frac{\Delta ep}{\Delta eg}$; I_p const.
4) $\frac{\Delta Ip}{\Delta eg}$; e_p const.

ET02030 The effect of grid bias on the DC resistance of a triode may be summarized this way:

4\.

1) an increase in bias causes an increase in d-c resistance.
2) an increase in bias causes a decrease in d-c resistance.
3) an increase in bias has no effect on d-c resistance.

ET02060 An electron tube has an amplification factor of 80 and a plate resistance of 40 K. Find its transconductance in μmhos.

5\.

1) 20 μmhos
2) 500 μmhos
3) 25,000 μmhos
4) 2000 μmhos

ET02100

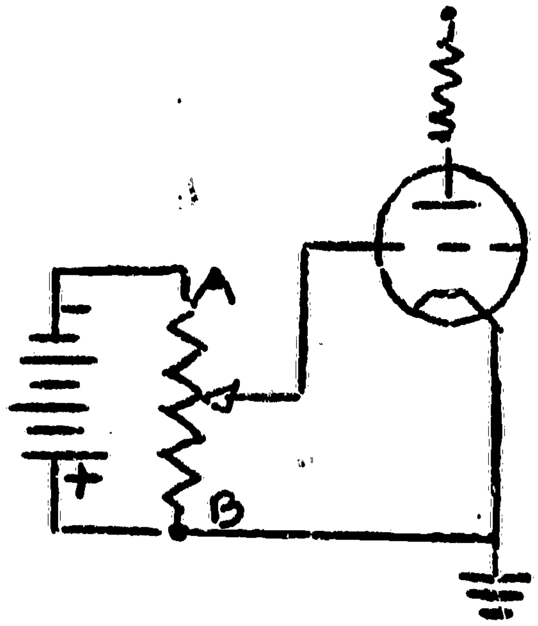
6\. When the wiper of the potentiometer is at point _____, the Plate __________.

1) A, current is maximum

2) B, current is maximum

3) B, voltage is maximum

4) A, voltage is minimum



ET02120

7\. What is the voltage gain of an amplifier for which $\mu = 16$, $R_L = 25K$ and $r_p = 8500$ ohms?

1) 16

2) 11.9

3) 46.4

4) 40

ET02140

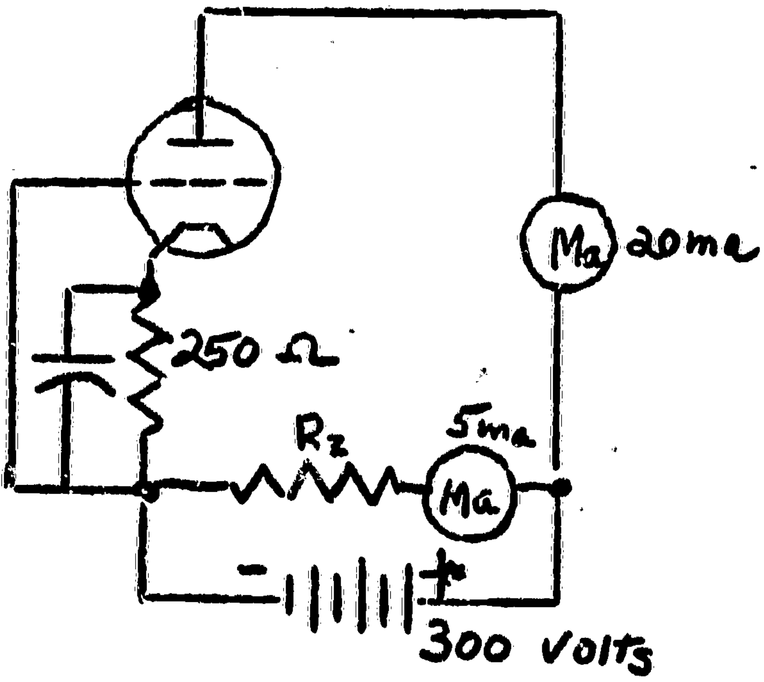
8\. The value of the bias voltage is:

1) 6.25 volts

2) 5 volts

3) 50 volts

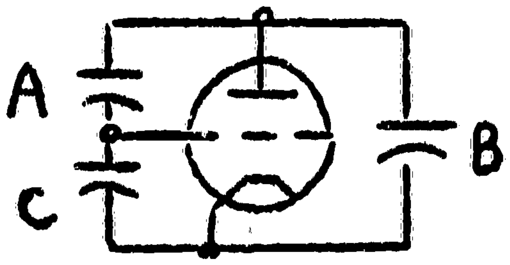
4) 1.25 volts



ET02180 Choose the answer which names the three capacitors below.

9.

	A	B	C
1)	C_{gk}	C_{pk}	C_{gp}
2)	C_{pk}	C_{gk}	C_{gp}
3)	C_{gp}	C_{pk}	C_{gk}
4)	C_{gk}	C_{gp}	C_{pk}



ET5030
03010
3A

ET02200

1\. For the half wave rectifier with a capacitor input filter, the Peak inverse voltage will be approximately ________ the peak voltage of the transformer secondary.

1) equal to
2) twice
3) one half
4) 1.41 times

ET02220

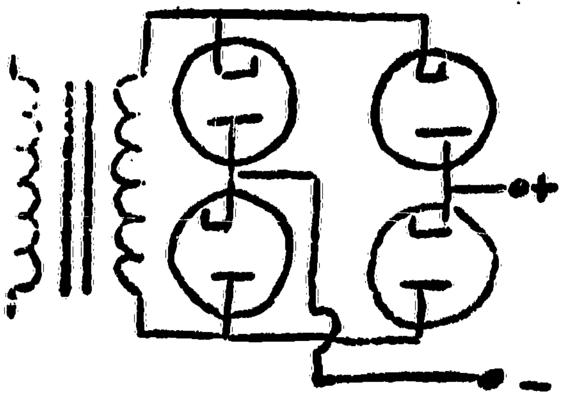
2\. The tube that can not amplify is the:

1) triode
2) pentode
3) diode
4) tetrode

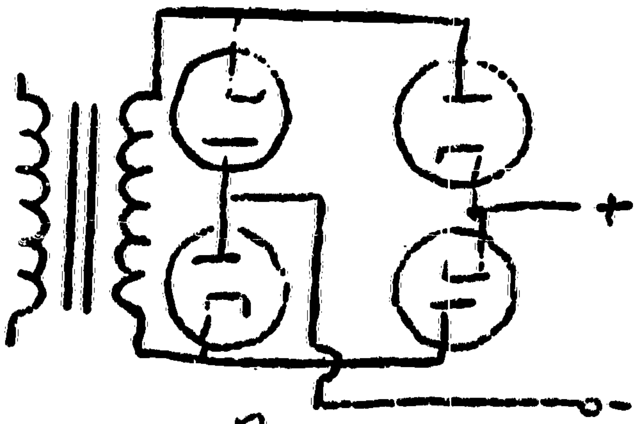
ET02240

3\. Choose the correct diagram of the full wave Bridge rectifier.

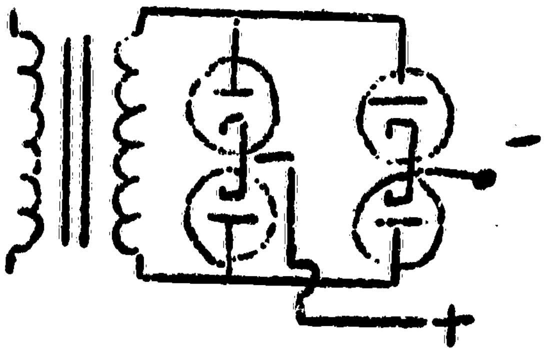
1) A
2) B
3) C
4) D



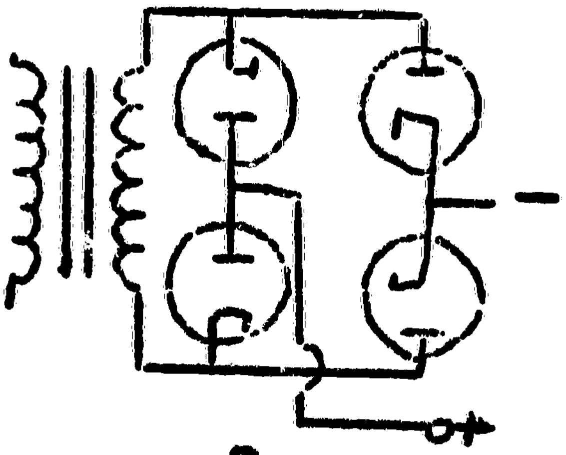
A



B



C



D

ET02250 The ripple frequency of a full wave rectifier is:

4.
1) 1/2 the ripple frequency of a half wave rectifier
2) 2 times the ripple frequency of a half wave rectifier
3) $\frac{1}{\sqrt{2}}$ times the ripple frequency of a half wave rectifier
4) Equal to the ripple frequency of a half wave rectifier

ET02260 Given a transformer with a primary voltage of 120 v, a current of 1a and primary to secondary turns ratio of 1 to 4, find the secondary voltage and the secondary current.

5.
1) 30 volts, 250 ma
2) 480 volts, 4 amps
3) 480 volts, 250 ma
4) 30 volts, 4 amps

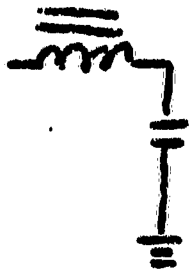
ET02270 The filament of a tube heated by DC has a distribution of potentials along its length; this distribution is sometimes called:

6.
1) space charge distribution
2) secondary emission
3) potential gradient

ET02280 Which circuit bests fits the following description? --- A filter with excellent smothing, heavy and costly.

7.
1) A
2) B
3) C
4) D

A)



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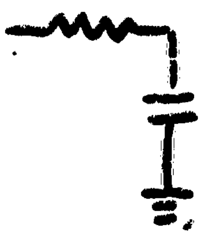

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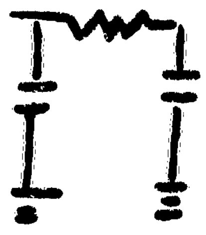
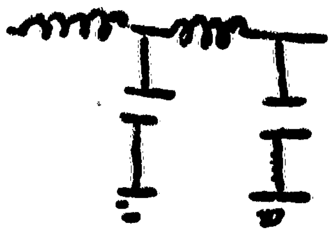


D)

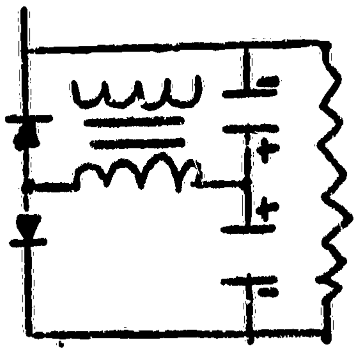


ET02290 Voltage Doubler circuits provide

1.
1) high voltages and high current
2) high voltages and low current
3) good regulation and low voltage
4) poor regulation and high current

ET02290 Which circuit is the correct circuit for a voltage doubler?

2.



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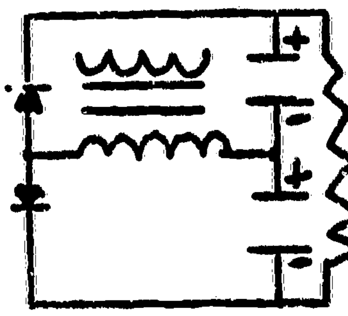

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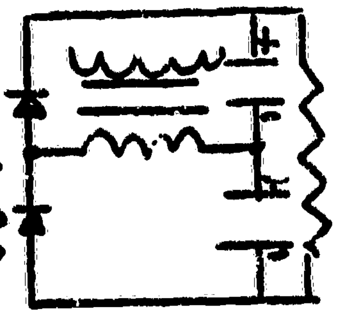
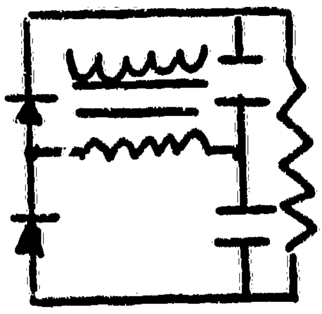
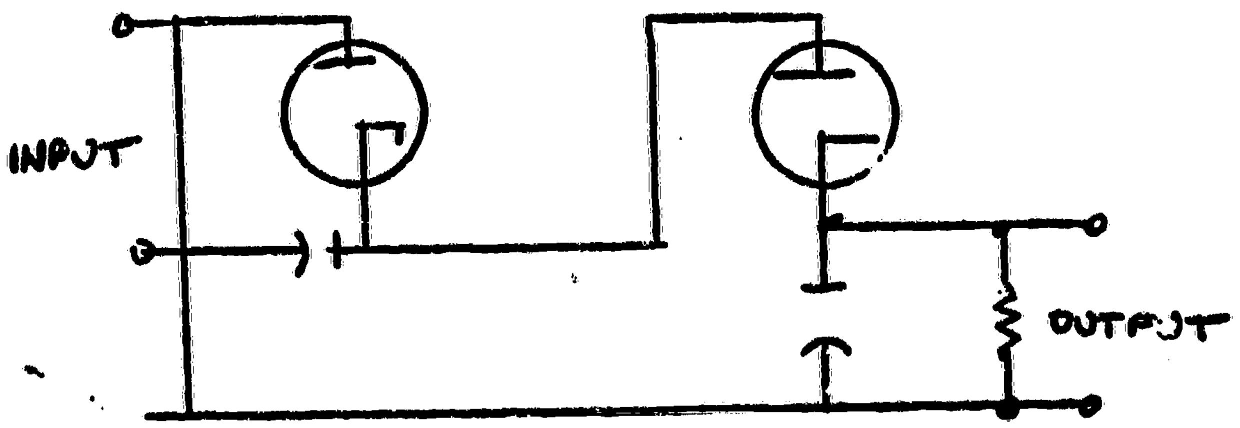




ET02290 The circuit below is:

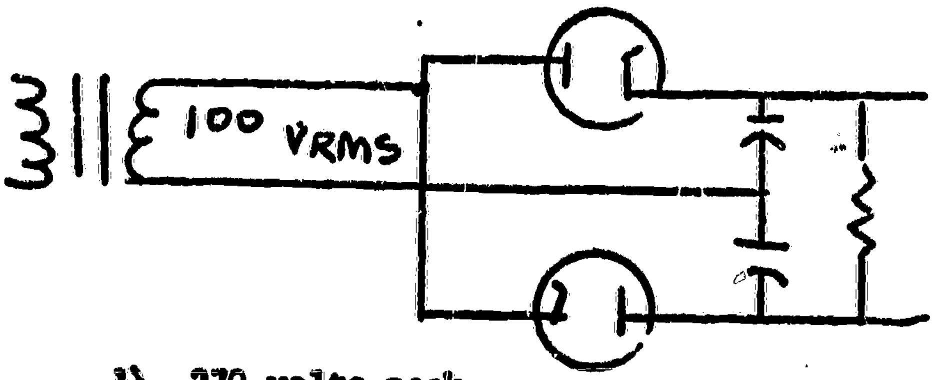
3.



1) half wave voltage doubler
2) full wave voltage doubler
3) contact type Bridge circuit
4) full wave rectifier

ET002290
02300

4. The output of the circuit below is:



1) 270 volts peak
2) 282 volts peak
3) 200 volts peak
4) 140 volts peak

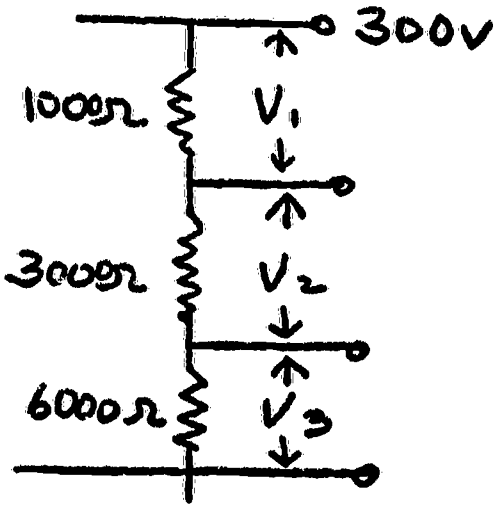
ET02303

5. A bleeder resistor:

1) is very critical
2) prevents shock hazards
3) improves the ripple frequency
4) may replace a choke in a power supply

ET02305

6. Find the values of V_1, V_2, and V_3 of the voltage divider shown below:



1) 40, 100, 160
2) 40, 80, 180
3) 30, 90, 180
4) 30, 60, 210

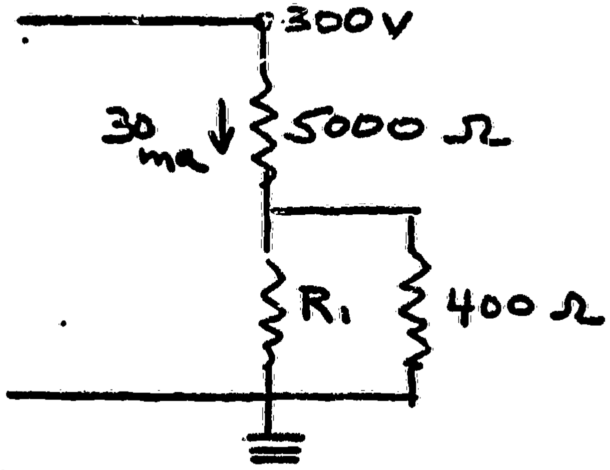
ET02305

7. A bleeder resistor:

1) improves voltage regulation
2) is very critical
3) improves the ripple frequency

ET02305

8. Find the value of the bleeder resistor R_1 if the bleeder current is 10ma.



1) 40KΩ

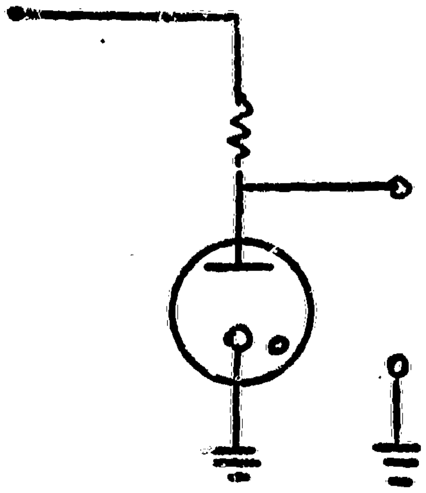
2) 15KΩ

3) 30KΩ

4) 15Ω

ET02310

9. The circuit below is used to:



1) rectify large AC voltages

2) rectify small AC voltages

3) provide regulated voltages

4) handle large currents

ET02310

10. A voltage regulator tube operates:

1) somewhat above its starting voltage

2) just below its starting voltage

3) at its starting voltage

4) at about 3/4 of its starting voltage

ET02330

1. In a tetrode vacuum-tube, the order of the elements going from the cathode to the plate is:

1) cathode, control grid, screen grid, suppressor grid, plate

2) cathode, control grid, suppressor grid, plate

3) cathode, control grid, screen grid, plate

4) cathode, control grid, plate

ET02340

2. The purpose of the screen grid in a tetrode vacuum-tube is to:

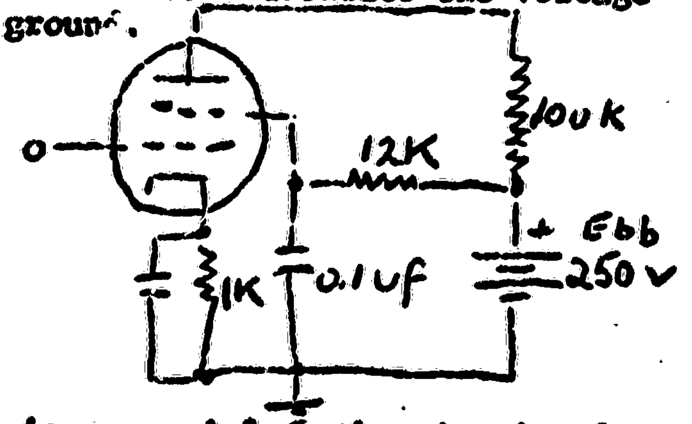
1) reduce feedback between the plate and the control grid

2) reduce the interelectrode capacitance between the control grid and the plate

3) increase the amplification factor of the tube, making high amplification possible at low plate voltages

ET02350

3. In the tetrode circuit shown below, the grid-to-cathode voltage is -11.5 volts and the plate current is 10.0 ma. Calculate the voltage at the screen grid with respect to ground.



1) 245 volts

2) 232 volts

3) 268 volts

4) 18 volts

ET02360

4. If the screen grid bypass capacitor is removed from the circuit of a tetrode amplifier tube, which of the following will occur?

1) plate current will increase

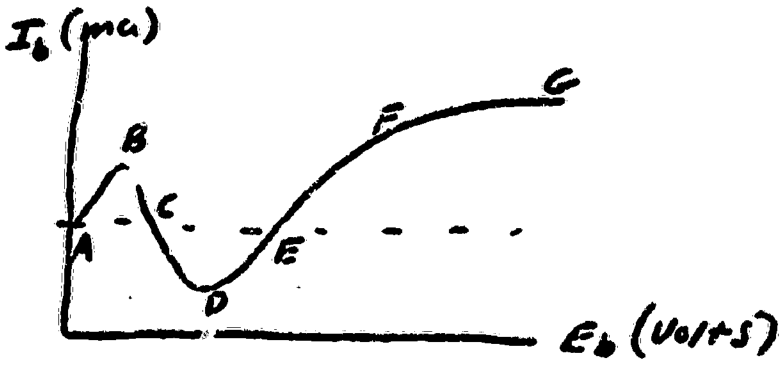
2) screen grid current will increase

3) screen grid voltage will decrease

4) amplification will decrease

ET02370

5. The characteristic curve for a typical tetrode is shown below. The region of negative resistance is



1) region A-B

2) region B-C

3) region B-D

4) region A-E

ET02380 6. When the plate voltage applied to a certain tetrode amplifier is increased from 0 to 10 volts, the plate current is observed to increase. However, when the plate voltage is increased from 10 to 40 volts, the plate current decreases. The reason for this is:

1) the number of secondary electrons emitted from the screen grid is greater than the number emitted from the plate

2) the number of secondary electrons emitted from the plate is greater than the number of primary electrons reaching the plate

3) the formation of an electron cloud around the plate caused by secondary emission

4) the high voltage on the screen grid attracts more primary electrons than the lower voltage on the plate

ET02390 7. A tetrode vacuum tube will amplify linearly only if

1) the screen grid bypass capacitor has a very low reactance

2) the screen grid voltage is approximately equal to the plate voltage

3) a low value of screen grid resistance is used

4) a high plate voltage is used

ET02400 8. Which of the following types of tubes always contains a suppressor grid?

1) heptode

2) tetrode

3) pentode

4) beam power tube

ET02410 9. The suppressor grid in a pentode

1) is negative with respect to the plate

2) is negative with respect to ground

3) prevents secondary emission

4) attracts the secondary electrons emitted from the plate

RT02420 Which of the following statements is false?

10.

1) In a pentode all secondary electrons which are emitted from the plate must return to the plate.

2) The pentode exhibits a negative resistance characteristic for very low values of plate voltage.

3) The suppressor grid of a pentode is negative with respect to the plate.

4) A pentode does not have a dynatron region.

ET02430 If the plate supply voltage of a pentode which is operating in a linear region is doubled, while all other tube voltages remain the same, then

11.

1) the amplification will double

2) the amplification will increase

3) the amplification will remain the same

4) the plate current will increase

ET02440 A certain pentode operates into a load resistance of R_L = 1.0 megohm. It is found that when the plate voltage is increased from 100 to 250 volts the plate current increases from 0.30 ma to 0.55 ma. Calculate the plate resistance of the pentode.

12.

1) 438 K ohms

2) 333 K ohms

3) 600 K ohms

4) 1.0 M ohms

ET02450 Which of the following statements is false?

13.

1) In a pentode the suppressor grid is usually connected to the cathode.

2) The plate impedance of a triode is greater than the plate impedance of a pentode.

3) The plate current of a pentode which is operating within the linear range of the characteristic curves is independent of the plate voltage.

4) The interelectrode capacitance between the plate and control grid of a pentode may be disregarded because of the presence of the screen grid.

ET02460 The following information is given about a type 6AU6 pentode:

14. Plate resistance = 1.5 M ohms Plate supply voltage = 250 volts
Load resistance = 200 K ohms Transconductance = 4,500 micromhos

Calculate the voltage amplification of the tube.

1) 6750

2) 2700

3) 900

4) 122.5

ET02470 In a remote cut-off pentode

1.
1) the transconductance of the tube is constant over a wide range of grid voltages
2) the control grid wire is wound uniformly around the cathode
3) the transconductance becomes smaller as the bias is made more negative
4) the transconductance becomes greater as the bias is made more negative

ET02480 A pentode will deliver a constant current into a wide range of load resistances because of its

2.
1) very high voltage gain
2) high plate resistance
3) remote cutoff characteristic
4) variable-mu feature

ET02490 When a pentode is used as a triode

3.
1) the suppressor and screen grids are connected to the control grid
2) the screen grid is connected to the cathode
3) the suppressor grid is connected to the screen grid
4) the suppressor grid and the screen grid are connected to the plate

ET02500 If a sinusoidal input signal is applied to a variable-mu pentode,

4.
1) the tube will operate in class B
2) fixed bias must be used to prevent the amplification factor of the tube from changing
3) the cathode resistor must be bypassed
4) the output signal will be distorted

ET02500 In which of the following could a variable-mu pentode be used?

5.
1) high-gain audio amplifier
2) local oscillator in an AM radio receiver
3) I.F. amplifier in an AM radio receiver
4) class C amplifier

ET02510
6. A beam power tube is:

1) a triode

2) a tetrode

3) a pentode

4) either a tetrode or a pentode

ET02510
7. Which of the following types of tubes has the highest power sensitivity?

1) power triode

2) power pentode

3) beam power tube

4) power tetrode

ET02520 1. When a power amplifier tube is used to drive a loudspeaker, an output transformer is used

1) to improve the fidelity

2) to reduce distortion

3) to increase the plate-circuit efficiency

4) to provide impedance matching

ET02530 2. Which of the following is not an example of a transducer?

1) a battery

2) a transformer

3) a light bulb

4) a motor

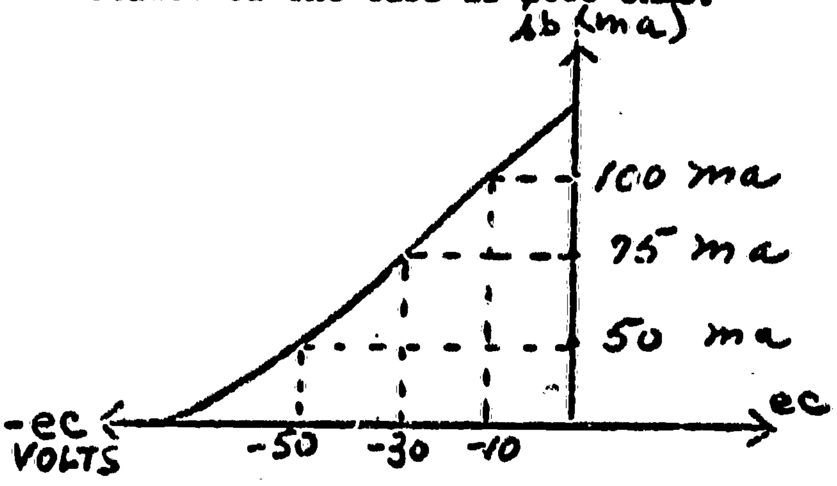
ET02540 3. Calculate the value of the input signal required to produce an output signal of 50 volts peak to peak. Assume that the grid bias voltage is -30 volts, and the load resistance of the tube is 2000 ohms.

1) 20 volts

2) 25 volts

3) 40 volts

4) 50 volts



ET02550 4. In order to obtain minimum distortion when using a power pentode, the load impedance should be

1) smaller than the plate impedance

2) equal to the plate impedance

3) larger than the plate impedance

4) adjusted for minimum plate current

ET02560

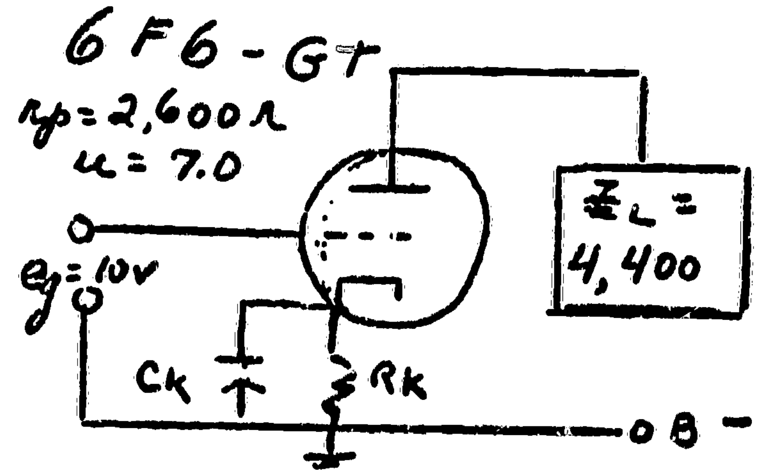
5. If an excessive input signal is applied to an amplifier tube using cathode bias, the result will be

1) grid current flow on the positive half cycles of the input signal
2) the positive half cycles of the output signal will be clipped
3) phase distortion of the output signal
4) all of the above

ET02570

6. The following information is given for a type 6F6-GT tube used as a triode amplifier: Amplification Factor (u) = 7.0, Plate Resistance (r_p) = 2,600 ohms. If the load impedance (Z_L) is 4,400 ohms, calculate the output power for an input signal of 10 volts.

1) 0.116 watt
2) 0.44 watt
3) 0.62 watt
4) 1.16 watt



ET02580

7. For reasonable power output with lowest distortion, the load impedance (Z_L) for a triode should be

1) less than the plate impedance (r_p)
2) equal to the plate impedance (r_p)
3) greater than the plate impedance (r_p)
4) equal to the load resistance (R_L)

ET02590

8. Determine the power sensitivity of the 50L6-GT tube from the following information:

Load Resistance = 4000 ohms
Plate impedance = 28,000 ohms
Input Voltage = 8.0 volts (p-p)
Amplification Factor = 6.8
A.C. Load Current = 22.4 ma (r.m.s.)

1) 31,300 micromhos
2) 63,000 micromhos
3) 27,100 micromhos
4) 20,900 micromhos

ET02600

9\. The suppressor grid in a power pentode is connected directly to the cathode in order to

1) reduce secondary emission from the plate

2) maintain the suppressor grid at a lower potential than the plate and the screen grid, thereby reducing secondary emission

3) return secondary electrons to the emitting electrode, thereby improving the linearity of the i_b - e_b curve

ET02610

10\. Given the following information about a type 6F6-GT power pentode:

Plate Voltage = 250 volts
Plate Current = 34 ma
Screen Grid Current = 7.0 ma
Screen Grid Voltage = 250 volts
Load Resistance = 7000 ohms
Control Grid Bias Voltage = -16 volts

Calculate the value of cathode resistance which will produce a bias voltage of -16 volts on the control grid.

1) 270 ohms

2) 390 ohms

3) 470 ohms

4) 2300 ohms

ET02620

11\. A feature of the beam power tube is that the screen grid current is very low. This is due to

1) the spacing between the screen grid and the cathode

2) the presence of the beam-confining electrode

3) the highly negative space charge region between the screen-grid and the plate

4) the alignment between the control-grid and screen-grid wires

ET02640

12\. An amplifier is considered to be operating in class A1 when the angle of plate current flow is

1) less than 90 degrees

2) less than 180 degrees

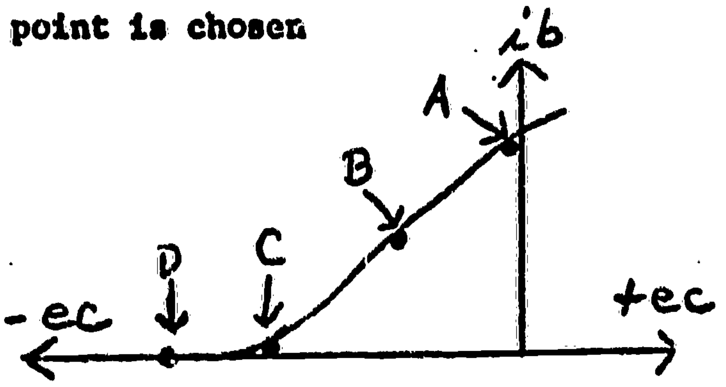
3) 180 degrees

4) 360 degrees

ET02650 In a class A1 amplifier, the bias point is chosen

1\.

1) at point A
2) at point B
3) at point C
4) at point D



ET02660 A class B amplifier may be defined as:

2\.

1) one in which the grid bias is appreciably greater than the cutoff value, so that the plate current flows for appreciably less than 1/2 cycle.
2) one in which the grid bias and the a-c grid potentials are such that plate current flows at all times
3) one in which the grid bias is such that plate current flows for more than half, but less than the entire cycle
4) one in which the grid bias is approximately equal to the cutoff value, so that plate current flows for approximately one-half of each cycle.

ET02670 If the power input to a class B amplifier is 50 watts, which of the following is the approximate power output?

3\.

1) 40 watts
2) 10 watts
3) 30 watts
4) 20 watts

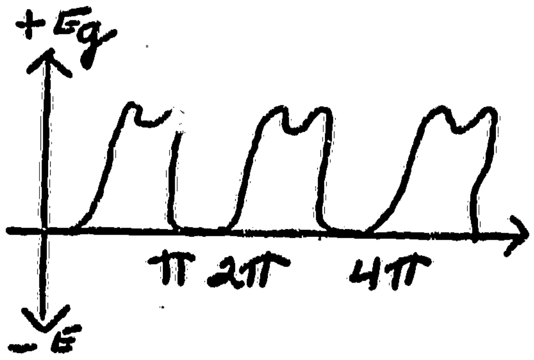
ET02680 If you were designing a high-fidelity amplifier, and you had a choice of using either a class A1 or a push-pull class B output stage, both of which would deliver the same output power, which would you pick?

4\.

1) the class A1 stage, because it uses only one tube, and is cheaper to build
2) the class B stage, because it is more efficient than the class A1, and is of simpler construction
3) the class A1 stage, because it has low distortion and the wide frequency response required for high-fidelity
4) the class B stage, because it is more efficient, and does not produce second harmonic distortion

ET02690 Given the following waveform, which of the following types of amplifiers would you choose to amplify this signal?

5.



1) Class A1

2) Class B or Class B push-pull

3) Class A1 or Class B push-pull

4) Class B or Class C

ET02700 The bias voltage for a class C amplifier is selected so that it is

6.

1) considerably more negative than the cutoff bias for the tube

2) equal to the cutoff bias for the tube

3) midway between cutoff bias and zero bias

4) equal to zero bias

ET02710 When a class C amplifier is used as an r.f. amplifier

7.

1) the tube will only conduct on the negative half cycles of the input waveform

2) the output waveform will consist only of positive going half cycles

3) the tank circuit supplies the missing parts of the output cycle

4) the plate current drawn during the positive half cycles of the input signal is zero

ET02730 If an amplifier tube conducts for more than 180 degrees but less than 360 degrees of the input signal, the amplifier is said to be operating .

8.

1) class A

2) class AB

3) class B

4) class C

ET02740 A sinusoidal input signal is applied to an amplifier operating in class B. The output signal will consist of

9.

1) negative going half cycles

2) positive going half cycles

3) a sinusoidal signal which is 180 degrees out of phase with the input signal

4) none of the above

ET02750 Which of the following types of amplifiers would amplify the signal shown with no distortion and maximum efficiency?

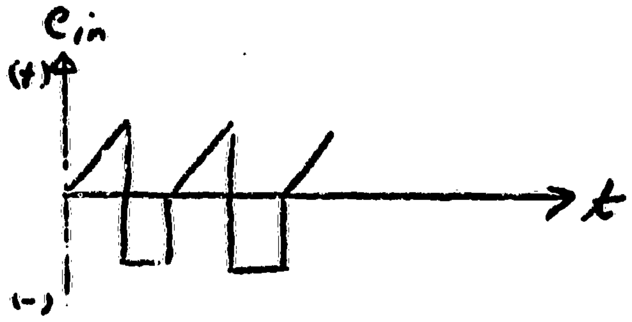
10.

1) class A1

2) class B

3) class C

4) class AB_1



ET02760 The output voltage of a class B amplifier

11.

1) consists of positive going half cycles

2) consists of negative going half cycles

3) consists of both positive and negative going half cycles

4) consists of positive going half cycles and negative going peak.

ET02770 An advantage of a class B amplifier over a class A amplifier is

12

1) less harmonic distortion

2) less phase distortion

3) higher voltage amplification

4) higher efficiency

ET02790 In a class B push-pull audio amplifier each tube conducts for

13

1) less than 180 degrees of the input cycle

2) 180 degrees of the input cycle

3) more than 180 degrees but less than 360 degrees of the input cycle

4) 360 degrees of the input cycle

ET02800 The primary advantage of a class C amplifier over all other classes is

14

1) lower plate resistance

2) higher efficiency

3) lower distortion

4) higher power output

ET02810

1. A certain amplifier is designed to have a perfectly flat response down to a frequency of 20 cps. The amplifier uses RC coupling. If the grid resistance (R_g) is 1.0 megohms, what should the reactance of the coupling capacitor be at 20 cps?

   1) 100 megohms
   2) 10 megohms
   3) 1.0 megohms
   4) 0.01 megohms

ET02820

2. When impedance coupling is used

   1) the impedance match between stages is improved
   2) maximum power transfer can be obtained
   3) the quiescent plate voltage of the tube is approximately equal to the power supply voltage
   4) a coupling capacitor is not required

ET02830

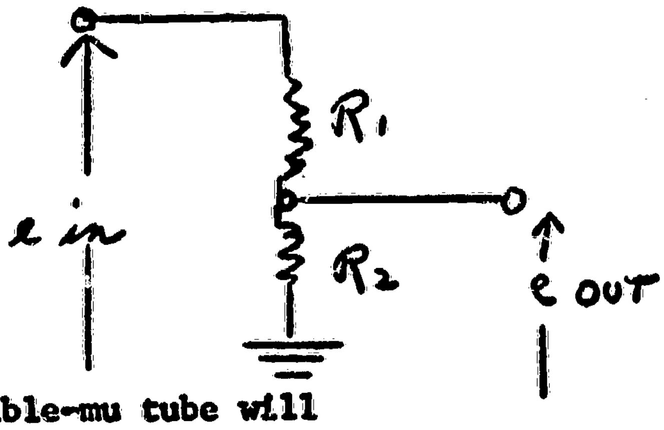
3. If a vacuum-tube amplifier uses transformer coupling

   1) the gain may be higher than with RC coupling
   2) the frequency response will be better than with RC coupling
   3) large coupling capacitors will be needed
   4) a higher plate voltage is required

ET02840

4. In the diagram shown below, what should be the ratio of R_1 to R_2 to obtain maximum output voltage?

   1) 0
   2) infinite
   3) 1
   4) indeterminate



ET02860

5. Varying the cathode bias of a variable-mu tube will

   1) affect the amplification at all frequencies
   2) affect the amplification at low frequencies only
   3) affect the amplification at middle and high frequencies only
   4) have no effect on the amplification

ET02870

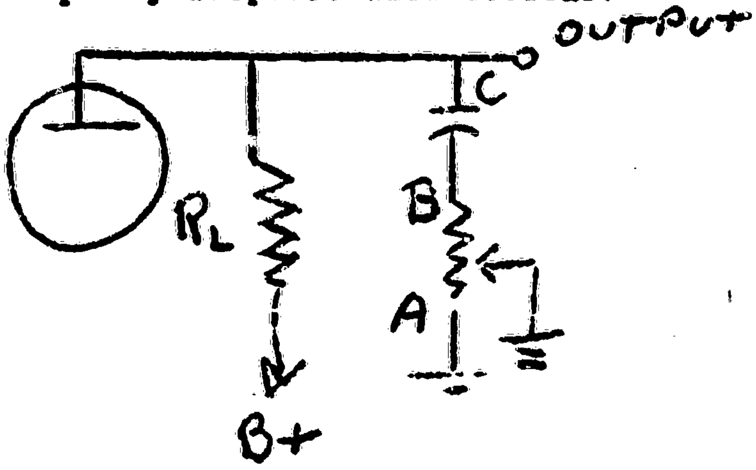
6. Course and fine volume controls are to be provided for a pentode amplifier.If both controls have the same resistance value, the most logical arrangement for these would be:

1) both controls on control grid
2) coarse on screen grid, fine on control grid
3) fine on screen grid, course on control grid
4) both on screen grid

ET02880

7. In the tone control circuit shown below, as the wiper of the potentiometer is moved from A to B

1) the low frequency response will increase
2) the low frequency response will decrease
3) the high frequency response will increase
4) the high frequency response will decrease



ET02890

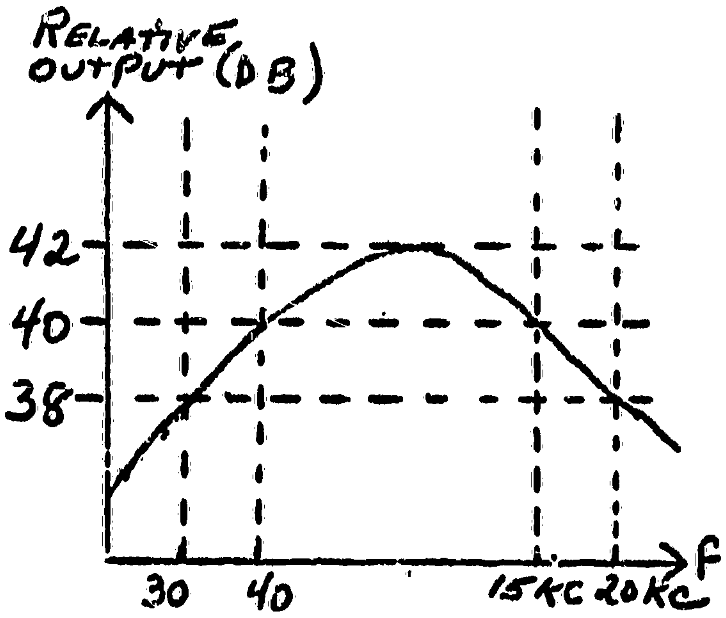
8. Most musical instruments do not produce fundamental frequencies over 5,000 cps. However, in order to reproduce faithfully the sounds of these instruments, an audio amplifier with a frequency response up to 20,000 cps is required in order to

1) reproduce the sound at the original volume level
2) reproduce the sounds of instruments whose fundamental frequencies are above 5,000 cps
3) reproduce the harmonic frequencies generated by each instrumen
4) reproduce the sound of several instruments simultaneously whose frequencies add according to the number of instruments

ET02900 The frequency response of a certain amplifier is shown below. Which of the following describes the response of this amplifier most accurate]

9.

1) 30 cps - 20 Kc
2) 40 cps - 15 Kc ± 2 db
3) 30 cps - 20 Kc ± 4 db
4) 30 cps - 20 Kc ± 2 db



ET02910 Which of the following designations for the response of an audio amplifier is the most meaningful?

10.

1) 20 - 20,000 cps
2) 20 - 20,000 cps ± 3 db
3) 20 - 20,000 cps + 2 db
- 1 db
4) flat from 20 to 20,000 cps

ET02920

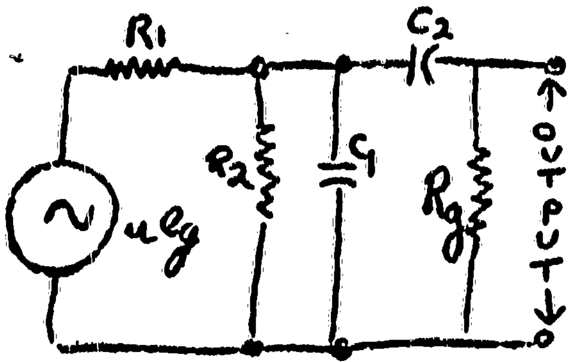
1\. The diagram below shows the equivalent circuit of an amplifier. In this circuit the plate resistance of the tube is symbolized by __________, and the total stray capacitances are symbolized by _____.

1) R2, C1

2) R2, C2

3) R1, C1

4) R1, C2



ET02930

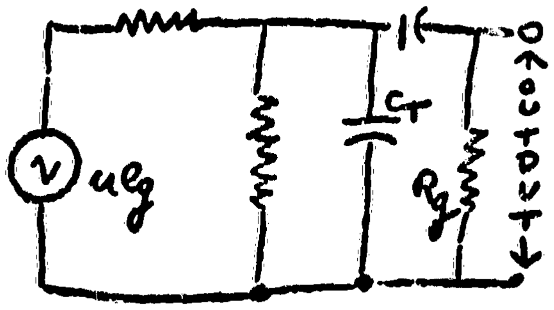
2\. The diagram below shows the equivalent circuit of a certain amplifier. The low frequency response of this amplifier is dependent on the ratio of

1) r_p / R_L

2) C_t / r_p

3) C_t / C_c

4) C_c / R_g



NOTE: $C_t = C_{pk} + C_{stray} + C_{gk}$

ET02940

3\. The low frequency response of an amplifier may be improved by

1) increasing the capacitance of the coupling capacitor

2) reducing the value of the grid resistor

3) minimizing stray wiring capacitances

4) increasing the value of the plate load resistance

ET02950

4\. Which of the following is an advantage of transformer coupling over R-C coupling?

1) maximum power transfer

2) better impedance matching

3) higher voltage gain

4) all of the above

5) maximum power transfer and higher voltage gain

ET02960 The high frequency drop-off of transformers is caused by the action of

5.

1) leakage inductance

2) stray capacitances

3) core losses

4) all of the above

5) core losses and stray capacitances

ET02970

1. If the plate load resistance of an amplifier is decreased, then

1) the frequency response will increase, but the amplification will decrease

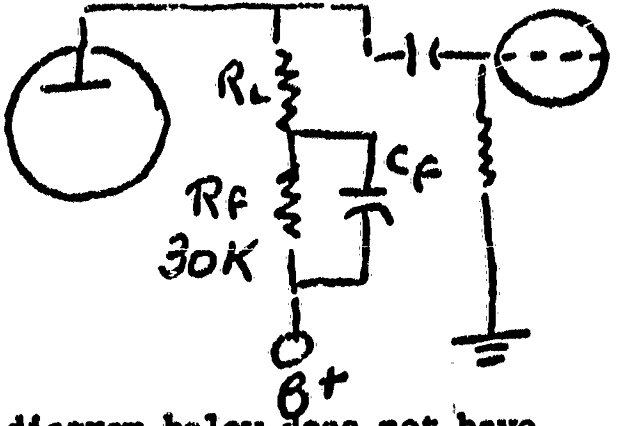
2) the amplification will increase, but the frequency response will decrease

3) the amplification at low frequencies will increase

4) the amplification at high frequencies will increase

ET02980

2. The components labeled C_f and R_f in the following diagram are intended to improve the low frequency response of the amplifier. If the value of R_f is 30,000 ohms, what should the reactance of the capacitor be at low frequencies?



1) 300 ohms

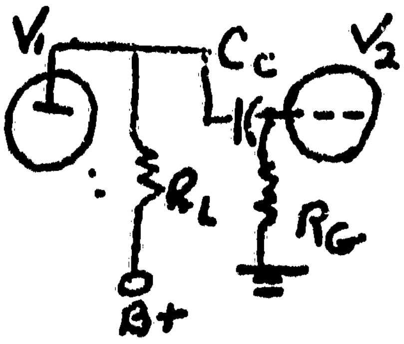
2) 3,000 ohms

3) 30 K ohms

4) 300 K ohms

ET02990

3. If the coupling capacitor, C_c, in the diagram below does not have enough capacitance, what will be the effect on the frequency response of the amplifier?



1) the amplification at low frequencies will be poor

2) the amplification at high frequencies will be poor

3) the amplification at all frequencies will be poor

4) the amplification at middle frequencies will be greater than the amplification at high frequencies

ET03100

4. If the cathode bypass capacitor (C_k) of an amplifier is replaced by one of infinite capacitance, what will be the effect on the frequency response of the amplifier?

1) the amplification at low frequencies will be greater than the amplification at middle and high frequencies.

2) the amplification at high frequencies will be greater than the amplification at middle and low frequencies.

3) the amplification at low frequencies will be less than the amplification at middle and high frequencies.

4) the amplification at all low frequencies will be the same

ET03110 Series peaking increases the high frequency response by:

5.

1) effectively increasing Z_g at high frequencies where Z_g is the combined effect of R_g and C_g

2) decreasing Z_L at high frequencies

3) decreasing Z_K at high frequencies

4) increasing Z_L at high frequencies

ET03120 When shunt peaking is employed to improve the high frequency response of an amplifier

6.

1) an inductance is placed in series with the coupling capacitor, C_c

2) a capacitor is placed in parallel with a part of the plate load resistance, R_f

3) an inductance is placed in series with the plate load resistance, R_L

4) an inductance is placed in series with the total shunt capacitance, C_t

ET03130 When series peaking is used to improve the high frequency response of an amplifier, the series peaking coil (L_{se}) forms a resonant circuit with

7.

1) C_{pk}

2) C_c

3) C_1

4) C_t (Note: $C_t = C_{pk} + C_{stray} + C_i$)

ET03140 When combination peaking is used to improve the high frequency response of an amplifier

8.

1) low frequency compensation cannot be used at the same time

2) a higher value of plate load resistance (R_L) is required

3) the high frequency compensation is poorer than other methods of high-frequency compensation

4) the high frequency compensation is better than the compensation obtained with series peaking

ET03150 Which of the following statements is false?

9.

1) 3,000,000 cps = 3 mc

2) 0.5 mc = 500 kc

3) 108 mc = 0.108 kmc

4) 1600 kc = 0.16 mc

ET03160 The circuit shown below is tuned to a station broadcasting on a frequency of 100 kc. If L = 10.0 millihenrys, calculate the value of C.

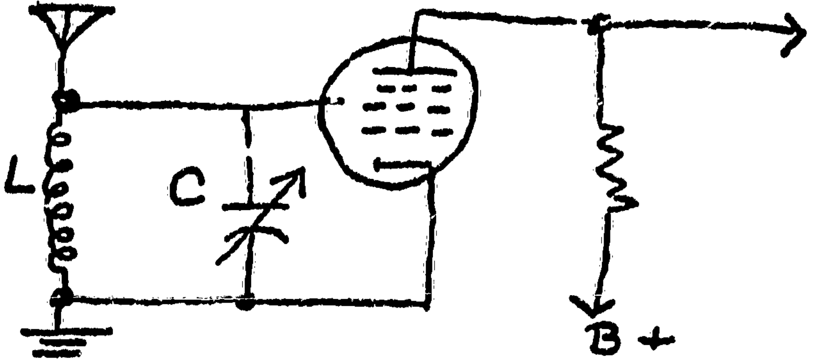
10.

1) 1,000 pf

2) 314 pf

3) 254 pf

4) 141 pf



ET03170 A double-tuned RF transformer may be used to couple the first and second stages of an RF amplifier together. When maximum gain is desired, the transformer is adjusted so that

11.

1) the resonant frequency of the primary is higher than the resonant frequency of the secondary

2) the resonant frequency of the primary is the same as the resonant frequency of the secondary

3) the resonant frequency of the primary is lower than the resonant frequency of the secondary

4) none of the above

ET03180

1. The "Q", or figure of merit, of a coil may be defined as

    1) the ratio of the inductive impedance of a coil to the resistance of the coil

    2) the ratio of the inductive reactance of the coil to the resonant frequency

    3) the ratio of the resistance of the coil to the inductive impedance

    4) the ratio of the inductive reactance of the coil to the resistance of the coil

ET03190

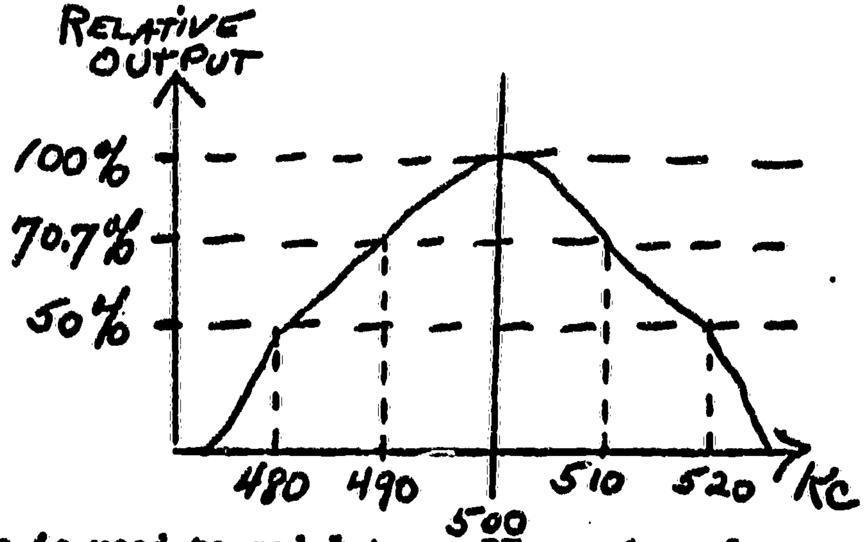
2. Calculate the passband of the amplifier whose response is shown in the figure below.

    1) 40 kc

    2) 30 kc

    3) 20 kc

    4) 10 kc



ET03200

3. If an audio signal of 10 Kc is used to modulate an RF carrier of 1,000 Kc, calculate the passband which the receiver must have to amplify this signal.

    1) 5 Kc

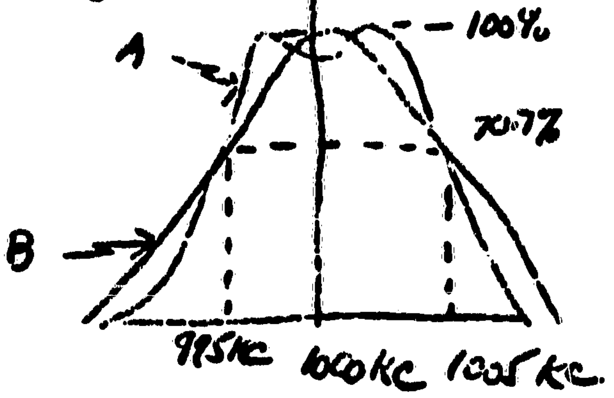
    2) 10 Kc

    3) 20 Kc

    4) 1,010 Kc

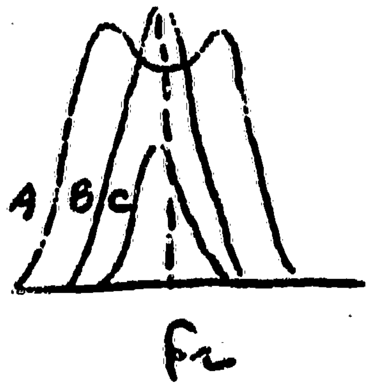
ET03210 Which of the following statements is true about the curves shown below?

4.
1) the passband of B is greater than the passband of A
2) the selectivity of A is less than the selectivity of B
3) the selectivity of A and B are the same, but the passband of A is greater than the passband of B
4) the passband of A and B are the same, but the selectivity of A is greater than the selectivity of B.



ET03220 Which of the statements below are correct?

5.
1) Curve B represents the kind of response obtained with loose coupling.
2) Curve C represents the kind of response obtained with tight coupling.
3) Curve A may be produced by placing a loading resistor across a transformer whose response is shown in curve B.
4) Curve A represents the kind of response obtained with tight coupling.



ET03230 Which of the following statements is false?

6.

1) In a cathode follower amplifier the plate is connected directly to the B+

2) The cathode resistor of a cathode follower amplifier is never bypassed

3) The output impedance of a cathode follower amplifier is greater than the input impedance

4) The output voltage of a cathode follower amplifier is developed across the cathode resistor

ET03240 The output of a certain amplifier feeds both a tape recorder and a very long cable which is connected to a device several hundred feet away. A cathode follower amplifier is used between the amplifier and the cable instead of a transformer. This is because

7.

1) the frequency response of a cathode follower is better than that of a transformer

2) the impedance matching which can be obtained with a cathode follower is better than that of a transformer

3) a cathode follower provides more isolation between input and output than a transformer

4) a cathode follower amplifier will provide just enough voltage amplification to overcome the losses in the cable

ET03250 Which of the following is not characteristic of a cathode follower amplifier?

8.

1) voltage gain

2) current gain

3) power gain

4) low output impedance

ET03260 The voltage gain of a certain cathode follower amplifier is 0.7. The grid resistance is $R_g = 1.0$ megohm, and the cathode resistance is $R_k = 500$ ohms. Calculate the power gain of the cathode follower.

9.

1) 1,400

2) 980

3) 720

4) none of the above

ET5030
12010
12 A

ETC3270
10.

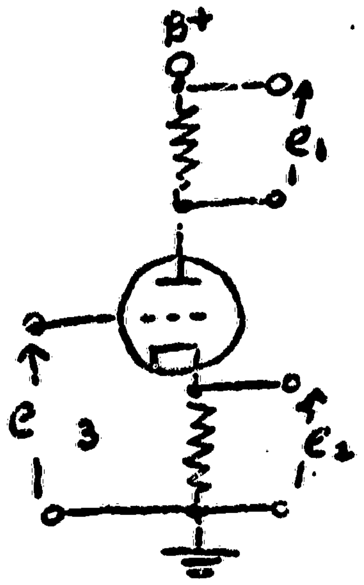
If a small resistance is connected in series with the plate of a cathode follower tube as shown below, then:

1) e_1, e_2, and e_3 will be in phase

2) e_1 and e_2 will be 180 degrees out of phase with respect to each other

3) e_2 and e_3 will be 180 degrees out of phase with respect to each other

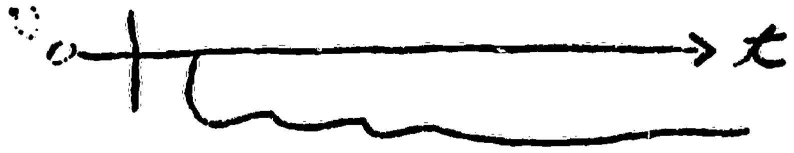
4) none of the above



ET03280
1. Positive feedback is necessary for any type of oscillation. In a mechanical clock it is provided by

1) the action of the pendulum, varying with its length
2) the low friction coefficient of the bearings
3) the main spring assembly
4) the downward motion of the minute hand alternate half hours

ET03290
2. The diagram below best describes:



1) the displacement of a clock pendulum, with an unwound main spring, upon being pushed
2) the displacement of a car wheel upon hitting a sudden drop in pavement level
3) the displacement of an empty rocking chair suddenly set into oscillation

ET03300
3. The main spring of a mechanical clock replaces energy lost through friction. The amount of energy needed could best be determined from data concerning:

1) changes in pendulum frequency with time
2) changes in maximum pendulum displacement with time
3) amount of frictional heat developed in the pendulum suspension system

ET03310
4. For a clock pendulum to oscillate with a constant frequency and amplitude:

1) the energy imparted by the main spring must equal the losses due to friction
2) the energy imparted must exceed the frictional losses
3) the energy imparted may be just a little less than the frictional losses

ET03320 If negative feedback of energy was applied to a clock pendulum:

5.

1) the amplitude of oscillation would increase

2) the frequency of oscillation would decrease

3) the frequency of oscillation would increase

4) the amplitude of oscillation would decrease

ET03330 In order to have sustained oscillations in an L-C circuit which contains some resistance, which of the following is required?

6.

1) positive feedback

2) negative feedback

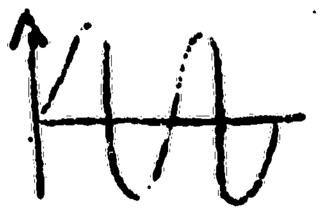
3) an input signal which is 180 degrees out of phase with the output signal

4) a tank circuit with a large L to C ratio

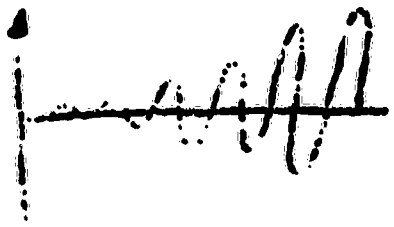
ET03340 Which of the following diagrams represents the oscillations which will be produced by an L-C circuit which contains no resistance?

7.

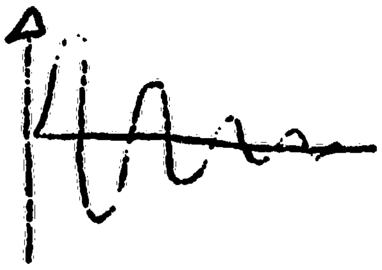
1)



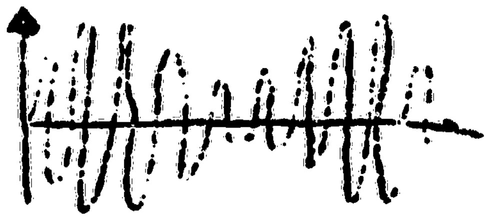
3)



2)



4)



ET03350 Which of the following feedback signals will produce sustained oscillations in an oscillator?

8.

1) 45 degrees out of phase with respect to the tank circuit signa

2) 90 degrees " " " " " " " " " "

3) 180 degrees " " " " " " " " " "

4) 720 degrees " " " " " " " " " "

5) none of the above

ET03360

9. If the tickler coil of an oscillator is not coupled to the coil in the tank circuit

1) the oscillator will not work

2) the oscillator will be "free-running"

3) the oscillator will not begin oscillating by itself, although it will continue running once started

4) the oscillator frequency will not be a function of the tickler coil inductance

ET03370 1. After oscillations in a grid-leak bias oscillator have built up, the oscillator operates:

1) Class A

2) Class B

3) Class C

4) Class D

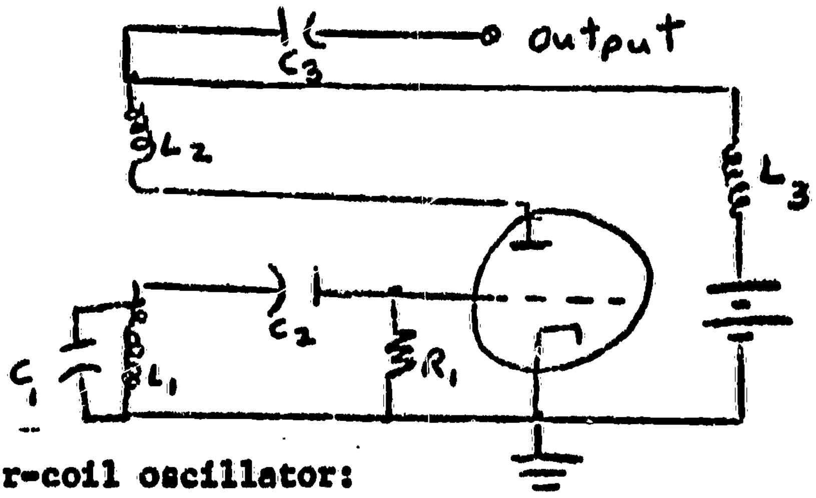
ET03380 2. In the diagram below, the component marked ________ is the radio-frequency choke, and the component marked ________ is the grid-leak bias capacitor.

1) L_3 ; C_1

2) L_2 ; C_2

3) L_3 ; C_2

4) L_3 ; C_3



ET03390 3. In the shunt-fed tickler-coil oscillator:

1) There are two capacitors in the tank circuit.

2) The tickler coil is effectively in parallel with the tank circuit coil.

3) A tapped tank circuit coil is used.

4) A d-c blocking capacitor is in series with the tickler coil.

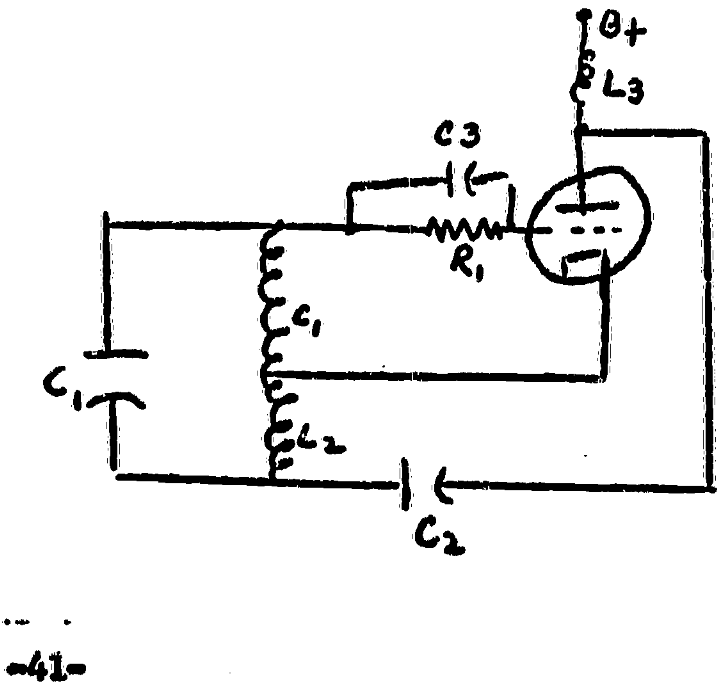
ET03410 4. The feed-back path in the shunt-fed Hartley oscillator shown below is through the components labeled ________ and __________.

1) C3 R1

2) L3 C2

3) L2 C2

4) C1 C2



ET03420 5. In the TPTG oscillator, the feedback path is through:

1) The plate tank circuit.

2) The inter-electrode capacitance of the tube.

3) The grid tank circuit.

4) The coupling capacitor connected between the plate tank circuit and the grid tank circuit.

ET03430 6. The TPTG oscillator will not work at audio frequencies because:

1) The grid-plate capacitive coupling is not sufficient to provide the required feedback at audio frequencies.

2) The output voltage at audio frequencies is too low to provide sustained oscillations.

3) The value of the grid-leak resistor must be made very small for audio frequencies, and this effectively shorts out the tank circuit.

ET03430 7. If the plate tank circuit of a TPTG oscillator is tuned to twice the frequency of the grid tank circuit, then:

1) The frequency at the plate will be twice the frequency at the grid.

2) The oscillator will stop working.

3) The oscillator will operate intermittently.

4) The oscillator will operate, but the time constant of the grid-leak bias components will have to be decreased.

ET03440 8. Calculate the inductance of an oscillator tank circuit which is tuned to a frequency of $f_r = 1,000$ Kc, and whose circuit capacitance is 500 picofarads (0.0005 µf).

1) 50.6 uH

2) 2.53 uH

3) 31.8 mH

4) 10.0 mH

ET03450 Which of the following statements is correct?

9\.

1) If a tank circuit is tuned to a lower resonant frequency, then the frequency stability of the oscillator will decrease.

2) If a resistance is placed in parallel with an oscillator tank circuit, the frequency stability will increase.

3) If the spacing between the grid and the cathode of the oscillator tube changes, the frequency stability will be affected.

4) A change in the filament temperature of the oscillator tube will affect the frequency stability of the oscillator.

ET03460 If random electrical pulses are applied to a crystal:

1\.

1) The crystal will be destroyed.

2) A large potential will be generated between the faces of the crystal.

3) The crystal will vibrate at its resonant frequency.

4) The crystal will vibrate at random frequencies.

ET03470 The "piezoelectric effect":

2\.

1) Refers to the very high strength of certain crystals.

2) Refers to the voltage developed when pressure is applied to a crystal.

3) Is responsible for the very high frequency stability of crystal oscillators.

4) Determines the resonant frequency of a crystal.

ET03480 Which of the following factors affects the frequency stability of a crystal oscillator the most?

3\.

1) Changes in stray wiring capacitance.

2) Vibration.

3) Temperature.

4) Changes in loading.

ET03490 The "electrical" axis of a crystal is called the:

4\.

1) X-axis

2) Y-axis

3) Z-axis

4) GT-axis

ET03510 The equivalent circuit for a crystal consists of which of the following:

5\.

1) An L-C parallel circuit.

2) An R-L-C parallel circuit.

3) An L-C series circuit.

4) An R-L-C series circuit.

ET03520 Calculate the "Q" of a crystal whose specifications are as follows:

6\.

Resonant frequency = 500 Kc
Equivalent resistance = 250 ohms
Equivalent Capacitance = 0.042 pf
Equivalent inductance = 2.13 H

1) 13,500

2) 15,900

3) 23,000

4) 27,000

ET03530 In crystal oscillators feedback is provided by means of:

7\.

1) Stray holder capacitance

2) Grid-to-plate capacitance

3) An inductance connected in series with the crystal

4) Inductive coupling between the RFC choke and the inductance in the plate tank circuit.

ET03540 The three elements of a communication system are:

8\.

1) intelligence, carrier wave, receiver

2) microphone, transmitter, receiver

3) intelligence, medium, receiver

4) transmitter, medium, receiver

ET03550 Modulation is the process of:

9\.

1) Transmitting a radio-frequency signal to a receiver.

2) Transmitting an audio signal to a receiver.

3) Impressing intelligence on a radio-frequency signal.

4) Generating a carrier wave in order to transmit intelligence.

ET03560 When an audio signal is applied to an AM transmitter, which of the following occurs?

10\.

1) The audio signal is amplitude modulated by the carrier wave.

2) The amplitude of the carrier wave varies in accordance with the amplitude of the audio signal.

3) The amplitude of the carrier wave varies in accordance with the frequency of the audio signal.

4) The amplitude of the audio signal varies in accordance with the frequency of the carrier signal.

ET5030
15010
15A

ET03570

11. In an AM transmitter, the oscillator is usually isolated from the modulator by one or more r-f amplifiers. The purpose of this is to:

1) Improve the stability of the oscillator.

2) Improve the quality of the modulation.

3) Reduce the amount of modulating power required.

4) Increase the output power.

ET03580 In the diagram below, the neutralizing capacitor is labeled:

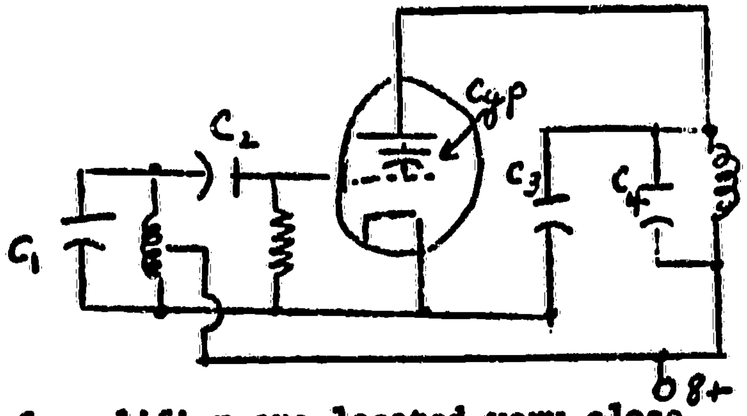
1.

1) C_1

2) C_2

3) C_3

4) C_4



ET03590 When an oscillator and an r-f amplifier are located very close to each other, the type of coupling which will result in maximum power transfer is:

2.

1) Link coupling.

2) Inductive coupling.

3) Capacitive (RC) coupling.

4) Transmission line coupling.

ET03600 When capacitance coupling is used to couple two r-f amplifiers:

3.

1) Maximum power transfer is usually obtained.

2) The two amplifiers must be very close to each other to prevent excessive radiation losses.

3) The output impedance of the first amplifier must be equal to the input impedance of the second.

4) Impedance matching is not critical.

ET03610 A tuned circuit which is loaded will have a high Q if:

4.

1) It has a small L/C ratio

2) It has a large L/C ratio

3) It has a small X_L/R ratio

4) It has a large L/R ratio

ET03620 "Link coupling" uses:

5.

1) Two tuned circuits.

2) A low impedance transmission line.

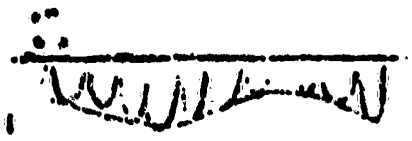
3) A high impedance transmission line.

4) None of the above.-

ET5030
16010
16A

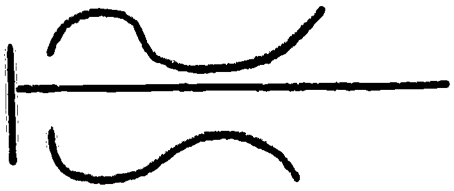
ET03630 Which of the following diagrams represents an AM signal which has been rectified?

6.

1)


3)


2)


4)


ET03650 In the diode detector shown below, the reactance of C_2 should be:

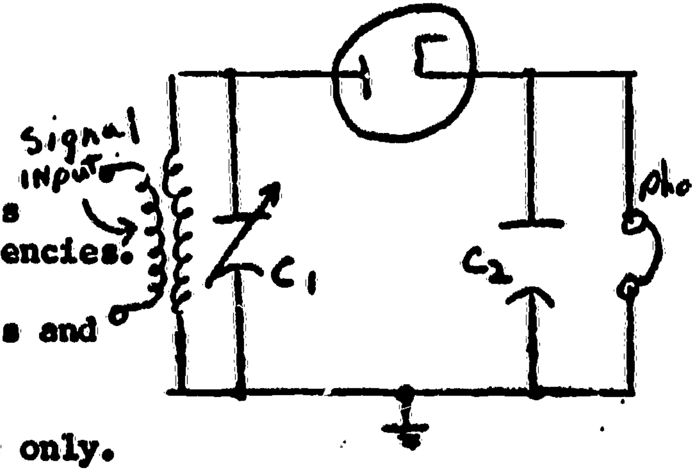
7.

1) Low for audio frequencies but high for carrier frequencies.

2) High for audio frequencies but low for carrier frequencies.

3) High for audio frequencies and carrier frequencies.

4) Low for audio frequencies only.



ET03660 Which of the following is <u>not</u> a characteristic of the plate detector?

8.

1) Zero grid current.

2) Poor selectivity.

3) Good sensitivity.

4) No loading of the input circuit.

ET03670 The type of detector having the greatest sensitivity is the:

9.

1) Plate detector.

2) Grid-leak detector.

3) Diode detector.

4) Tuned-circuit detector.

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ELECTRICAL TECHNOLOGY
5030

DIAGNOSTIC EXAMINATION ANSWERS

Book IV

ET5030
01010
1A

ET01790 Thermonic emission will take place only if:

1. (2) the cathode is heated

ET01810 One advantage of tungsten as a filament material is:

2. (4) it has a long life

ET01830 Given the circuit below, and a plate current of 100 ma find the value of r

3. (3) 2.5K

ET01850 Which is not an advantage of a twin diode?

4. (3) they can handle more voltage than a similar single diode

ET01861 Which statement best describes what happens in a gas-filled diode when the load current goes up?

5. (3) the output voltage remains constant

ET01880 If the input voltage wave shape over 1 period in the circuit below looks like figure 1, then what does the wave shape of the current in R look like?

6. (3) 

ET01900 A metal with a high work function will

7. (3) not emit electrons freely at relatively low temperatures

ET01920 Choose the answer that will make the statement correct.
The cloud of electrons near the ________ is called the ________.

8. (3) filament, space charge

ET01940 In the region labeled A, the plate current is limited by

9. (1) negative space charge

ET01960 Find the AC Plate resistance in region A and B.

10. (3) 5K, ∞

ET01971 Zener diodes are:

11. (3) used to furnish a constant D.C. reference voltage

ET01800 Which is not a definition of secondary emission?

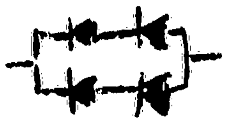
1. (3) The emission of electrons due to the impact energy of light rays.

ET01820 When several filaments are connected in series

2. (1) the current rating of each must be the same.

ET01840 If one diode can rectify .5 amps at 100 volts, how would you connect 4 diodes to handle 200 volts at 1 amp?

3. (2)



ET01860 Which statement best describes what happens in a high vacuum diode when the load current goes up?

4. (2) the plate voltage goes down

ET01870 A half-wave rectifier is connected across a 60 cps, 120 volts rms line. If there is zero voltage drop across the diode and a resistive load,
5. then the voltage measured across the load with a d-c meter is

(2) 53.5

ET01890 What are the polarities of Points A and B with respect to ground when the tube conducts?

6. (3) A+ B+

ET01910 Given a current of 400 ma in the circuit below find the value of R

7. (2) 9.5 ohms

ET01930 For the curve given below, what is the name given to the value of the current at point A?

8. (4) saturation current

ET01950 Find the dc plate resistance at point A

9. (3) 800 Ω

ET01970 The back resistance of a crystal diode is usually in the order of

10. (4) 1,000,000 Ω

ET01980 Metals commonly used for grids do no include

1. (3) copper

ET02000 Current will flow in the grid circuit only:

2. (1) if the grid is positive

ET02011 Curves A, B, C and D correspond to different:

3. (3) plate voltage

ET02040 The A-C plate resistance of a triode amplifier may be found using the:

4. (2) Ib vs Eb curves

ET02070 The plate voltage is equal to

5. (1) the value of the plate supply voltage minus the product of the plate voltage and the load resistance

ET02090 The two waves below are:

6. (3) out of phase by 90°

ET02110 Draw the load line for a 6BF6 in the circuit below. What are the x (Plate Volts) y (plate current) intercepts of the load line

7. (3) $\overset{x}{450}$ volts $\overset{y}{18}$ ma

ET02130 The grid bias of the circuit is

8. (3) 2 volts

ET02170 If in the circuit below the signal were removed the value of the grid bias would:

9. (2) go to zero

ET01990 When the grid is positive:

1. (2) more electrons reach the plate

ET02010 In a triode amplifier an ________ in signal voltage will produce a ________ in the output voltage.

2. (2) increase decrease

ET02020 $\mu =$:

3. (3) $\frac{\Delta ep}{\Delta eg}$; I_p const.

ET02030 The effect of grid bias on the DC resistance of a triode may be summarized this way:

4. (1) an increase in bias causes an increase in d-c resistance

ET02060 An electron tube has an amplification factor of 80 and a plate resistance of 40 K. Find its transconductance in µmhos.

5. (4) 2000 µmhos

ET02100 When the wiper of the potentiometer is at point ______ the plate ______.

6. (2) B, plate current is maximum

ET02120 What is the voltage gain of an amplifier for which $\mu=16$, $R_L = 25K$ and $r_p = 8500$ ohms?

7. (2) 11.9

ET02140 The value of the bias voltage is:

8. (2) 5 volts

ET02180 Choose the answer which names the three capacitors below.

9. (3) C_{gp} C_{pk} C_{pk}

ET02200

1\. For the half wave rectifier with a capacitor input filter, the peak inverse voltage will be approximately ________ the peak voltage of the transformer secondary.

(2) twice

ET02220

2\. The tube that can not amplify is the:

(3) diode

ET02240

3\. Choose the correct diagram of the full wave bridge rectifier.

(2) B

ET02250

4\. The ripple frequency of a full wave rectifier is:

(2) 2 times the ripple frequency of a half wave rectifier.

ET02260

5\. Given a transformer with a primary voltage of 120 volts, a current of 1a, and primary to secondary turns ratio of 1 to 4, find the secondary voltage and the secondary current.

(3) 480 volts, 250 ma

ET02270

6\. The filament of a tube heated by DC has a distribution of potentials along its length; this distribution is sometimes called:

(3) potential gradient

ET02280

7\. Which circuit bests fits the following description? A filter with excellent smoothing, heavy and costly.

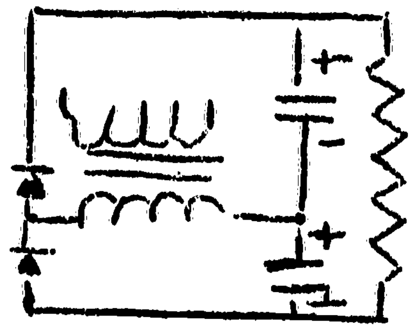
(4)

ET02290
1\. Voltage doubler circuits provide

2) high voltages and low current

ET02290
2\. Which circuit is the correct circuit for a voltage doubler?

3)



ET02290
3\. The circuit below is:

1) half wave voltage doubler

ET02290
02300
4\. The output of the circuit below is:

2) 282 volts peak

ET02305
5\. A bleeder resistor:

2) prevents shock hazards

ET02305
6\. Find the values of V_1, V_2 and V_3 of the voltage divider shown below.

3) 30, 90, 180

ET02305
7\. A bleeder resistor:

1) improves voltage regulation

ET02305
8\. Find the value of the bleeder resistor R_1 if the bleeder current is 10ma.

2) 15kΩ

ET02310
9\. The circuit below is used to

3) provide regulated voltages

ET02310
10\. A voltage regulator tube operates

4) at about 3/4 of its starting voltage

ET02330 In a tetrode vacuum-tube, the order of the elements going from the cathode to the plate is:

1\. (3) cathode, control grid, screen grid, plate

ET02340 The purpose of the screen grid in a tetrode vacuum-tube is to:

2\. (1) reduce feedback between the plate and the control grid.

ET02350 In the tetrode circuit shown below, the grid-to-cathode voltage is -11.5 volts and the plate current is 10.0 ma. Calculate the voltage at the screen grid with respect to ground.

3\. (2) 232 volts

ET02360 If the screen grid bypass capacitor is removed from the circuit of a tetrode amplifier tube, which of the following will occur?

4\. (4) amplification will decrease

ET02370 The characteristic curve for a typical tetrode is shown below. The region of negative resistance is

5\. (3) region B-D

ET02380 When the plate voltage applied to a certain tetrode amplifier is increased from 0 to 10 volts, the plate current is observed to increase. However, when the plate voltage is increased from 10 to 40 volts, the plate current decreases. The reason for this is:

6\. (2) the number of secondary electrons emitted from the plate is greater than the number of primary electrons reaching the plate.

ET02390 A tetrode vacuum tube will amplify linearly only if

7\. (4) a high plate voltage is used.

ET02400 Which of the following types of tubes always contain a suppressor grid?

8\. (3) pentode

ET02410 The suppressor grid in a pentode

9\. (1) is negative with respect to the plate

ET02420 Which of the following statements is false?

10\. (2) The pentode exhibits a negative resistance characteristic for very low values of plate voltage.

ET02430 If the plate supply voltage of a pentode which is operating in a linear region is doubled, while all other tube voltages remain the same, then

11\. (3) the amplification will remain the same

ET02440 A certain pentode operates into a load resistance of R_L=1.0 megohm. It is found that when the plate voltage is increased from 100 to

12. 250 volts the plate current increases from 0.30 ma to 0.55 ma. Calculate the plate resistance of the pentode.

(3) 600 K ohms

ET02450 Which of the following statements is false?

13. (2) The plate impedance of a triode is greater than the plate impedance of a pentode.

ET02460 The following information is given about a type 6AU6 pentode:

14. (3) 900

ET02470 In a remote cutoff pentode

1. (3) the transconductance becomes smaller as the bias is made more negative

ET02480 A pentode will deliver a constant current into a wide range of load resistances because of its

2. (2) high plate resistance

ET02490 When a pentode is used as a triode

3. (4) the suppressor grid and the screen grid are connected to the plate

ET02500 If a sinusoidal input signal is applied to a variable-mu pentode

4. (4) the output signal will be distorted

ET02500 In which of the following could a variable-mu pentode be used?

5. (3) I.F. amplifier in an AM radio receiver

ET02510 A beam power tube is:

6. (4) either a tetrode or a pentode

ET02510 Which of the following types of tubes has the highest power sensitivity?

7. (3) beam power tube

ET02520

1. When a power amplifier tube is used to drive a loudspeaker, an output transformer is used

(4) to provide impedance matching

ET02530

2. Which of the following is not an example of a transducer?

(2) a transformer

ET02540

3. Calculate the value of the input signal required to produce an output signal of 50 volts peak to peak. Assume that the grid bias voltage is - 30 volts, and the load resistance of the tube is 2000 ohms.

(1) 20 volts

ET02550

4. In order to obtain minimum distortion when using a power pentode, the load impedance should be

(1) smaller than the plate impedance

ET02560

5. If an excessive input signal is applied to an amplifier tube using cathode bias, the result will be

(1) grid current flow on the positive half cycles of the input signal

ET02570

6. The following information is given for a type 6F6-GT tube used as a triode amplifier: Amplification Factor (u) = 7.0, Plate Resistance (r_p) = 2,600 ohms. If the load impedance (Z_L) is 4,400 ohms, calculate the output power for an input signal of 10 volts.

(2) 0.44 watt

ET02580

7. For reasonable power output with lowest distortion, the load impedance (Z_L) for a triode should be

(3) greater than the plate impedance (r_p)

ET02590

8. Determine the power sensitivity of the 50L6-GT tube from the following information:

Load Resistance = 4000 ohms
Plate Impedance = 28,000 ohms
Input Voltage = 8.0 volts (p-p)
Amplification Factor = 6.8
A.C. Load Current = 22.4 ma. (r.m.s.)

(2) 63,000 micromhos

ET02600

9. The suppressor grid in a power pentode is connected directly to the cathode in order to

(3) return secondary electrons to the emitting electrode, thereby improving the linearity of the i_b-e_b curve

ET02610 Given the following information about a type 6F6-GT power pentode:

10.

Plate Voltage = 250 volts   Screen Grid Voltage = 250 volts
Plate Current = 34 ma.   Load Resistance = 7000 ohms
Screen Grid Current = 7.0 ma.   Control Grid Bias Voltage = -16 volts

Calculate the value of cathode resistance which will produce a bias voltage of -16 volts on the control grid.

(2) 390 ohms

ET02620 A feature of the beam power tube is that the screen-grid current is very low. This is due to

11.

(4) the alignment between the control-grid and screen-grid wire

ET02640 An amplifier is considered to be operating in class A1 when the angle of plate current flow is

12.

(4) 360 degrees

ET02650 In a class A1 amplifier, the bias point is chosen

1\. (2) at point B

ET02660 A class B amplifier may be defined as:

2\. (4) one in which the grid bias is approximately equal to the cutoff value, so that plate current flows for approximately one-half of each cycle.

ET02670 If the power input to a class B amplifier is 50 watts, which of the following is the approximate power output?

3\. (3) 30 watts

ET02680 If you were designing a high-fidelity amplifier, and you had a choice of using either a class A1 or a push-pull class B output stage, both of which would deliver the same output power, which would you pick?

4\. (4) the class B stage, because it is more efficient, and does not produce second harmonic distortion

ET02690 Given the following waveform, which of the following types of amplifiers would you choose to amplify this signal?

5\. (4) Class B or Class C

ET02700 The bias voltage for a class C amplifier is selected to that it is

6\. (1) considerably more negative than the cutoff bias for the tub

ET02710 When a class C amplifier is used as an r.f. amplifier

7\. (3) the tank circuit supplies the missing parts of the output cycle

ET02730 If an amplifier tube conducts for more than 180 degrees but less than 360 degrees of the input signal, the amplifier is said to be operating in

8\. (2) class AB

ET02740 A sinusoidal input signal is applied to an amplifier operating in class B. The output signal will consist of

9\. (1) negative going half cycles

ET02750 Which of the following types of amplifiers would amplify the signal shown with no distortion and maximum efficiency?

10\. (1) class A1

ET02760 The output voltage of a class B amplifier

11\. (2) consists of negative going half cycles

ET02770 An advantage of a class B amplifier over a class A amplifier is

12. (4) higher efficiency

ET02790 In a class B push-pull audio amplifier each tube conducts for

13. (2) 180 degrees of the input cycle

ET02800 The primary advantage of a class C amplifier over all other classes is

14. (2) higher efficiency

ET02810 1. A certain amplifier is designed to have a perfectly flat response down to a frequency of 20 cps. The amplifier uses RC coupling. If the grid resistance (R_g) is 1.0 megohms, what should the reactance of the coupling capacitor be at 20 cps?

(4) 0.01 megohms

ET02820 2. When impedance coupling is used

(3) the quiescent plate voltage of the tube is approximately equal to the power supply voltage

ET02830 3. If a vacuum-tube amplifier uses transformer coupling

(1) the gain may be higher than with RC coupling

ET02840 4. In the diagram shown below, what should be the ratio of R_1 to R_2 to obtain maximum output voltage?

(1) 0

ET02860 5. Varying the cathode bias of a variable-mu tube will

(1) affect the amplification at all frequencies

ET02870 6. Coarse and fine volume controls are to be provided for a pentode amplifier. If both controls have the same resistance value, the most logical arrangement for these would be:

(3) fine on screen grid, coarse on control grid

ET02880 7. In the tone control circuit shown below, as the wiper of the potentiometer is moved from A to B

(4) the high frequency response will decrease

ET02890 8. Most musical instruments do not produce fundamental frequencies over 5,000 cps. However, in order to reproduce faithfully the sounds of these instruments, an audio amplifier with a frequency response up to 20,000 cps is required in order to

(3) reproduce the harmonic frequencies generated by each instrument

ET02900 9. The frequency response of a certain amplifier is shown below. Which of the following describes the response of this amplifier most accurately?

(4) 30 cps - 20 Kc ± 2 db

ET02910 10. Which of the following designations for the response of an audio amplifier is the most meaningful?

(3) 20 - 20,000 cps + 2 db
- 1 db

ET02920 The diagram below shows the equivalent circuit of an amplifier. In this circuit the plate resistance of the tube is symbolized by ___________, and the total stray capacitances are symbolized by ___________.

1\.

(3) R1, C1

ET02930 The diagram below shows the equivalent circuit of a certain amplifier. The low frequency response of this amplifier is dependent on the ratio of

2\.

(4) C_c / R_g

ET02940 The low frequency response of an amplifier may be improved by

3\. (1) increasing the capacitance of the coupling capacitor

ET02950 Which of the following is an advantage of transformer coupling over R-C coupling?

4\.

(4) all of the above

ET02960 The high frequency drop-off of transformers is caused by the action of

5\.

(4) all of the above

ET02970 If the plate load resistance of an amplifier is decreased, then

1\. (1) the frequency response will increase, but the amplification will decrease

ET02980 The components labeled C_f and R_f in the following diagram are intended to improve the low frequency response of the amplifier.

2\. If the value of R_f is 30,000 ohms, what should the reactance of the capacitor be at low frequencies?

(4) 300 K ohms

ET02990 If the coupling capacitor, C_c, in the diagram below does not have enough capacitance, what will be the effect on the frequency

3\. response of the amplifier?

(1) the amplification at low frequencies will be poor

ET03100 If the cathode bypass capacitor (C_k) of an amplifier is replaced by one of infinite capacitance, what will be the effect on the

4\. frequency response of the amplifier?

(4) The amplification at all low frequencies will be the same.

ET03110 Series peaking increases the high frequency response by:

5\. (4) increasing Z_L at high frequencies

ET03120 When shunt peaking is employed to improve the high frequency response of an amplifier

6\. (3) an inductance is placed in series with the plate load resistance, R_L

ET03130 When series peaking is used to improve the high frequency response of an amplifier, the series peaking coil(L_{se}) forms a resonant

7\. circuit with

(2) C_c

ET03140 When combination peaking is used to improve the high frequency response of an amplifier

8\. (4) the high frequency compensation is better than the compensation obtained with series peaking

ET03150 Which of the following statements is false?

9\. (4) 1600 kc = 0.16 mc

ET03160 The circuit shown below is tuned to a station broadcasting on a frequency of 100 kc. If L = 10.0 millihenrys, calculate the

10\. value of C.

(3) 254 pf

ET03170

11. A double-tuned RF transformer may be used to couple the first and second stages of an RF amplifier together. When maximum gain is desired, the transformer is adjusted so that

(2) the resonant frequency of the primary is the same as the resonant frequency of the secondary

ET03180 The "Q", or figure of merit of a coil may be defined as

1\. (4) the ratio of the inductive reactance of the coil to the resistance of the coil

ET03190 Calculate the passband of the amplifier whose response is shown in the figure below.

2\. (3) 20 kc

ET03200 If an audio signal of 10 Kc is used to modulate an RF carrier of 1,000 Kc, calculate the passband which the receiver must have to amplify this signal.

3\. (3) 20 Kc

ET03210 Which of the following statements is true about the curves shown below?

4\. (4) The passband of A and B are the same, but the selectivity of A is greater than the selectivity of B.

ET03220 Which of the statements below are correct?

5\. (4) Curve A represents the kind of response obtained with tight coupling.

ET03230 Which of the following statements is false?

6\. (3) The output impedance of a cathode follower amplifier is greater than the input impedance.

ET03240 The output of a certain amplifier feeds both a tape recorder and a very long cable which is connected to a device several hundred feet away. A cathode follower amplifier is used between the amplifier and the cable instead of a transformer. This is because

7\. (3) a cathode follower provides more isolation between input and output than a transformer

ET03250 Which of the following is not a characteristic of a cathode follower amplifier?

8\. (1) voltage gain

ET03260 The voltage gain of a certain cathode follower amplifier is 0.7. The grid resistance is $R_g = 1.0$ megohm, and the cathode resistance is $R_k = 500$ ohms. Calculate the power gain of the cathode follower.

9\. (2) 980

ET03270 If a small resistance is connected in series with the plate of a cathode follower tube as shown below, then:

10\. (2) e_1 and e_2 will be 180 degrees out of phase with respect to each other

ET5030
13010
13 A

ET03280. Positive feedback is necessary for any type of oscillation. In a mechanical clock it is provided by:

1.

(3) the main spring assemble

ET03290 The diagram below best describes:

2.

(2) the displacement of a car wheel upon hitting a sudden drop in pavement level

ET03300 The main spring of a mechanical clock replaces energy lost through friction. The amount of energy needed could best be determined from data concerning:

3.

(2) changes in maximum pendulum displacement with time

ET03310 For a clock pendulum to oscillate with a constant frequency and amplitude

4.

(2) the energy imparted must exceed the frictional losses

ET03320 If negative feedback of energy was applied to a clock pendulum

5.

(4) the amplitude of oscillation would decrease

ET03330 In order to have sustained oscillations in an L-C circuit which contains some resistance, which of the following is required?

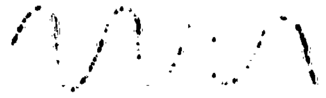
6.

(1) positive feedback

ET03340 Which of the following diagrams represents the oscillations which will be produced by an L-C circuit which contains no resistance?

7.

(1)



ET03350 Which of the following feedback signals will produce sustained oscillations in an oscillator?

8.

(4) 720 degrees out of phase with respect to the tank circuit signal

ET03360 If the tickler coil of an oscillator is not coupled to the coil in the tank circuit

9.

(1) the oscillator will not work

ET03370 After oscillations in a grid-leak bias oscillator have built up, the oscillator operates:

1. 3) class D.

ET03380 In the diagram below, the component marked ________ is the radio-frequency choke, and the component marked ________ is the grid-leak bias capacitor.

2. 3) L_3 ; C_2

ET03390 In the shunt-fed tickler-coil oscillator

3. 4) a d-c blocking capacitor is in series with the tickler coil.

ET03410 The feed-back path in the shunt-fed Hartley oscillator shown below is through the components labled ________ and ________.

4. 3) L2 C2

ET03420 In the TPTG oscillator, the feedback path is through

5. 2) the coupling capacitor connected between the plate tank circuit and the grid tank circuit.

ET03430 The TPTG oscillator will not work at audio frequencies because:

6. 2) the grid-plate capacitive coupling is not sufficient to provide the required feedback at audio frequencies.

ET03430 If the plate tank circuit of a TPTG oscillator is tuned to twice the frequency of the grid tank circuit, then

7. 1) the frequency at the plate will be twice the frequency at the grid.

ET03440 Calculate the inductance of an oscillator tank circuit which is tuned to a frequency of f_r = 1,000 Kc, and whose circuit capacitance is 500 picofarads (0.0005 μf).

8. 1) 50.6 uH

ET03450 Which of the following statements is correct?

9. 3) If the spacing between the grid and the cathode of the oscillator tube changes, the frequency stability will be affected.

ET03460 If random electrical pulses are applied to a crystal,

1. 3) the crystal will vibrate at its resonant frequency

ET03470 The "piezoelectric effect"

2. 2) refers to the voltage developed when pressure is applied to a crystal

ET03480 Which of the following factors affects the frequency stability of a crystal oscillator the most?

3. 3) temperature.

ET03490 The "electrical" axis of a crystal is called the

4. 1) X-axis

ET03510 The equivalent circuit for a crystal consists of which of the following:

5. 4) an R-L-C series circuit.

ET03520 Calculate the "Q" of a crystal whose specifications are as follows:

6. Resonant frequency = 500 Kc
Equivalent Capacitance = 0.042 pf
Equivalent inductance = 2.15 H
Equivalent resistance = 250 ohms

4) 27,000

ET03530 In crystal oscillators feedback is provided by means of

7. 2) grid-to-plate capacitance.

ET03540 The three elements of a communication system are:

8. 4) transmitter, medium, receiver.

ET03550 Modulation is the process of

9. 3) impressing intelligence on a radio-frequency signal.

ET03560 When an audio signal is applied to an AM transmitter, which of the following occurs?

10. 2) The amplitude of the carrier wave varies in accordance with the amplitude of the audio signal.

ET03570 In an AM transmitter, the oscillator is usually isolated from the modulator by one or more r-f amplifiers. The purpose of this is to

11. 1) improve the stability of the oscillator.

ET03580 In the diagram below, the neutralizing capacitor is labled

1. 3) C_3

ET03590 When an oscillator and an r-f amplifier are located very close to each other, the type of coupling which will result in maximum power transfer is

2. 2) inductive coupling

ET03600 When capacitance coupling is used to couple two r-f amplifiers,

3. 2) the two amplifiers must be very close to each other to prevent excessive radiation losses.

ET03610 A tuned circuit which is loaded will have a high Q if

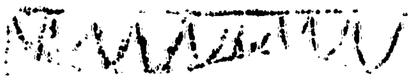
4. 1) it has a small L/C ratio.

ET03620 "Link coupling" uses

5. 2) a low impedance transmission line.

ET03630 Which of the following diagrams represents an AM signal which has been rectified?

6. 1)



ET03650 In the diode detector shown below, the reactance of C_2 should be

7. 2) high for audio frequencies but low for carrier frequencies.

ET03660 Which of the following is <u>not</u> a characteristic of the plate detector?

8. 2) poor selectivity.

ET03670 The type of detector having the greatest sensitivity is the

9. 2) plate detector.

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DIAGNOSTIC QUESTIONS

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PH00010 What are the fundamental dimensions of force?

1) $\frac{ML}{T^2}$

2) MTL

3) $\frac{LM}{T}$

4) ML^2

PH00020 The depth of the water in a lake is to be measured by placing a weighted string in the water. If the length of the string below the water is 1,425 cm, what is the depth of the water in fathoms?

1) 7.8

2) 50.3

3) 92.5

4) 281

5) 1120

PH00030 An automobile travels with a velocity of 60 miles/hr. Express this velocity in fps units.

1) 41ft/sec

2) 60ft/sec

3) 88ft/sec

4) 128ft/sec

5) 528ft/sec

PH00040 A fly is 3.1 millimeters long. What is his length in kilometers?

1) 3.1 km

2) $3.1x10^3$km

3) $3.1x10^{-3}$ km

4) $3.1x10^{-5}$ km

5) $3.1x10^{-6}$ km

PH00050 The angstrom unit is a unit of length often used in optical measurements. It is defined by the relation: 1 Angstrom (A) = 10^{-8} centimeters. How many Angstroms are there in one inch?

1) 2.54×10^{-8} 2) 3.96×10^{-9} 3) 3.96×10^{7}

4) 2.54×10^{8} 5) none of these

PH00060 A caliper is marked in 10 millimeter increments. In using the scale of the instrument the maximum possible error in measurement would be

1) ± 10 mm

2) ± 1 mm

3) ± 5 mm

4) ± 2.5 mm

5) none of these

PH00070 A man takes a walk every morning;at the middle of his walk, he has walked 1 mile west, then 1/4 south and then 1/2 mile east. How far is the man from his home?

1) 0.25 miles

2) 0.47 miles

3) 0.56 miles

4) 0.83 miles

5) 1.75 miles

PH00080 Mass, density, speed, are examples of ________quantities.

1) Vector

2) Scalar

3) Units

4) Energy

5) none of these

PH00090 Force, according to Newton's Second Law is __________

1) friction x mass

2) mass x velocity

3) mass x acceleration

4) velocity x time

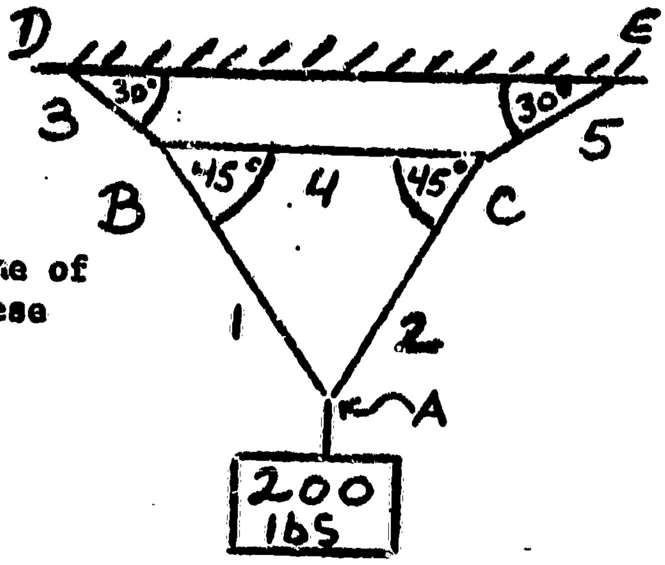
5) none of these

PH00100 The x and y components of three vectors are $\vec{A}$: 3, -2; $\bar{B}$: -5, 1; C: 2,1 respectively. What are the components of $\vec{A} + \vec{B}$?

1) 8,3 2) 2,1 3) -8,-3

4) -8,-1 5) -2,-1

PH00110 A 200 lb. weight is suspended from cords arranged as shown in the diagram. Find all the forces acting at point A.



1) $T_1=100$, $T_2=100$ 3) $T_1=70.7$, $T_2=141.$ 5) None of these

2) $T_1=70.7$, $T_2=70.7$ 4) $T_1=141$, $T_2=141$

PH00120 A test car drives around a circular track one mile long at a uniform speed, so that it takes three fourths of a minute to make one complete trip around the track. What is the displacement of the car when it has gone half way around the track?

1) 0 miles 3) 0.318 miles 5) 1.00 miles

2) 0.159 miles 4) 0.500 miles

PH00130 Which equation describes motion for constant velocity?

1) $x = v_o + vt$ 3) $v_2 = v_1 + xt$ 5) $v_2^2 = v_1^2 + 2vx$

2) $x = vt$ 4) $x = v.t + \frac{1}{2} vt^2$

PH00140 A man walks with a constant velocity of six feet per second to the east relative to the deck of a boat. The boat moves with a constant velocity of 15 feet per second to the north, relative to the earth. What is his displacement relative to the deck after 7 seconds?

1) 23.2 ft. 3) 53.4 ft. 5) 113.4 ft.

2) 42.0 ft. 4) 87.1 ft.

PH00150 Which equation is the defining equation for acceleration, when the acceleration is constant?

1) $x = at^2$ 3) $v_2 = v_1 + at$ 5) $a = v_1x + \frac{1}{2} v_2t^2$

2) $x = v_1t + \frac{1}{2} at^2$ 4) $v_2^2 = v_1^2 + 2ax$

PH00160 A ball, thrown vertically upward, passes a window 21 feet above the ground with a velocity of 16 feet/second (directly upward). How high above the ground will the ball rise?

1) 4 ft.
2) 8 ft.
3) 13 ft.
4) 17 ft.
5) 25 ft.

PH00170 A boy throws a ball vertically upward so that it reaches a maximum height of 100 feet. What was the initial velocity of the ball? (Neglect the height of the boy)

1) 47 ft/sec
2) 56.5 ft/sec
3) 59 ft/sec
4) 64 ft/sec
5) 80 ft/sec

PH00180 Light travels at a speed of approximately

1) 3×10^8 Angstroms/sec
2) 3×10^8 cm/sec
3) 3×10^{10} m/sec
4) 3×10^8 m/sec
5) none of these

PH00190 An airplane flying horizontally, at a speed of 600 miles/hour releases a bomb from an altitude of 400 feet. What is the horizontal component of velocity when the bomb hits the ground? (Neglect air friction)

1) 0 mph
2) 200 mph
3) 400 mph
4) 600 mph
5) none of these

PH00200 Newton's First Law is sometimes called the ______________.

1) Law of the Mean
2) Law of Acceleration
3) Law of Conservation of Energy
4) Law of Conservation of Momentum
5) none of these

PH00210 Two weights, 10 and 15 lbs., are attached to opposite ends of a string which passes over a frictionless, weightless pulley. (a) What is the tension in the string? (b) What is the magnitude of the acceleration of the system?

1) $T = 9$ lbs., $a = 9$ ft/sec^2

2) $T = 12$ lbs., $a = 9$ ft/sec^2

3) $T = 15$ lbs., $a = 9$ ft/sec^2

4) $T = 9$ lbs., $a = 6$ ft/sec^2

5) $T = 12$ lbs., $a = 6.4$ ft/sec^2

PH00220 On an imaginary planet, which we will call Alpha, a freely falling body, near the surface of this planet, accelerates at a rate of 20 feet/second^2. What is the mass of a man, who weighs 160 lbs. on earth, when he is on Alpha?

1) 4 slugs
2) 5 slugs
3) 8 slugs
4) 10 slugs
5) 16 slugs

PH00230 The tires of a certain car exert a force of 3000 lbs. against the pavement. The pavement exerts ____________.

1) no force on the tires
2) an equal force on the tires
3) 1500 lbs. total on all the tires
4) 6000 lbs. total on all the tires
5) none of these

PH00240 What is the gravitational force between the earth and a body with a mass of 1 slug which is 1000 miles above the surface of the earth?

1) 32.2 lbs.
2) 20.6 lbs.
3) 25.6 lbs.
4) none of the above

PH00250 The Cavendish Experiment is a method to obtain ____________.

1) g, the acceleration due to gravity.

2) G, the Universal Gravitational Constant.

3) The mass of a substance.

4) The specific gravity.

5) none of these.

PH00260 What is the minimum work necessary to raise a 40 lb. block a vertical distance of 1 foot up a frictionless plane inclined at an angle of 45°, by a force directed parallel to the plane?

1) 20.0 ft-lbs.	3) 40.0 ft-lbs.
2) 28.3 ft-lbs.	4) 56.6 ft-lbs.

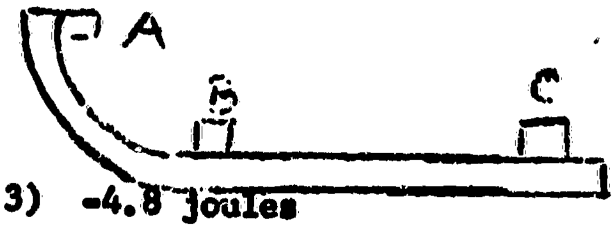
PH00270 Which of these is NOT a unit of energy?

1) watt/sec	3) dune-cm
2) foot-pound	4) horsepower-hour

PH00280 What is the potential energy (with respect to the surface of the earth) of a man in an airplane 5000 feet above the ground, if the man has a mass of 80 kg?

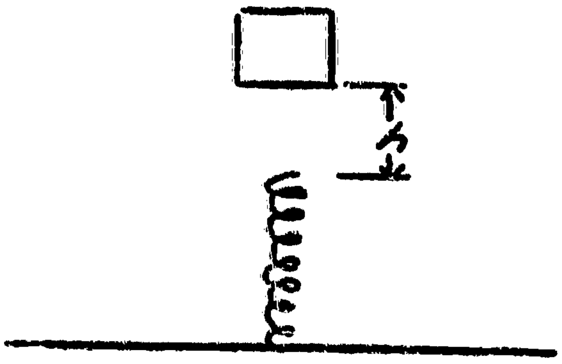
1) 6.0×10^5 joules	3) 2.4×10^6 joules
2) 1.2×10^6 joules	4) 4.8×10^6 joules

PH00290 A block having a mass of 2 kg slides down a ramp in the shape of a quarter-circle with a radius of 1 meter. When it reaches point B it is traveling at a speed of 4 m/sec. How much work is done on the block by friction on the curve?



1) -3.6 joules	3) -4.8 joules
2) -4.2 joules	4) -15.6 joules

PH00300 A block with a mass of 2 kg is dropped vertically onto a spring from a height h = 10 meters, as shown in the diagram. The spring constant is 20 nt/m. What is the maximum distance the spring will be compressed? (Hint: the potential energy of a compressed spring is $\frac{1}{2}$ k x 2, where k = spring constant and x = distance compressed.)



1) 10.00 meters	3) 4.24 meters
2) 3.56 meters	4) 5.52 meters

PH00310 A 20 lb. block rests on a horizontal surface. The coefficient of static friction for the two surfaces is 0.6. The kinetic coefficient is 0.5. A horizontal force, F, which continually increases is applied. What is the maximum value of F before motion occurs?

1) 5 lb 3) 10 lb 5) 20 lb

2) 6 lb 4) 12 lb

PH00320 An 8 lb block is placed at the top of a 4 ft. long plane at an angle of 30°. The upper half of the plane is frictionless, while the lower half offers a uniform frictional surface to the block. The block is released at the top of the plane, and has a velocity of 10 ft/sec at the bottom of the plane. What is the velocity of the block halfway down the plane?

1) 0.71 ft/sec 3) 5.66 ft/sec 5) 16 ft/sec

2) 2 ft/sec 4) 8 ft/sec

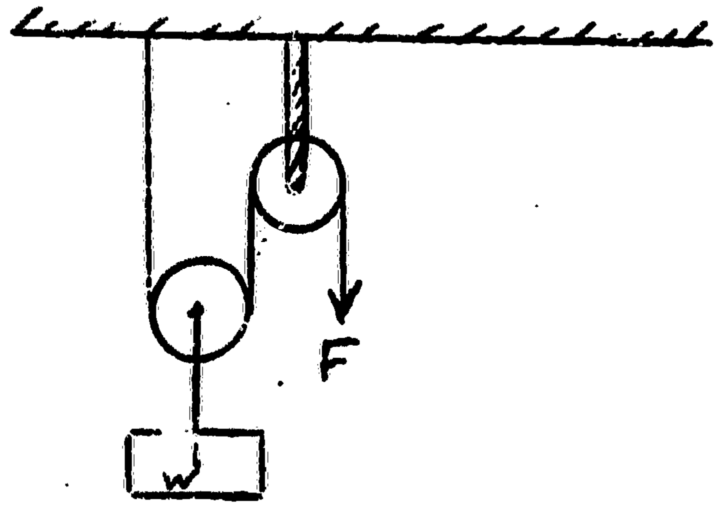
PH00330 Which of the following relationships is FALSE?

1) 0.746 kw = 1 hp 4) 1 joule=1.36 ft-lbs.

2) 550 ft - pounds = 1 hp - sec

3) 1 joule = 625 x 10^{18} electron volts.

PH00340 In the pulley system shown below, a force of F = 100 lbs is required to lift a weight of 130 lbs. What is the efficiency of the system?



1) 130% 3) 65%

2) 77% 4) 43%

PH00350 The Ideal Mechanical Advantage of a machine is defined as ________.

1) ratio of output force to input force 4) ratio of heat loss and friction

2) ratio of input distance to output distance

3) ratio of work output to work input 5) none of these

PH00360 An electric motor has an efficiency of 65%. If the motor can lift a 500 lb weight a distance of 100 feet in 10 sec, and the electric company charges 5 cents/kwh, how much does it cost to use the motor for 15 min.?

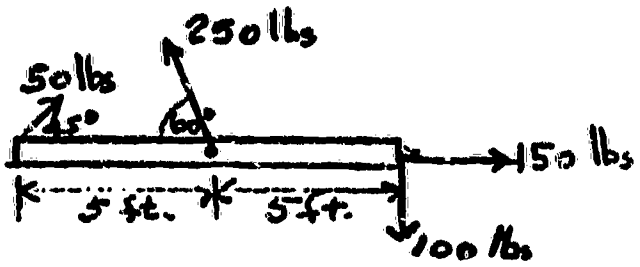
1) 4 cents 3) 13 cents

2) 8 cents 4) 16 cents

PH00370 In the diagram below, a bar is shown with 4 forces acting on it. A fifth force is to be applied in order to maintain the bar in equilibrium. How far from the left end of the bar should this force be applied? Neglect the weight of the bar.

1) 8.09 ft 3) 1.22 ft

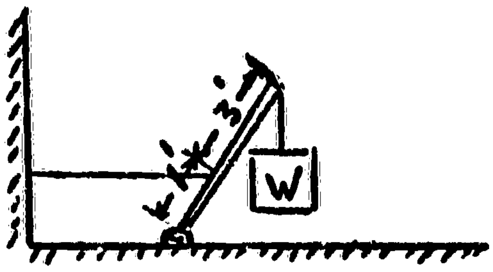
2) 3.77 ft 4) .54 ft



PH00380 In the diagram, a weightless strut is supported by a horizontal wire connected to the vertical wall. A weight w = 100 lbs. is connected to the strut at its upper end. What is the tension in the wire?

1) 231 lbs 3) 262 lbs

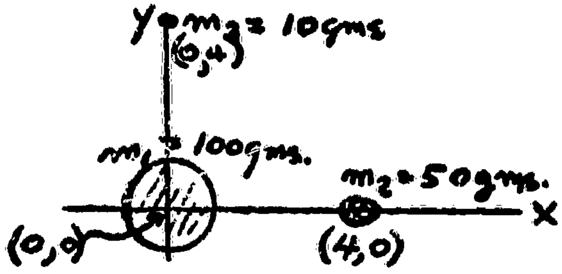
2) 249 lbs 4) 275 lbs



PH00390 In the diagram below, the positions and masses of three bodies are shown. Where is the center of mass of the three-body system located?

1) (1.25, 0.25) 3) (2.00, 2.00)

2) (1.00, 0.50) 4) (1.14, 0.33)



PH00400 A wheel rotates with a constant angular velocity of 10 rad/sec. What is the tangential velocity of a point located 15 cm from the center?

1) 1.5 cm/sec 3) 150 cm/sec

2) 100 cm/sec 4) 300 cm/sec

PH00410 A wheel starts from rest and rotates with constant angular acceleration. The time required for the wheel to make its first revolution is 5 seconds. Find the angular velocity of the wheel after it has made 10 revolutions.

1) 2π rad/sec
2) 2.5π rad/sec
3) 3π rad/sec
4) 3.5π rad/sec

PH00420 A centrifuge, starting from rest, rotates with a constant angular (α) acceleration. After 1 minute, the radial acceleration at a point 1 cm from the axis is 100,000g. What is the value of α ?

1) 23 rad/sec^2
2) 46 rad/sec^2
3) 69 rad/sec^2
4) 165 rad/sec^2

PH00430 A certain system of mass 1 has a moment of inertia equal to 100. Its radius of gyration is

1) 10
2) 100
3) 1000
4) 10000

PH00440 The moon rotates once every 28 days. If its radius is 1000 miles, what is the tangential velocity on the surface at the moon's equator?

1) 2.07 mph
2) 6.14 mph
3) 9.35 mph
4) 12.72 phm

PH00450 Momentum is:

1) a scaler quantity
2) a vector quantity
3) a form of energy
4) a force which produces rotation
5) a form of work

PH00460 When a bat hits a baseball, the "impulse" is:

1) the direction in which the bat moves.

2) the force of the bat against the ball.

3) the time in which the bat hits the ball.

4) the change in momentum of the ball.

5) the product of the average force between the bat and the ball, and the time interval through which it acts.

PH00470 In a closed system, which of the following is always preserved?

I) Momentum II) Energy III) Kinetic energy

1) I only 3) III only 5) I, II and III

2) II only 4) I and II only

PH00480 Angular Momentum is defined as the product of ________.

1) mass and angular velocity

2) moment of inertia and angular velocity

3) moment of inertial and angular acceleration

4) mass and torque

5) none of these

PH00490 A ball with a mass of 200 grams is dropped onto a horizontal table from a height of 1 meter. It rebounds three times, and on the third rebound, the ball attains a height of 10 cm. What is the coefficient of restitution between the ball and the table?

1) 0.10 3) 0.46

2) 0.32 4) 0.68

PH00500 A ball with a mass of m_1=100 grams collides head on with a ball of mass m_2=200 grams. Before the collision, the balls were moving towards each other colinearly, with velocities of v_1=20 cm/sec and v_2=25 cm/sec, respectively. The coefficient of restitution between the two balls is 0.75. What is the velocity of the first ball after the collision? (Assume that before the collision, m_1 was moving to the right, and m_2 to the left.)

1) 1.25 cm/sec to the right 3) 28.75 cm/sec to the left

2) 16.25 cm/sec to the left 4) 32.50 cm/sec to the left

PH00510 A flywheel rotating about its central axis weighs 50 pounds and has a rotational kinetic energy of 500 ft-lbs. What is its angular momentum, if its radius is 1 foot.

1) 16.3 lb-ft-sec
2) 27.9 lb-ft-sec
3) 32.6 lb-ft/sec
4) 41.4 lb-ft-sec
5) none of these

PH00520 A gyroscope has a moment of inertia of 10 kg-m^2, and an angular velocity of 3 rev/sec. What is its angular velocity of precession, if the torque on it is 5 nt-m?

1) 0.143 rpm
2) 0.194 rpm
3) 0.253 rpm
4) 0.411 rpm
5) none of these

PH00530 An earth satellite rotates in a circle 1000 miles above the surface of the earth. It must have a velocity of

1) 5,800 mph
2) 7,300 mph
3) 15,900 mph
4) 23,200 mph

PH00540 An automobile travels at a constant velocity on a curve of radius 500 ft. The curve is not banked. What must be the minimum coefficient of friction between the automobile and the pavement for the car to travel at 75 mph without skidding?

1) 0.54
2) 0.63
3) 0.76
4) The car will skid no matter what the coefficient of friction.

PH00550 A spring moving in SHM has an amplitude of 3 feet and a frequency of 4 cps. What is the velocity of the spring when x = 2 ft? What is the acceleration?

1) ± 20.1 ft/sec, -943 ft/sec^2
2) ± 36.0 ft/sec, -1042 ft/sec^2
3) ± 48.3 ft/sec, -1360 ft/sec^2
4) ± 64.8 ft/sec, -1527 ft/sec^2
5) ± 56.3 ft/sec, -1262 ft/sec^2

PH00560 What is the force constant of the spring moving in SHM with an amplitude of 3 feet, and frequency of 4 cps, if the mass is 1 slug?

1) -631 lbs/ft 3) -896 lbs/ft 5) none of these

2) -742 lbs/ft 4) -1003 lbs/ft

PH00570 In the diagram, wires L and R are of equal length, and are attached to either end of a metal bar. The bar is 3 feet long and its weight of 10 pounds is uniformly distributed along its length. Wire L is made of a material for which Young's Modulus is $15x10^6$ lbs/in^2. For wire R, Young's Modulus is $30x10^6$ lbs/in^2. The cross sectional areas of L and R are 0.015 in^2 and 0.02 in^2 respectively. Locate the 100 pound weight with respect to distance from L if: (a) the strain in L is double that in R; (b) the stress in L is equal to the stress in

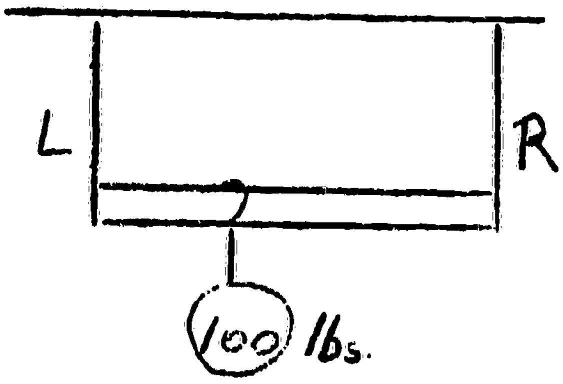
1) 20.8 inches to the right of L.
15.2 inches to the right of L

2) 16.2 inches to the right of L
12.8 inches to the right of L

3) 18.8 inches to the right of L
15.3 inches to the right of L

4) 24 inches to the right of L
19 inches to the right of L

5) none of these



PH00580 A cylinder of an hydraulic press with a 10 inch diameter contains: water to a depth of 2 feet, and a cube of lead 4 inches on a side. The reciprocal of the bulk modulus (sometimes called the compressibility, k,) of water is $50x10^{-6}$ (atmospheres^{-1}) (1 atmosphere = 14.7 lbs/in^2). The bulk modulus of lead is 1.1×10^6 lbs/in^2. A 10,000 pound force is applied to the top surface of the water by means of a piston.

(a) Compute the distance the piston will move, assuming the cylinder walls remain rigid.
(b) Compute the decrease in volume of the lead cube.

1) .01 inches
1.85×10^{-3} in^3

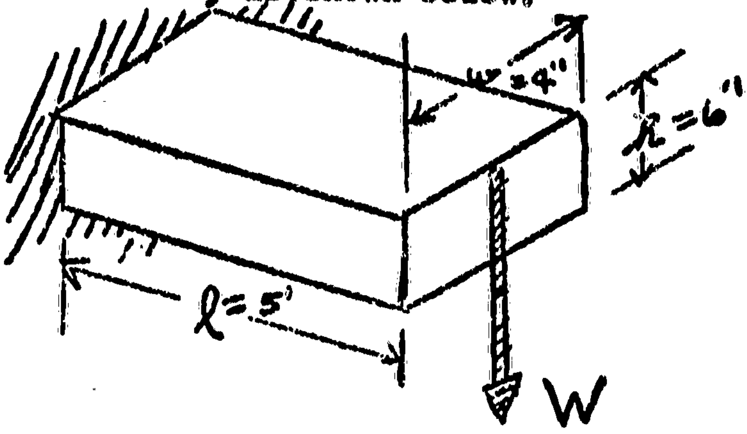
2) .10 inches
3.7×10^{-3} in^3

3) 1.0 inches
2.8×10^{-3} in^3

4) 3.15 inches
7.1×10^{-3} in^3

5) none of these

PH00590 An aluminum bar is to be used as a structural member in such a way that it will be fixed at one end and a weight will be suspended from the other end, as shown below:



The dimensions of the bar are:

l (length) = 5 feet
w (width) = 6 inches
h (height) = 4 inches

The shear modulus of aluminum is 3.4×10^6 lbs/in^2.

(a) Find the angle of deflection produced if the weight is 500 pounds
(b) Find the weight necessary to produce a 0.1° deflection.
(Assume we remain within the shear elastic limit).

1) 6.13×10^{-6} radians
143,000 lbs

2) 4.2×10^{-6} radians
120,000 lbs.

3) 8.1×10^{-6} radians
164,000 lbs.

4) 5.5×10^{-6} radians
155,000 lbs.

5) none of these

PH00600 A particle moves with SHM according to the equation $x=200 \cos 100 \pi t$. What are the period and amplitudes of the motion? (Note: units are in cm and sec)

1) $\frac{1}{100}$ sec; 200 cm

2) $\frac{1}{50}$ sec; 200 cm

3) $\frac{1}{100}$ sec; 100 cm

4) $\frac{1}{50}$ sec; 100 cm

5) none of these

PH00610 A particle moves with SHM according to the equation $x = 200 \cos 100 \pi t$. What is the position of the particle when $t = 1$ second?

1) 200 cm
2) 100 cm
3) 0
4) -200 cm
5) none of these

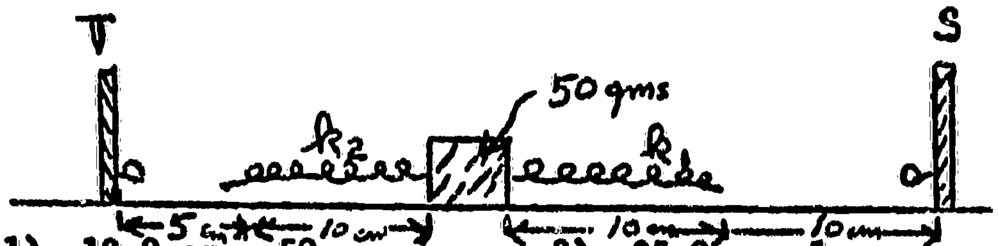
PH00620 A particle moves with SHM according to the equation $x = 200 \cos 100 \pi t$. What is the velocity of the particle when $t = .0625$ seconds?

1) -44,300 cm/sec
2) -52,700 cm/sec
3) +61,000 cm/sec
4) 0
5) none of these

PH00630 A particle moves with SHM according to the equation $x = 200 \cos 100 \pi t$. What is the acceleration of the particle when $t = .0025$ seconds?

1) -1.39×10^7 cm/sec^2
2) 1.04×10^7 cm/sec^2
3) 4.22×10^6 cm/sec^2
4) 1.04×10^6 cm/sec^2
5) none of these

PH00640 A block with a mass of 50 grams is connected to two springs of unstretched length 10 cm. The springs are then stretched and connected to two stands S and T, as shown below. The springs have force constants $k_1 = 1000$ dynes/cm and $k_2 = 2500$ dynes/cm. The block is moved to its equilibrium point and then displaced a short distance. How far is this equilibrium point from S? What is the period of motion of the block when it is released?



1) 12.9 cm, .50 sec
2) 16.4 cm, 1.25 sec
3) 25.0 cm, 1 sec
4) 20.7 cm, 0.75 sec
5) none of these

PH00650 Resonance is the result of impulses applied at ______________

1) the same frequency as the natural frequency of a vibrating body
2) different frequency from the natural frequency of a vibrating body.
3) any rate upon a resonating body.
4) any time during the period of oscillation.

PH00660 A cube of a certain metal has sides 3 inches long and weighs 2.5 lbs. Find the weight density (in lbs 1 ft^3) of the metal.

1) 22.4
2) 37.9
3) 74.8
4) 120
5) none of these

PH00670 A cube of a certain metal has sides 3 inches long and weighs 2.5 lbs. Find the specific gravity of the metal.

1) 1.22
2) 1.48
3) 1.97
4) 2.56
5) none of these

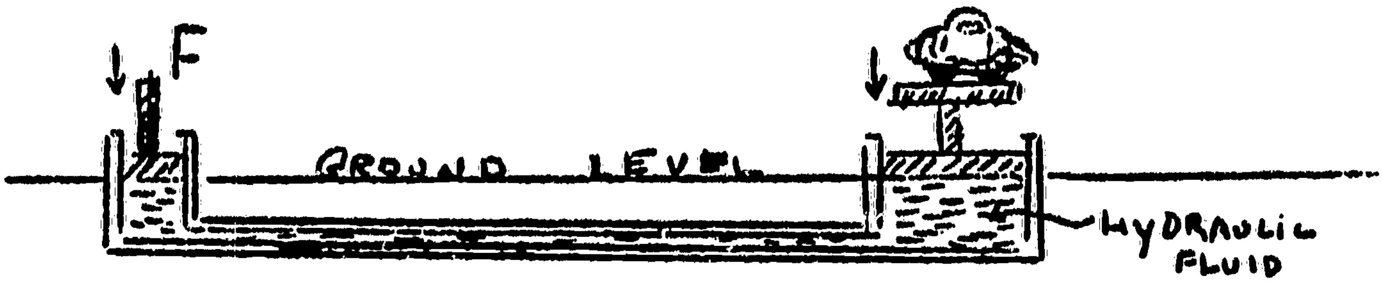
PH00680 The water at one end of a swimming pool rises to a height of 10 feet. What is the total force of water against that wall if it is 30 ft. long?

1) 42,200 lbs.
2) 57,800 lbs.
3) 74,200 lbs.
4) 93,600 lbs.
5) none of these

PH00690 Convert 14.7 lbs/in^2 to bars.

1) 1.71 bars
2) 2.57 bars
3) 3.11 bars
4) 4.09 bars
5) none of these

PH00700 A car is supported by an hydraulic press, as shown below:



The total weight of the car and its support mechanism is 4,000 lbs. The large cylinder of the press has a radius of 1 ft. and that of the smaller is 6 inches.

a) Find the pressure exerted by the base of the large piston on the fluid.
b) Find the force necessary to maintain the car in the position shown. (Neglect the weight of the small piston).

1) 2.2 lbs/in^2
249 lbs.

2) 1.5 lbs/in^2
120 lbs.

3) 3.0 lbs/in^2
200 lbs.

4) 5 lbs.
300 lbs/in^2

5) none of these

PH00710 Helium, maintained at a gauge pressure of 15 lbs/in^2 is stored at constant temperature, in a cylindrical tank 6 feet high with an inner diameter of 1 foot. All of the helium is then exhausted into a balloon where it remains at a gauge pressure of 2 lbs/in^2 at the same temperature as in the tank. Atmospheric pressure can be taken as 15 lb/in^2.

(a) Compute the absolute pressure in the helium when it is in the cylindrical tank and when it is in the balloon.

(b) Assuming the balloon takes on a spherical shape, compute its volume after it contains the helium.

1) 30 lbs/in^2 in the tank; 17 lbs/in^2 in balloon; 1.25 ft^3

2) 60 lbs/in^2 in the tank; 25 lbs/in^2 in the balloon; 3.5 ft^3

3) 15 lbs/in^2 in the tank; 12 lbs/in^2 in the balloon; 5.6 ft^3

4) 75 lbs/in^2 in the tank; 36 lbs/in^2 in the balloon; 10 ft^3

5) none of these

PH00720 A steel ingot, suspended by a string, is lowered into a cylindrical can containing water. The radius of the can is 5 cm. When the ingot is fully immersed, the water level has risen 1.5 centimeters. The Specific Gravity of steel is 7.8. (a) Find the weight of the ingot; (b) Find the tension in the string when the weight is fully immersed. (HINT: the volume of a cylindrical can is equal to the product of its height and its cross-sectional area).

1) 827,000 dynes
710,500 dynes

2) 65,000 dynes
52,000 dynes

3) 6,000 dynes
5,000 dynes

4) 545,000 dynes
470,000 dynes

5) none of these

PH00730 Water, when in a capillary tube made of a certain metal, has a surface which bends upwards at the walls of the tube. The diameter of the tube is 0.01 inches and the water rises to a height of 4 inches. The surface tension is 70 dynes/cm. (a) Which forces are of greater magnitude: adhesive or cohesive? (b) Compute the contact angle between the surface of the liquid and the walls of the tube.

1) adhesive
25° 10'

2) cohesive
25° 10'

3) adhesive
18° 30'

4) cohesive
18° 30''

5) none of these

PH00740 Water, when in a capillary tube made of a certain metal, has a surface which bends upwards at the walls of the tube. The diameter of the tube is 0.01 inches and the water rises to a height of 4 inches. The surface tension is 70 dynes/cm.

(a) Find the diameter of a glass capillary tube which would raise the same weight of water as the metal tube. The angle of contact of the water surface and the glass wall is 0°. For the metal tube the center angle was 25°10'.

(b) Find the diameter of a glass capillary tube which will raise a column of water to the same height as the metal tube.

1) 9.05×10^{-3} inches
   1.11×10^{-2} inches

2) 7.1×10^{-3} inches
   2.7×10^{-2} inches

3) 10.5×10^{-3} inches
   0.70×10^{-2} inches

4) 12.1×10^{-3} inches
   2.1×10^{-2} inches

5) none of these

PH00750 In the following problem, we will assume steady, non viscose, incompressible fluid flow.

A fluid flows with a velocity, v, through a circular pipe of diameter, d,

(a) If the pipe is constricted at one point such that the velocity triples, find the diameter of the constricted portion in terms of d (the original diameter)

(b) If the pipe widens out at one point such that its diameter is triple the original value, find the velocity at the wider portion, in terms of v (the original velocity)

1) $\frac{\sqrt{3}}{3} d$
   $\frac{v}{9}$

2) $\frac{\sqrt{2}}{2} d$
   $\frac{v}{6}$

3) $\frac{\sqrt{5}}{2} d$
   $\frac{v}{4}$

4) $\frac{\sqrt{3}}{2} d$
   $\frac{v}{3}$

5) none of these

PH00760 In laminar flow, the velocity of the fluid:

1) varies with the square of the distance from the moving surface

2) decreases linearly with increasing distance from the moving surface

3) is independent of the distance from the moving surface

4) is randomly distributed in the fluid

PH00770 We have defined η, the coefficient of viscosity, assuming fluid flow which is:

1) turbulent

2) laminar

3) horizontal

4) not compressible

PH00780 A 500 gallon water tank stands on the roof of a large apartment building. The water level in this tank is 100 feet above the ground. A man standing on the ground turns on a hose which draws water from the tank. The hose has a 1 inch diameter. The nozzle of the hose has the same cross section as the hose. (a) Find the gauge pressure of the water flowing through a portion of the hose lying on the ground. (Assume the pressure at the surface in the tank to be atmospheric). (b) Find the velocity of the water as it flows from the hose, when it is lying on the ground.

1) gauge pressure=0
80 ft/sec

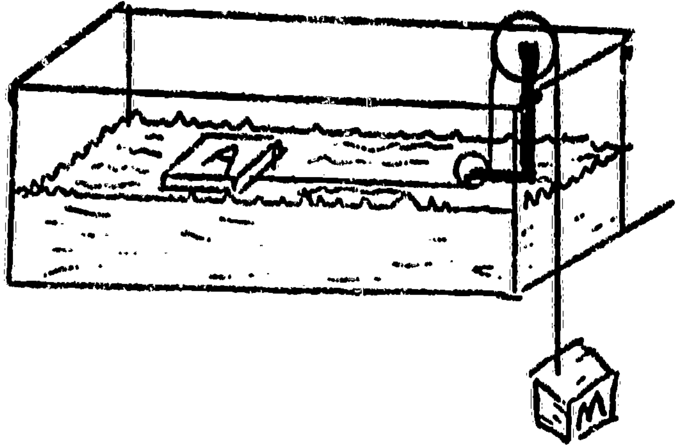
2) 10 lbs/in^2
60 ft/sec

3) 100 lbs/in^2
25 ft/sec

4) 30 lbs/in^2
12 ft/sec

5) none of these

PH00790 Shown below is a crude device with which one may measure the viscosity of a liquid. The pulleys are all to be considered frictionless.



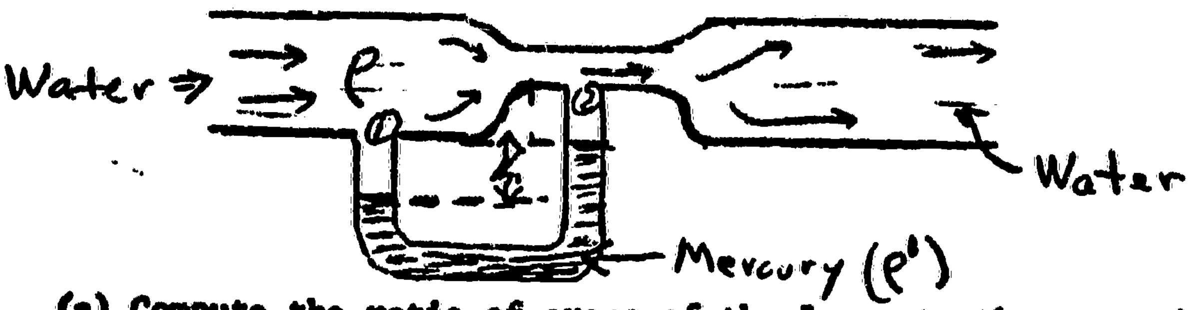
If mass M falls with constant velocity v, then the viscosity of the liquid in the tank is given by: $\eta = \frac{MgL}{Av}$

where: L is the depth of the tank
A is the surface area of the floating board

If the apparatus described above consists of a 10 gram mass, a board 40 cm long and 25 cm wide, find an expression for η as a function of t, the time required for the mass to fall (at constant velocity) 1 meter, and L, the depth of the liquid.

1) $\eta = 9.8 \times 10^{-2}$ L
2) $\eta = 8.5 \times 10^{-2}$ L
3) $\eta = 10.2 \times 10^{-2}$ L
4) $\eta = 7.9 \times 10^{-2}$ L
5) none of these

PH00800 The Venturi meter as shown below uses mercury (Specific Gravity 13.6) in the Venturi tube to measure the flow of water in a pipe. The velocity of water flowing in the constricted region of the pipe is 40 ft/sec and there is a difference of 3 inches in the heights of the mercury in the arms of the Venturi tube. The weight density of water is 62.5 lbs/in^2.



(a) Compute the ratio of areas of the large to the constricted region of the pipe

(b) If the velocity in the large region were to double, what would the height difference of mercury be in the Venturi tube?

1) 1.07
1 ft.

2) 2.7
2.0 ft.

3) 3.6
1.9 ft.

4) 0.75
0.3 ft.

5) none of these

PH00810 Toricelli's Law states that the efflux velocity of a liquid from an orifice in a tank:

1) is equal to the velocity a freely falling body would attain in falling a height equal to the depth of the orifice below the liquid surface.

2) depends only on the size of the orifice.

3) is the same for an orifice any depth below the liquid surface.

4) is equal to the velocity of a freely falling body.

PH00820 Of the following instruments, temperature cannot be measured by

1) a thermocouple

2) a radiation pyrometer

3) a gas thermometer

4) a platinum heatometer

5) a resistance thermometer

PH00830 The temperature in a physics laboratory is read on a Celsius (centigrade) thermometer as 25.5°C. What is the room temperature expressed in degrees Fahrenheit?

1) 53.3° F

2) 45.9° F

3) 77.9° F

4) 13.2° F

5) 84.3° F

PH00840 An unknown compound freezes at -127° F. What is its freezing point on the Celsius (centigrade) scale?

1) -88.3° C

2) -97.1° C

3) -75.6° C

4) -101° C

5) none of these

PH00850 The coefficient of expansion of any gas at constant pressure is ______

1) 1/372

2) 1/100

3) 1/212

4) 1/273

5) 0.0732

PH00860 Absolute zero is

1) the lowest temperature to which a substance can be lowered

2) exactly 0.000000...° C

3) exactly 0.000000...° F

4) exactly 32.00000...° F

5) the freezing point of air

PH00870 A steel tape is used to measure the length of a piece of copper tubing at 20°C. The length obtained is 4.5 meters. Assuming that the tape reads correctly at 20°C, what would it read at 40°C, if the linear coefficients of expansion of copper and steel are: α Cu = 17 x 10^{-6}/°C, and α Steel = 11 x 10^{-6}/°C.

1) 3 meters

2) 350.7 cm

3) 450.05 cm

4) 520 cm

5) none of these

PH00880 The volume of a gas depends

1) only on the temperature of the gas

2) only on the pressure of the gas

3) only on the number of molecules contained

4) on all of the above

5) on none of the above

PH00890 Convert the mechanical equivalent of heat to $\frac{\text{ft.lbs.}}{\text{calorie units}}$.

$J = 4.186 \frac{\text{joules}}{\text{cal}}$

1) $2.093 \frac{\text{ft.lbs}}{\text{cal}}$

2) $3.09 \frac{\text{ft.lbs}}{\text{cal}}$

3) $4.186 \frac{\text{ft.lbs}}{\text{cal}}$

4) $8.372 \frac{\text{ft.lbs}}{\text{cal}}$

5) none of these

PH00900 The specific heat of the material of the body is

1) the heat capacity per unit temperature rise

2) the heat capacity per unit calorie supplied

3) the heat capacity per unit mass

4) the heat capacity times the temperature rise

5) the heat capacity divided by the mass times the temperature ris

PH00910 While undergoing a change from the water phase to the steam phase,

1) the potential energy of the water molecules remains constant
2) the temperature changes very slowly
3) the temperature changes rapidly
4) the average kinetic energy of the molecules remains the same
5) the temperature remains the same because steam is always at 100

PH00920 A block of aluminum of 380 gm. mass is heated to 85°C and dropped into 160 gm. of water at 18°C in an aluminum calorimeter of 50 gm.mass, and the resulting temperature is noted as 40°C. Calculate the specific heat of aluminum.

1) 1.6 cal/gm.C°
2) 4.3 cal/gm.C°
3) .8 cal/gm.C°
4) .22 cal/gm.C°
5) none of these

PH00930 A _____ gas cannot be liquified if its temperature is _____ its _____ temperature.

1) ideal, below, critical
2) ideal, above, critical
3) real, below, critical
4) real, above, critical
5) none of the above

PH00940 A pane of glass is 75 x 60 cm. and 2.5 mm thick. If one face is at 20°C, and the other at -20°C, how much heat flows through the glass in an hour if the thermal conductivity of the glass is 0.029 cal/cm°C sec.

1) 8.2 x 10^{7}cal
2) 6.15 x 10^{7}cal
3) 25600 cal
4) 4800 cal
5) none of these

PH00950 In the process of heat transfer by convection

1) the hot material remains where it is, passing on its energy by means of thermal collisions
2) the hot material remains where it is, passing on its energy by means of convection collisions
3) the heated material actually moves from one place to another
4) the heated material only appears to move due to the change in optical density
5) none of the above

PH00960 Using standard symbols, Stefan's Law states

1) $R = kT^2$

2) $R = keT^2$

3) $R = kT^3$

4) $R = keT^3$

5) none of the above

PH00970 In what proportion will the energy emitted by an incandescent lamp in a room at 27°C be increased if the temperature of the lamp is raised from 923°C. to 973°C. $R_2/R_1 = ?$

1) 1.05

2) 1.19

3) 50

4) 120

5) none of these

Social Science 2010 - Principles of Economics

The attached copies of Book I represent the application of the curriculum innovations method to typical basic social science courses.

NEW YORK INSTITUTE OF TECHNOLOGY

ECONOMICS 2010

ITEM ANALYSIS
and
SOURCE REFERENCES

Book I

COMPUTER CURRICULUM ANALYSIS
NYIT PRESS

NEW YORK INSTITUTE OF TECHNOLOGY

ECONOMICS
2010

Project Director	Bertram Spector, Ph.D. Dean of Academic Affairs
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NEW YORK INSTITUTE OF TECHNOLOGY

SOURCE REFERENCES

ECONOMICS 2010

Number	Reference
1405	G. L. Bach Economics, An Introduction to Analysis and Policy
1410	J. H. Dodd and T. J. Hailstones Economics, Principles and Applications
1415	M. L. Joseph and N. C. Seeber Workbook in Economics

Week 1 - COURSE - SS2010 SUBJECT: What is Economics About; and The American Economy Page 1 of 1

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES								
NUMBER	TITLE	1405	1410	1415						
SS00010	Purpose of Course	3,5,6	3	1-2						
SS00020	Definitions	1-2	3-4, 16-17	1-2						
SS00030	Introduction to Problems	1-2		1-2						
SS00040	Economics vs Business Administration	3-4		1-2						
SS00050	Economics and Social Science	4-5		1-2						
SS00060	Comparative World Economic Output	9-12		3-5						
SS00070	Incomes and Consumption in U.S.	12-14	340- 341	3-5						
SS00080	Production and Employment in U.S.	14-16	34-35	3-5						
SS00090	Government, Production and Employment	16-17	604- 605	3-5						
SS00100	Scarcity	18-20		3-5						

Week 2 COURSE - SS2010 SUBJECT: Private Enterprise, Profits, and the Price System Page 1 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES							
NUMBER	TITLE	1405	1410	1415					
SS00110	Foundations of Economic Progress	21-23		6-7					
SS00120	Cooperation and Competition in a Private Enterprise Economy	23-25	21-24	6-7					
SS00130	Solution of Economic Problems Through the Price System	25-28	143-146	6-7					
SS00170	The Circular Flow of Economic Activity	28-29		6-7					
SS00180	Economic Growth and Fluctuations	29-30	34-36	6-7					
SS00190	Individual Freedom and the Role of Government	30-31	24-30	6-7					
SS00200	The Mixed Economy	31-32	26	6-7					
SS00210	Capitalism Today	32-33	26	6-7					

Week 2 (Contd.) COURSE SS2010 SUBJECT: Straight Thinking in Economics Page 2 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES							
NUMBER	TITLE	1405	1410	1415					
SS00220	Use of Simplified Models	35-40	15	9-13					
SS00230	Steps in Problem Solving	40-42	10-13	9-13					
SS00240	Setting and Evaluating Social Goal	42-46	32-38	9-13					
SS00250	Some Common Fallacies in Logic	46-50		9-13					

Week 3 COURSE SS2010 SUBJECT: National Income, Production and Employment, and Changing Price Levels: Inflation and Deflation

Page 1 of 1

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES							
NUMBER	TITLE	1405	1410	1415					
SS00260	Definition of Economic Production	53-54	47	14-18					
SS00270	Detailed Explanation of G.N.P.	54-62	511-516	14-18					
SS00280	The integrated Social Accounts	59-62	515-518	14-18					
SS00290	Growth in the American Economy	62-65		14-18					
SS00300	G.N.P. as a Measure of Economic Well-Being	65-67		14-18					
SS00310	Price Indexes and Price Level Changes	72-76	119-121 424-428	19-22					
SS00320	Price Levels and the Value of Money	76	428	19-22					
SS00330	What is Inflation	76-84	434-436	19-22					
SS00340	Impact of Deflation	85	434	19-22					

Week 4 COURSE SS2010 SUBJECT: Money and the Banking System Page 1 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES							
NUMBER	TITLE	1405	1410	1415					
SS00350	Money and Near Monies	88-89	360-362	23-28					
SS00360	Private Financial Institutions	89-91	383-385	23-28					
SS00370	The Supply of Currency	91-93	362-373	23-28					
SS00380	The Supply of Bank Money	94-95	393-396	23-28					
SS00390	Potential Creation of Credit by a Bank	95-97	385-392	23-28					
SS00400	Limits to Credit Creation by a Bank	97-100		23-28					
SS00410	Credit Creation by the Banking System	100-103	397-401	23-28					
SS00420	Contraction of Credit by the Banking System	103		23-28					
SS00430	Money and the Creation of Near Monies	104		23-28					

Week 4 (Contd.) COURSE SS2010 SUBJECT: Federal Reserve System and the Money Supply Page 2 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES							
NUMBER	TITLE	1405	1410	1415					
SS00440	Organization of the Federal Reserve System	107-109	409-413	29-33					
SS00450	Service Functions of the Federal Reserve	109-111	414-419	29-33					
SS00460	Fundamental Nature of Central Banking	111		29-33					
SS00470	Main Federal Reserve Powers	111-112	414-419	29-33					
SS00480	Open-Market Operation	112-114	418	29-33					
SS00490	Rediscount Rate Changes	114-115	417	29-33					
SS00500	Change in Member Bank Reserve Requirements	115		29-33					
SS00510	"Selective" Credit Controls	115-118		29-33					

Week 5 - COURSE SS2010 SUBJECT: Modern Theory of Income, Employment and Prices Page 1 of 1

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES						
NUMBER	TITLE	1405	1410	1415				
SS00520	Consumption Expenditures	121-127	114-117	34-39				
SS00530	Private Investment Expenditures	127-131	591-594	34-39				
SS00540	Model of National Income Determination	131-136		34-39				
SS00550	Changing Investment - The Multiplier	136-140	557-564	34-39				
SS00560	Rising Expenditures, Total Output, and Inflation	140-142	588-589	34-39				
SS00570	The Role of Government	142-143	586-588	34-39				
SS00580	Introduction to Econometrics	144-149	15	34-39				

Week 6 COURSE - SS2010 SUBJECT: The Role of Money Page 1 of 1

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES						
NUMBER	TITLE	1405	1410	1415				
SS00590	The Quantity Theory	151	430-432	41-45				
SS00600	Money in Relation to G.N.P. and Price Level	152	424-428	41-45				
SS00610	The Equation of Exchange	152-154	428-430	41-45				
SS00620	G.N.P. and the Equation of Exchange	154		41-45				
SS00630	M, V, and Total Spending	155-156		41-45				
SS00640	The Cash-Balance Approach	156-159		41-45				
SS00650	Money, Securities, Other Assets and the G.N.P.	159-162	515-518	41-45				
SS00660	The Importance of Money	162-163		41-45				

Week 7 COURSE - SS2010 SUBJECT: Economic Growth: The Foundations Page 1 of 1

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES								
NUMBER	TITLE	1405	1410	1415						
SS00570	American Economic Growth: History and Outlook	164-167	34-36	46-49						
SS00680	Economic Growth Defined	167		46-49						
SS00690	Malthus and Ricardo	167-168		46-49						
SS00700	Real and Money Factors in Economic Growth	168-169		46-49						
SS00710	The Source of Growth	169-170		46-49						
SS00720	Natural Resources	170-172	53-56	46-49						
SS00730	Capital Goods and Capital Accumulation	172-175	57-58	46-49						
SS00740	Technology	175-178	50-53	46-49						
SS00750	Population and the Labor Force	178-186	58-51	46-49						
SS00760	Economic Organization and Social Environment	186-188		46-49						

Week 8 COURSE - SS2010 SUBJECT: Economic Growth: Aggregate Demand, Saving, and Investment Page 1of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES								
NUMBER	TITLE	1405	1410	1415						
SS00770	How fast should we grow	190-191		50-53						
SS00780	What money demand is needed for stable economic growth	191-194		50-53						
SS00790	Role of private enterprise	194-195	143-145	50-53						
SS00800	Danger of lagging growth and unemployment	195-196		50-53						
SS00810	Danger of inflation with growth	196-199		50-53						
SS00820	The prospect for the future	199-200		50-53						

Week 8 (Contd.) COURSE - SS2010 SUBJECT: Economic Fluctuations Page 2 of 2

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES								
NUMBER	TITLE	1405	1410	1415						
SS00830	Economic growth and Fluctuations	202-205		54-59						
SS00840	Business-cycle theories	205-208	546-551	54-59						
SS00850	The cumulative upswing	208-215	536-537	54-59						
SS00860	Upper turning point or continuing prosperity	215-216	537-538	54-59						
SS00870	The downswing	216-217	538-540	54-59						
SS00880	The role of the stock market	217-218		54-59						
SS00890	International aspects of business fluctuations	218		54-59						
SS00900	Stable growth without fluctuation	218-219		54-59						

Week 9 COURSE - SS2010 SUBJECT: Monetary Policy Page 1 of 1

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES									
NUMBER	TITLE	1405	1410	1415							
SS00910	Central-bank (monetary) policy	223-234	609-611	60-65							
SS00920	The 1920's - Boom and Bust	234-235		60-65							
SS00930	The 1930's - Crash and Stagnation	235-236		60-65							
SS00940	WWII - War finance, Gold and Congress	236-237		60-65							
SS00950	The Federal Reserve and the national debt, 1946-51	237-238		60-65							
SS00960	The dilemma of inflation of unemployment in '50's	238-239		60-65							
SS00970	The soaring or sagging 60's	239		60-65							
SS00980	Gold and the monetary standard	239-242	364-370	60-65							
SS00990	The "mixed" standard today	242	373-379	60-65							

Week 10 COURSE - SS2010 SUBJECT: Fiscal Policy Page 1 of 1

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES									
NUMBER	TITLE	1405	1410	1415							
SS01000	Fiscal policy and the Government	244-247	443	66-71							
SS01010	Fiscal powers against unemployment	247-254		66-71							
SS01020	Fiscal powers to check inflation	244-245	609	66-71							
SS01030	Fiscal power and the balanced-budget tradition	255-258	604	66-71							
SS01040	Fiscal policy and economic growth	258	606-607	66-71							
SS01050	Proper mix of monetary and fiscal policy	259		66-71							

Week 11 COURSE SS2010 SUBJECT Practical Problems of Stabilization Policy Pg. 1 of 1

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES									
NUMBER	TITLE	1405	1410	1415							
SS01060	Problem of Long-Run guides to Policy	262-266		72-76							
SS01070	The Unemployment-inflation dilemma	266-267	599-603 608-611	72-76							
SS01080	Problem of short run flexibility	267-270		72-76							
SS01090	Problem of expanding Gov't.Control	270	603-607	72-76							
SS01100	Problem of the public debt	270-277	444-448	72-76							
SS01110	Are depressions obsolete?	277-279		72-76							

Week 12 COURSE SS2010 SUBJECT: Business Enterprise in the Modern Economy; and Demand,. the Role of the Consumer Page 1 of 1

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES								
NUMBER	TITLE	1405	1410	1415						
SS01120	Definition of terms	285-286		77083						
SS01130	The modern corporation	286-290	628-631	77-83						
SS01140	Business consolidations and combinations	290-294	632-637	77-83						
SS01150	Introduction to business accounting	295-301		77-83						
SS01160	Statistics on consumer potential	310-313		84-88						
SS01170	Individual Demand	313-316	150-151	84-88						
SS01180	Aggregate, or market demand	316-317	151-153	84-88						
SS01190	Elasticity of demand	317-322	155-163	84-88						
SS01200	Interacting demands	322		84-88						

Week 13 COURSE - SS2010 SUBJECT: Demand, Supply, and Market Prices; and the Business Firm and It's Costs Page 1 of 1

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES									
NUMBER	TITLE	1405	1410	1415							
SS01210	Role of the market and market prices	324-326	152	89-94							
SS01220	Supply	326-328	163-167	89-94							
SS01230	Demand, supply, and the market price	329-333	168-170	89-94							
SS01240	The economics of price-fixing	333-336		89-94							
SS01250	Summary: The law of supply and demand	336-337		89-94							
SS01260	Why worry about costs?	339	175-179	95-100							
SS01270	What are costs?	339-342	179-180	95-100							
SS01280	Cost of production and rate of output	342-345		95-100							
SS01290	Unit-cost curves	345-346		95-100							
SS01300	Short-run and long-run view of costs	346-348		95-100							
SS01319	How big is optimal?	348-351	637-638	95-100							

Week 14 COURSE SS2010 SUBJECT The Business Firm: Competitive Output and Price in the Short Run; and Long Run Competitive Equilibrium

Pg. 1 of 1

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES									
NUMBER	TITLE	1405	1410	1415							
SS01320	The Theory of the Firm	358		101-106							
SS01330	Competitive Firm in Short Run	358-364	181-189	101-106							
SS01340	Short-run Cost curves and Supply Curves	364	181-189	101-106							
SS01350	Do firms try to maximize profits?	364-366		101-106							
SS01360	Firm as a buyer of productive Services	366		101-106							
SS01370	Competition and Monopoly	369-371	205-206	107-111							
SS01380	Long-run Equilibrium and Equilibrium Tendencies	371-372	189-192	107-111							
SS01390	Long-run equilibrium: The search for profits	372-378	189-192	107-111							
SS01400	Equilibrium of a Competitive Economy	379-380	192-193	107-111							
SS01410	Evaluation of Purely Competitive Economy	380-385	192-193	107-111							

Attachment BB

Curriculum Analysis Materials
and
Procedures Manual

NEW YORK INSTITUTE OF TECHNOLOGY

CURRICULUM ANALYSIS PROCEDURES AND MATERIAL

INDEX

INTRODUCTION

This manual contains information concerning the use of the computer for grading examinations, the use of the new Answer Cards, and the generation of materials utilized throughout the on-going curriculum analysis and development program.

A concentrated effort has been made to analyze and standardize course contents. Along with this, methods have been developed whereby a student can be referred to the sources containing the material. In this regard, the following objectives should be kept in mind:

a) the student should know, in considerable detail, what his courses will cover at the beginning of the term.
courses

b) the student may study at his own pace and, if the administrative procedures permit, terminate the course in less than the 15 week period.

c) the student should be tested on each major item within his courses.

d) following each examination, he should receive, with minimum delay, the results of the examination, and be told where to find the answers to those questions he did not answer correctly.

The attainment of these objectives necessitates the preparation of certain materials and procedures, the most important of which are the course "item analyses ". Each of these analyses provides a de detailed breakdown of the course content, some incorporating as many as 200 topics. With each of these topics appears a listing of the pages of each of several source references which treat the subject matter.

By detailing each course in this way, the minimum course content is specified and the basis for course standardization is established. However, minimum standarization does not inhibit the teacher from including additional material. Nor does it define the approach that he will take in presenting the material. Rather, it serves as a guide to the teacher and the student and assures that different sections of a class will cover the same basic topics and that the students may study ahead knowing they are studying the proper material. Articles II, VII, and VIII treat the generation and use of these Item Analyses.

The second phase of the materials development was rewriting information contained in the Item Analyses in computer-useable form. A "Topic Number" was assigned to each item contained in the Item Analyses. The result was the generation of "Detailed Referrals", descriptions of which are given in Articles II, III, VII.

The generation of Detailed Referrals and the associated computer processing techniques was a means to carry out the third phase, the scoring of "diagnostic examinations" and feeding back to students the examination scores, class analyses, examination analyses and detailed referral information. Articles Ia-3, II and VI describe these procedures. The generation of the examination questions is described in Articles II, V and VII.

An important by-product of the materials development was the generation of a flexible and effective examination-scoring computer program applicable to many types of objective examinations. The details and use of this program and the associated Student Answer Cards are discussed in Articles I, II, IV, and V.

It is desired that this manual will provide a clearer understanding of one step NYIT is taking to improve its curriculum and teaching methods and that it will provide a vehicle for wider use of our test scoring program and increase the desire of members of the faculty to contribute to the growth and improvement of the curriculum materials.

Article I

NEW YORK INSTITUTE OF TECHNOLOGY

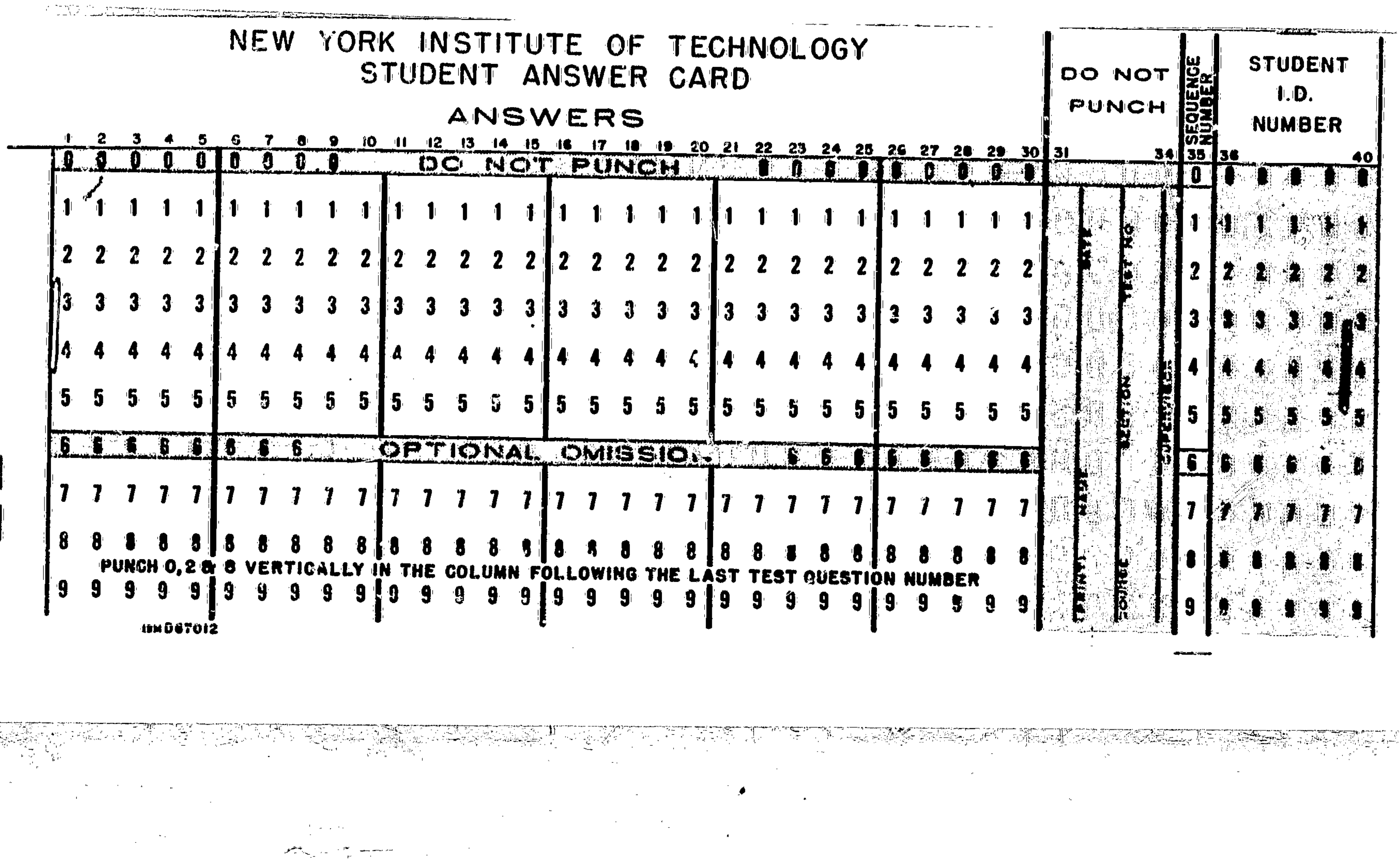
CURRICULUM ANALYSIS PROCEDURES AND MATERIAL

EXAMINATION GRADING BY COMPUTER

The new student answer cards, (a sample is attached below) can be used for objective examinations of the True-False or Multiple Choice types. In certain departments they are used primarily for diagnostic examinations, the purpose for which they were originally designed. They will also serve, however, for use on mid-term examinations, short quizzes, finals, etc.

When used in the more general applications, the cards offer the following advantages:

1. Computer grading
2. Four copies of a comprehensive class analysis are returned to the teacher. This analysis includes the grades, their frequency distribution, the cumulative frequency distribution, the mean and the standard deviation.



NEW YORK INSTITUTE OF TECHNOLOGY
STUDENT ANSWER CARD
ANSWERS

DO NOT PUNCH

OPTIONAL OMISSION

DO NOT PUNCH

SEQUENCE NUMBER

STUDENT I.D. NUMBER

PUNCH 0,2 & 8 VERTICALLY IN THE COLUMN FOLLOWING THE LAST TEST QUESTION NUMBER

IBM D87012

3. Two copies of the individual student's performance are returned to the teacher. The ID number, grade, and a list of those questions answered incorrectly or omitted are listed f for each student.

4. If the instruction "Sort on 80-72" is included when the cards are sent to the computer center, the listing of the students will be in ascending order of ID numbers.

5. The time spent in processing these new cards is much less than was required with the early "teach-test" cards. This means that more exams can be processed within a given time period and each teacher will receive prompter service from the computer center.

STUDENT ANSWER CARDS WILL NOT BE PROCESSED IF:

1. The 0,2 8 punch is not made properly or is in the wrong column.
2. The sequence number (Col. 35) is punched incorrectly or omitted.
3. The cards are out of order on a test incorporating more than one card per student. (If time permits, the computer operator may rearrange them and resubmit them for processing.)
4. There is more than one punch for any single question.
5. The cards are not cleanly punched.
6. The cards are bent, torn, stapled, mutilated or excessively damp.

OTHER COMMENTS

1. If the student fails to punch his ID number his card <u>will</u> be processed. On the print-out his ID number will appear as 0.

2. The following forms must accompany the cards to the computer center: a) an answer key - either punched on a student Answer Card, written on the form available for that purpose, or listed in any other readable format; b) an Examination Sheet; and c) a Test Item - Topic Number Specification form (if detailed referrals are used).

Article Ia-1

NEW YORK INSTITUTE OF TECHNOLOGY

CURRICULUM ANALYSIS PROCEDURES AND MATERIAL

COMPUTER GRADING WITH OPTIONAL OMISSIONS

Additional flexibility is incorporated into the new test-scoring program via the inclusion of an OPTIONAL OMISSION choice on the Student Answer Cards. In brief, this permits the following:

1. Part of an examination may be taken.

   This is advantageous in variably-paced programs since a student may wish to take an examination on a certain body of material, without being ready for an examination which covers additional material. The instructor can specify which questions the student should answer, the OPTIONAL OMISSION choice being punched for the remaining questions.

2. The student is permitted a choice of questions.

   Numerous possibilities for the use of the resulting statistics suggest themselves. For example, for a given test, a knowledge of the questions students omitted could mean that a question was too difficult or that insufficient emphasis had been placed on that material by the teacher.

   Or, it may be desirable to give the students a chance to obtain better grades by selecting the questions they wish to answer.

3. How to Specify the Options

   a. for case 1 above: instruct the students to punch choice 6 for the questions which are not to be answered.

   b. for case 2 above: instruct the students that they should answer _______ out of _____ questions. For those they choose not to answer, they should punch choice 6.

Article Ia-2

NEW YORK INSTITUTE OF TECHNOLOGY

CURRICULUM ANALYSIS PROCEDURES AND MATERIAL

COMPUTER GRADING WITH VARIABLE WEIGHTING

It is often beneficial to apply non-uniform weighting to test questions. For example, it may be desirable to indicate several parts to a question without overweighting the whole question. Or, certain concepts which have been stressed in class may be considered more important. The computer grading procedures are arranged to permit this flexibility.

Weights of 1 through 9 are permitted; only those other than 1 must be specified. Fractional weights, such as 2.5, are not permitted. If no weights are specified, all answers will receive equal weight.

To make the specifications, assign a 1 to the least heavily counted answer. Then assign weights of 1 through 9 to those remaining. Again, the weight of 1 need not be specified.

Example 1. On a ten-question examination, questions 1 through 4 are each worth 10 points, question 5 is worth 5 points, question 6 is worth 15 points, and questions 7 through 10 are each worth 10 points.

Specification:

Ques. Number	Weight
1-4	2
5 (optional)	1
6	3
7-10	2

Example 2.

On a 150 question examination, the last 50 should count twice as heavily as the previous 100.

Specification:

Ques. Number	Weight
1-100 (optional)	1
101-150	2

Example 3.

On a 20 question examination, all answers are worth 5 points.

Specification: No specification is necessary.

Example 4.

On a 20 question examination, the last 10 answers are worth twice as much as the first 10. In addition, the students are instructed that they should answer any 15 of the 20 questions; i.e. they are permitted 5 optional omissions.

Specification:

Ques. Number	Weight
1-10 (optional)	1
11-20	2

Note: The test scoring procedure will work correctly, even though it is not possible to tell before hand which questions the students will choose to answer.

NEW YORK INSTITUTE OF TECHNOLOGY

CURRICULUM ANALYSIS PROCEDURES AND MATERIAL

COMPUTER GRADING WITH DETAILED REFERRALS

The Institute is continuing to develop Curriculum Analyses and Detailed Referral information. As these materials become available, and upon confirmation from the Computer Center, teachers may request Detailed Referral information following examination grading.

The Detailed Referrals provide the following information regarding each student:

1. His ID number, score and examination information data.
2. For each question he answered incorrectly or omitted (and only those) :
    a. the topic number, topic title and information category. (see attachments)
    b. for each referral line which follows:
        1. question number
        2. topic number (7 characters).
        3. source reference number (4 digits).
        4. Page number (s) (4 digits each).
        5. method of presentation (2 letters - see attachments).
        6. estimate of academic level (2 digits - see attachments).
        7. extent of treatment (numbered 1 through 5; 1 for very brief mention, 5 for extensive treatment.)
        8. prerequisites, if any are designated (each given by a 7 digit topic number).

Example

The following printout was provided following an examination in course ET5011. The information contained on the first line, except for the student's ID number and grade, was provided by the instructor via the Examination Information Sheet. (see attachments)

```
46987 80 ET5011   7A  07010  EToo670 ET00790 05/02/66  10  20 WLUTHER
 QUEST   TOPIC     SRCE   PAGES                     MP  AL  DEPTH  PRE REQ
 ET00740   INDUCED EMF-MAGNETIC INDUCTION    LW     CP

     5  ET00740    0140       0124                  PT  00  1
     5  ET00740    0125       3601,3801             PT  01  2
     5  ET00740    0100       0657,0666             NT  01  1
     5  ET00740    0095       0390                  NT  01  1
     5  ET00740    0105       0190                  WK  01  1
     5  ET00740    0150       0173                  NT  01  1
     5  ET00740    0151       0202                  NT  01  1
     5  ET00740    0375       0890                  MP  01  1

 ET00770  MUTUAL INDUCTANCE    LW   CP

     8  ET00770    0140       0128                  PT  00  1
     8  ET00770    0095       0405                  NT  01  1
     8  ET00770    0375       0439,0924             MP  01  3
```

The first line, following the ID number and score, indicates that the course is ET5011; the examination number is 7A which has an alternate designation of 07010; the first topic treated is ET00670 and the last topic treated is ET00790. The date of the examination was 5/2/66. There were 10 questions on the exam. with no optional omissions, and 20 students took part. It was given in Westbury and the test supervisor was Luther.

The column headings QUEST, TOPIC, SRCE, etc., apply to all information below them, except the title line for each topic.

This student missed questions 5 and 8. For question 5, eight referral lines are printed. For question 8, three referral lines are printed. The content of each line is described on the previous page.

Detailed Referrals are normally returned to the instructor in duplicate. It thus becomes possible to distribute one copy to the student and retain the other for permanent records. It is <u>not</u> possible to specify how many referrals are to be printed out for each incorrectly answered or omitted question. This figure has been previously determined by the author of the materials and the Computer Center.

(Attachments Follow)

NEW YORK INSTITUTE OF TECHNOLOGY

EXAMINATION INFORMATION SHEET

(To be filled out by instructor administering the examination)

For "Class ID" Card and "Student ID and Test Information" Card

C.C.			SAMPLE
5-12	SECTION		B
14-19	COURSE		ET5030
21-35	EXAMINATION NUMBER		02010 (2A)
37-43	FIRST TOPIC TESTED		ET01790
45-51	LAST TOPIC TESTED		ET02140
53-60	DATE		6/27/65
62-65	NUMBER OF QUESTIONS		12
67-70	NO. OF STUDENTS TAKING EXAM		23
72	LOCATION	M B S W	M B S W
73-79	SUPERVISOR		Prof. Flynn

No. of optional omissions______________

Variable Weighting Used? Yes or No ______
(if Yes, include weighting information)

M - Manhattan
B - Brooklyn
S - Syosset
W - Old Westbury

Detailed Referrals Desired? Yes or No ________

If no reference is made to item analyses, disregard the "First and Last Topic Tested."

Notes to Computer Center

Sort student answer cards on cc 80-72

other:

METHODS OF PRESENTATION

01	CP	Class Presentation
02	PT	Programmed Text
03	MP	Machine Presented Program
04	FL	Film
05	LK	Lecture
06	VT	Video Tape
07	AT	Audio Tape
08	CN	Course Notes
09	NT	Normal Text
10	ST	Self-study (self-taught)
11	LM	Laboratory Manual
12	WK	Theory and/or Problem Workbook
13	BT	Abridged Textbook

(99 designations are permitted)

ACADEMIC LEVELS

00	High School
01	1st semester college
02	2nd semester college
..	
..	
..	
12	12th semester college

(09-12 are graduate level)

INFORMATION CATEGORIES

AT	Analytical Technique	pencil and paper operation
BG	Background, general information	
CP	Concept	a mental construct - an idea not based upon sensory perceptions alone
DF	Definition	statement or meaning of a term
ED	Engineering Device	circuit or physical object designed and/or built
ET	Experimental Technique	operation in lab or shop
FA	Fact	experimentally verified theory
FD	Factual data	units, constants, constraints and properties of materials as needed to effect a design of an instrument or an engineering device
IN	Instrument	a device used primarily for making an observation or a measurement
LW	Law	a statement summarizing a body of experiences or a logical deduction from basic principles
PE	Percept	phenomenon we become acquainted with through the senses
PR	Principle	plays the role of axiom or postulate and cannot be derived
SI	Special Illustration	item presented in class as an illustration of a topic already discussed
TH	Theory	
PF	Proof	rigorous mathematical or logical proof

INFORMATION CATEGORIES FOR ENGLISH

BG	Background	Historical introductions, anecdotes, or explanations about the aims and values of the course.
CT	Concept	A general category used to analyze writing, criticism, etc. e.g. use of topic sentence, detail, paragraph development.
DE	Definition	Formal definition of technical words, e.g. noun, circumlocution.
XM	Example	Lists of examples, both positive and negative, e.g. typical topic sentences, common errors, illustrations.
FT	Fact	Sheer, gross fact, e.g. spelling, vocabulary, etymologies.
MA	Material	External, physical material, and its use e.g. dictionaries, outside reading.
MO	Model	A major example, positive or negative, summarizing the work of a lesson or unit, e.g. a model paragraph, business letter, research theme.
RU	Rule	A rule or convention clearly governing the use of something, e.g. a spelling rule, the use of semi-colons, footnote form.
SK	Skills	Methods of fostering specific skills or techniques, e.g. reading comprehension and rate.
SR	Stylistic rule	Rule or advice which cannot be made specific, e.g. avoid redundancies, seek for clarity and preciseness.

Article II

NEW YORK INSTITUTE OF TECHNOLOGY

CURRICULUM ANALYSIS PROCEDURES AND MATERIAL

TEST SCORING PROGRAM-SELECTED TECHNICAL INFORMATION

The information included in this document is intended for those persons involved in the technical aspects of the NYIT test scoring program. Normal users of the test scoring program should not have need of this information but, rather, should refer to the more descriptive information available.

NEW YORK INSTITUTE OF TECHNOLOGY

CURRICULUM ANALYSIS PROCEDURES AND MATERIAL

INSTRUCTIONS FOR SPECIFYING DETAILED REFERRAL TOPIC NUMBERS

When Detailed Referrals are to be part of the examination grading procedures, the topic numbers corresponding to the question numbers must be specified. This information must be sent, together with the examination cards, to the Computer Center. If the Computer Center already has the information on file, it should be verified.

Normally, one or more topic numbers are specified for each test question; the "Test Item-Topic Number Specification" form indicates this procedure. In some cases the relevant topic numbers appear alongside the test questions. Otherwise, the instructor must determine the proper topic numbers. In either case, the topic numbers for each question should be specified and sent to the Computer Center.

An instructor may wish to call out a certain Detailed Referral if a combination of test questions is missed. For instance, if missing questions 1, 3 and 4 indicates that the student did not understand an underlying theory, the instructor may wish to have the Detailed Referral to that theory printed out to the student. If, on the other hand, the student missed questions 1 and 3 but answered 4 correctly, the instructor would assume that the student knew the theory but made computational or other errors in answering questions 1 and 3.

In making the proper specifications, the instructor would follow the procedure indicated below, where each question has its own topic number (s), and the combination has an additional topic number (s).

number(s).

Question No. (3 digits)	Topic Numbers			
001	MD03145	MD03146	MA00229	ET00059
002	MD03149	BF62386		
003	MD04002			
004	MD04105			
etc.				
001 003 004	MD03625			

A copy of the Test Item-Topic Specification form is attached.

NEW YORK INSTITUTE OF TECHNOLOGY

TEST ITEM - TOPIC NUMBER SPECIFICATION

Course_______________

Exam No. ____________

Alt. Exam No. _______

Question No. (3 Digits)	TOPIC NUMBERS					

Article IV

NEW YORK INSTITUTE OF TECHNOLOGY

CURRICULUM ANALYSIS PROCEDURES AND MATERIAL

USING THE STUDENT ANSWER CARDS

In using the STUDENT ANSWER CARDS, the following steps should be taken:

1. In the spaces provided, fill in your Name, Date, Section, Test No., and the Supervisor's name.

2. Using the Port-A-Punch Unit, punch your ID Number in columns 36 to 40.

3. Punch a 1 in column 35 (labeled Sequence Number) to indicate that this is the first card in the examination. If more than thirty questions appear in the examination you will need additional cards. Punch additional cards sequentially (i.e., 2, 3, 4, etc.) in this column.

4. Answer each question of the examination, first by circling your choice in pencil or ink. (The answer to question 1 should be in column 1, the answer to question 2 should be in column 2, etc.) When you are sure of your choice, punch out your answer.

5. Do not answer more than 30 questions on any one card.

6. Punch 0, 2, and 8 in the column following the last test question number.

   Examples: 1. For a 15-question test, punch o, 2, and 8 in column 16, regardless of how many questions you choose to answer.

   2. For a 45-question test, punch 0, 2, and 8 in column 16 of the second card.

   3. For a 30-question test, punch 0, 2, and 8 in column 31.

   4. For a 150-question test, punch 0, 2, and 8 in column 31 of the fifth card.

7. If the answers to the test questions are indicated as A, B, C, etc. make the correspondence:
   A=1 C=3
   B=2 D=4 etc.

8. If the question is of the True-False type, the normal correspondence will be: True= 1, False= 2. If it is to be otherwise, the test supervisor will so inform you.

9. Note: Your card will be rejected by the computer if you make the 0, 2, and 8 punch incorrectly, punch the sequence number (s) incorrectly, make more than one punch for any single question, do not make the punch cleanly, or cause the card to become bent, torn, or otherwise mutilated.

Article V

NEW YORK INSTITUTE OF TECHNOLOGY

CURRICULUM ANALYSIS PROCEDURES AND MATERIAL

INSTRUCTIONS FOR GENERATING ANSWER KEYS

There are two ways of generating an answer key for the use of the Computer Center:

1. by enclosing a student answer card with the proper punches and clearly marking it "ANSWER KEY-TEST .....". Proper punches include: the correct answer to each question, the 0, 2, & 8 punch in the proper column and the proper sequence number. In addition, it is suggested that relevant information be provided in the spaces provided in case the card is misplaced or referred to at a later date.
2. by simply listing the answers in the form:

   1 - 3
   2 - 4
   3 - 3
   4 - 3
   5 - 2
   etc.

Article VI

NEW YORK INSTITUTE OF TECHNOLOGY

CURRICULUM ANALYSIS PROCEDURES AND MATERIAL

HINTS REGARDING the USE of COMPUTER GRADING PROCEDURES

The use of the computer in grading examinations can certainly save time for the instructor and provide the student with more information about his examination. At the same time, however, it is necessary for the instructor to take a slightly different approach as he prepares the materials to be sent to the computer center following the examination. There are certain advantages and disadvantages in using various techniques of handling these procedures. The following indications serve here as suggestions.

A computer can process examinations much faster than we can, although there may be delays in the communication between us and the computer center. Although it may take five minutes or one hour for the computer center to process the examinations, it may take a matter of days before we can receive the results. To facilitate speedy transmission to the computer center, it is important that the materials, to the extent possible, be prepared prior to entering the examination room. This involves the preparation of the following several forms: 1) Examination Information Sheet which contains information regarding the course, the test number, date, number of students, the manner in which the information is to be fed out from the computer. It can be prepared in advance except for filling in the number of students taking the examination. 2) Answer Key, which can also be made up before entering the examination room. 3) Test Item-Topic Number Specification sheet is required. The instructor should determine before hand what topic numbers apply to each test question and record the information on the form available from the Education Research Office.

There are procedures to facilitate the use of the minimum number of student answer cards and the most efficient collection of cards as the students complete the examination.

It is unrealistic to hope that all the students will punch their answer cards without making errors. In administering the examination, an attempt to minimize the number of students who need more than one card can be made. To this end I suggest that the cards be handed out after students begin the examination. By distributing the cards at this time the students pay less attention to them and continuemto work on the examination. At the end of the examination they can transfer their answers onto the punched cards.

There are certain punches that must appear on the answer cards, without which they cannot be processed by the Computer Center. These include: the 0, 2, and 8 punch in the column following the last test question number, and the Sequence Number-punched in column 35. Students frequently fail to punch these numbers. Check for 0, 2, and 8 punches and Sequence Number punches as the cards are collected. This may be done simply holding the cards up to the light and checking for the appropriate punches. In the event that any of the punches is missing, return the card to the student for correction. In the event that the student punched the 0, 2, and 8 or the Sequence Number in the wrong column, he must punch a new card. It can be expected that students will make fewer errors as they become accustomed to using the cards.

It is usually desirable to separate the cards into class sections as they are collected. Count the number of cards in each section and enter the figure on the Examination Information Sheet.

One effective prodcure for transmitting cards to the Computer Center is to wrap the student answer cards in the examination information sheet for each section. Then place copies of the answer key between the packages. Wrap the Test Item-Topic Number Specification sheet around the packages. Finally, place them in an envelope and send it to the computer center for grading.

When the information is returned from the computer center, strive to relay it to the students at the very next meeting..

Normally, the examination feedback will be sent in duplicate from the Computer Center. The paper is of a continuous form; that is, no page is attached to the next with perforations, and the copy is still separated from the original by carbon paper. Separate the two copies and dispose of the carbon paper.

One copy, preferably the original, will be returned to the student; the other copy should be kept in your files.

At the end of the student referrals, there is an Examination Analysis. Normally there is a total of four copies of the Class Analysis - two originals and two carbon copies. One of the original copies should be placed on top of the sheets distributed to the students so they can see how they rank in the class. One original and one carbon should be stapled together and retained for your records or sent to the Educational Research Office. The second carbon may be left with the carbons of the student analysis and kept with your records.

To summarize the key points: First, as much work as possible should be done prior to the examination. Second, the student Answer Cards should be handed out sometime after the examination is in progress. Third, as the student answer cards are collected the 0, 2 and 8 punch and the Sequence Number punch should be checked so that, if there are punching errors, the card may be handed back to the student immediately. Fourth, the instructor may find it beneficial to follow the procedure outlined for returning the examination results. He should fee free, however, to devise his own method for doing so, hopefully with the intent of minimizing the delay in returning the examination results to the students.

Article VII

NEW YORK INSTITUTE OF TECHNOLOGY

CURRICULUM ANALYSIS - PROCEDURES AND MATERIAL

GENERATING ITEM ANALYSES, DETAILED REFERRALS AND QUESTIONS

To help departments in the preparation of curriculum analyses, the procedures followed by this office are explained in considerable detail.

The overall materials development is divided into seven stages, as shown on the left side of the timetable on Attachment 1, and as indicated below.

STEP	PROCESS	SEE ATTACHMENT
1	curriculum analysis generation	2
2	curriculum analysis typing	3,4
3	detailed referrals generation	5
4	detailed referrals typing	6
5	detailed referrals punching	———
6	examination questions generation on 4 x 6 index cards with referrals to topic number, source number and page, complete with multiple choice answers & answer key.	7
7	assemblage of questions on examination sheets and assignment of an examination code number.	———

Detailed information regarding each step is given below.

Step 1 - curriculum analysis generation - see Attachment 2

a) should be made in duplicate.

b) topic numbers filled in after all desired entries are made.

c) last digit kept zero to allow for a more detailed breakdown at a later date.

d) all pages mentioning the material are indicated.

e) reference sources called out in order of importance, rather than according to number sequence.

f) a one-semester course should be divided up into 150 to 200 topics.

NOTE: the form used when generating these analyses may be obtained from the Educational Research Office.

Step 2 - curriculum analysis typing - see Attachment 3

a) the same form will be used, with a stencil made up for each page. The stencils should be laid out as shown on Attachment 4.

b) twenty (20) copies should be made from each stencil, and the stencil retained. At least 15 copies should be supplied to this office for subsequent distribution.

Step 3 - detailed referral generation - see Attachment 5

a) these should be made in duplicate, one copy retained by the author, the other submitted for typing.

b) ample room should be left between topics to permit inclusion of additional references.

c) since this information will later be punched, the format indicated in Article Ia-3 "Computer Grading With Detailed Referrals", must be rigidly adhered to. Any deviation will render the data useless.

Step 4 - detailed referral typing - see Attachment 6

a) there must be no deviation from the handwritten format.

b) this form should be made in triplicate with the following distribution:

1. the author
2. this office for retention
3. this office for forwarding to the card punching facility

Step 5 - detailed referral punching

a) this office will insure that the material is ready to be punched and will handle the actual processing.

Step 6 - examination question generation - see Attachment 7

a) in generating a large number of questions, many text books should be referred to. Questions may also be generated directly. Where an outside source is used, it should be specified by source number and page, in the upper <u>left</u> corner of the 4 x 6 index card. The relevant topic number should appear in the upper <u>right</u> corner.

b) four questions should be generated for each topic number.

6 c) the correct answers and three or four alternate answers should be indicated on the card, either on the front or the back.

d) the correct answer should be indicated by an asterisk (*).

e) the answers should not be numbered, since they will be varied for each examination, i.e. for one text the correct answer may appear as choice 2, for another - choice 3, etc.

Step 7 - assemblage of questions into test papers

a) at least 3 examinations should be prepared for each week's work. If the course material is divided into 15 sections, a total of 45 examinations should be generated. They should be then be numbered 1A, 1B, 1C, 2A, 2B, 2C,......15A, 15B, 15C.

b) after a question is used in an examination it should be placed in a different file box.

c) when a question is used, a note should be made as to which of the multiple choices it was. It should not appear as the same choice on consecutive usages.

NOTE: It is assumed that the work generated by this office will illustrate the methods to be used by other departments. Therefore, as the work here progresses, and small modifications to the original format are made, they will be so indicated in addenda such as this. It is important the uniformity be maintained throughout the materials development, and that close contact be maintained with this office.

Article VII
Attachment 1

COURSE ETS011 TIME SCHEDULE ([illegible])

WEEK ENDING

	JUN/65			JULY/65					AUG/65				SEPT/65				OCT/65	
STEP	11	18	25	2	9	16	23	30	6	13	20	27	3	10	17	24	1	8
① CURRICULUM ANALYSIS GENERATION	▨	▨	▨															
② CURRICULUM ANALYSIS TYPING			▨	▨	▨								ALL PHASES COMPLETED					
③ DETAILED REFERRALS GENERATION				▨	▨	▨												
④ DETAILED REFERRALS TYPING					▨	▨	▨											
⑤ DETAILED REFERRALS PUNCHING								▨	▨	▨								
⑥ EXAM QUESTION GENERATION								▨	▨	▨	▨							
⑦ EXAMINATION PREPARATION										▨	▨	▨	▨					

Article VII
Attachment 2

COURSE ET5030 SUBJECT Electron Emission - Diodes Page 1 of 3

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES					
NUMBER	TITLE	126	155	195	225	245	265
ET01790	THERMIONIC EMISSION	1-2		9-11	32	94	1
ET01800	SECONDARY EMISSION	2				104	
ET01810	FILAMENT MATERIALS	1,7		10,13-5	32-3	101-3	
ET01820	FILAMENT CIRCUITS	2,3					
ET01830	PLATE CIRCUIT	3					
ET01840	DIODE USES			36	32	121-7	
ET01850	DIODE TYPES			31 31	32-3	121-4	
ET01860	DIODE, VACUUM	3	225 277-90	34-8	35-7		
ET01861	DIODE, GAS	11	227				
ET01870	RECTIFIER FULLWAVE	5-7	225-7	15,16		114, 123	5-7
ET01880	RECTIFIER HALF WAVE	5-7	225-9	15,16	37	114-11 124	5-7
ET01890	RECTIFIER	5,6				124	5

Article VII
Attachment 3

COURSE ET5030 SUBJECT Electron Emission-Diodes Page 1 of 3

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES					
NUMBER	TITLE	190	155	195	255	245	205
ET01700	Thermionic Emission	1-2		9-11	32	94	1
ET01800	Secondary Emission	2	9-11			107	
ET01810	Filament Materials	1,71		10 13-15	32-3	101-3	
ET01820	Filament Ckts.	2-3					
ET01830	Plate Circuit	3					
ET01840	Diode Uses		3	36	32	126-7	
ET01850	Diode Types			36-7	32-3	126-7	
ET01860	Diode, Vacuum	3	225 279-80	34-8	3 -7		
ET01861	Diode, Gas	11	227				
ET01870	Full Wave Rectifier	5-7	225-7	15-6		114,123	5-7
ET01880	Rectifier, Half Wave	5-7	225-9	15-6	37	114-16 124	5-7
ET01890	Rectifier Ckts.	5,6, 10				124	5

Article VII
Attachment 4

DETAILED REFERRALS

ETO1790 THERMIONIC EMISSION LW
ETO1790 0190 0001# 02 01 1#
ETO1790 0195 0009# 13 01 1#
ETO1790 0235 0032# 09 01 1#
ETO1790 0245 0074# 09 01 1#
ETO1790 0265 0001# 11 01 1#

ETO1800 SECONDARY EMISSION LW
ETO1800 0190 0002# 02 01 1#
ETO1800 0245 0107# 09 01 1#

ETO1810 FILAMENT MATERIALS FD,ED
ETO1810 0190 0001,0007# 02 01 1#
ETO1810 0195 0010,0013# 13 01 1#
ETO1810 0235 0032# 09 01 1#
ETO1810 0245 0101# 09 01 1#

etc.

Note: prerequisites are conspicuously absent. Since this is an introductory course there are no prerequisites from the same department. Later, when topic numbers are generated for Math courses, relevant prerequisites can be added in by changing (repunching) the necessary cards.

Article VII

Attachment 5

DETAILED REFFERALS

ET01790 thermoinic emission LW LW
ET01790 0190 0001 # 02 01 1 #
ET01790 0195 0009 # 13 01 1 #
ET01790 0255 0032 # 09 01 1 #
ET01790 0245 0094 # 09 01 1 ##

E ET01800 SECONDARY EMISSION LW
ET01800 0190 0002 # 02 01 1 #
ET01800 0245 0107 # 09 01 1 # #

ET01810 FILAMENT MATERIALS FD ED
ET01810 0190 0001, 0007 # 02 01 1 #
ET01810 0195 0010, 0013 # 13 01 1 #
ET01810 0255 0032# 09 01 1 #
ET01810 0245 0101# 09 01 1 # #

etc.

note: the number of spaces between items in a line does not matter, and may be arranged for readability. These will later be put on punched cards, and all extra spaces and commas will be removed. It is imperative, however, that all numbers contain the correct number of digits, and that they be in the proper order, e.g. the source reference number must appear before the page number, etc.

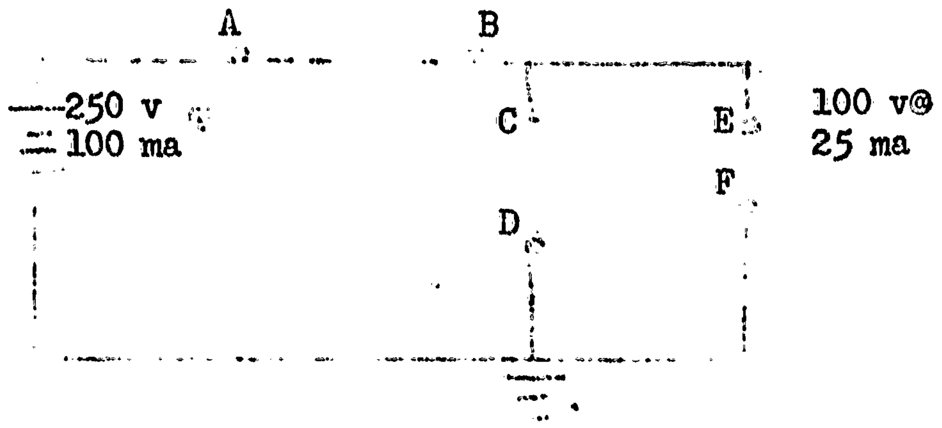
Article VII
Attachment 6

Front of Card

0125
p. 115

ET00490

In designing a voltage divider to supply 100 volts at 25 ma. from a 250 volt source of emf; if the total drain on the source is to be 100 ma., you would connect:



ANS. ON BACK

Back of card

* a 1.5 K ohm resistor between A & B, and a 1.33 K ohm resistor between C & D.

a 1.33 K ohm resistor between A & D only

a 1.33 K ohm resistor between C & D and a 5 K ohm resistor between A & B.

a 1.5 K ohm resistor between A & B only

none of these

Article VIII

NEW YORK INSTITUTE OF TECHNOLOGY

CURRICULUM ANALYSIS PROCEDURES AND MATERIAL

ASSIGNMENT OF TOPIC NUMBERS AND SOURCE REFERENCE NUMBERS

Topic Numbers

It is imperative that there be no duplication of topic numbers. Hence, before performing an analysis of a new course, an instructor must check with the Educational Research Office to determine what topic number he should start with. (At the present time Mrs. Schaffer can provide this information.)

The item analysis for several courses has already been carried out. These courses are listed below along with the first and last topic number.*

Course	First Topic	Last Topic
CH4510	CH00010	**
EN1010	EN00010	**
ET5011	ET00010	ET01780
ET5030	ET01790	ET03660
ET5090	ET03700	ET05860
MA3012	MA00010	MA00750
MA3011	MA02000	MA05010
MA3021	MA19000	MA21230
MA3050	MA00600	MA14120 ***
MA3060	MA30000	MA30780

Course	First Topic	Last Topic
PH4011	PH00010	PH00970
PH4021	PH01200	**
SC4410	SC00010	SC02380
SC4420	SC02390	SC04220
SS2010	SS00010	SS01410
SS2020	SS02010	SS03570
SS2500	HS00010	HS01930

Source Reference Number

In performing curriculum analyses, numbers are assigned to the source references quoted. The Educational Research Office is responsible for these assignments.

Normally the department in question will be assigned a block of numbers, within which it has freedom of allocation. It is suggested, however, that the sources be given numbers in increments of 5. Then, if and when an additional source is added which parallels or is a later edition of one already numbered, it can be assigned a number close to it.

At present, the following assignments have been made: *

Physics	1 to 139 and 1005 to 1295
Math	501 to 799
English	405 to 500
ET	140 to 400 and 800 to 1000
Science Survey	1300 to 1400

Social Studies	1405-1700
Life Science	1705-2000

In associated disciplines, such at ET and Physics, the same reference may be cited in the respective item analyses. In these cases, there should be a single number for the reference-not two. Before assigning a number to a source reference, it should be determined whether it already has another number. If it does, that number should be used.

Forms are available for specifying source references. A copy is attached.

* The list is current through 8/1/66

** This course is still under development

*** The overlap of topic number occurs because of an overlap of material covered.

NEW YORK INSTITUTE OF TECHNOLOGY

CURRICULUM ANALYSIS PROCEDURES AND MATERIEL

SOURCE REFERENCE INFORMATION

Ref. No.	Course	Source Title	Author	Year	Publisher	Mtd. Pres.

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EXAMINATION INFORMATION SHEET

(To be filled out by instructor administering the examination)

For "Class ID" Card and "Student ID and Test Information" Card

C.C.			SAMPLE
5-12	SECTION		B
14-19	COURSE		ET5030
21-35	EXAMINATION NUMBER		02010 (2A)
37-43	FIRST TOPIC TESTED		ET01790
45-51	LAST TOPIC TESTED		ET02140
53-60	DATE		6/27/65
62-65	NUMBER OF QUESTIONS		12
67-70	NO. OF STUDENTS TAKING EXAM		23
72	LOCATION	M B S W	M B S W
73-79	SUPERVISOR		Prof. Flynn

No. of optional omissions____________

Variable Weighting Used? Yes or No ______
(if Yes, include weighting information)

Detailed Referrals Desired? Yes or No _______

M - Manhattan
B - Brooklyn
S - Syosset
W - Old Westbury

If no reference is made to item analyses, disregard the "First and Last Topic Tested."

Notes to Computer Center

Sort student answer cards on cc 80-72

other:

NEW YORK INSTITUTE OF TECHNOLOGY

ANSWER KEY SPECIFICATION

Course No. ______
Exam No. ______
Alternate No. ______

1 -
2 -
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NEW YORK INSTITUTE OF TECHNOLOGY

TEST ITEM - TOPIC NUMBER SPECIFICATION

Course ____________
Exam No. ____________
Alt. Exam No. ________

Question No. (3 Digits)	TOPIC NUMBERS					

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ITEM ANALYSIS

COURSE SUBJECT Page of

TOPIC		SOURCE REFERENCE NUMBERS AND PAGES						
NUMBER	TITLE							

Attachment CC

Course and Curriculum Records

Attachment CC

The Course and Curriculum Records are the following:

1. Test and Question Analysis - summarizes student test performance in terms of mean, standard deviation and total responses for both on and off-campus pupils. In addition, each question is analyzed in terms of a frequency distribution of possible answers as well as the mean performance category ranking of students responding correctly and incorrectly to that question.

2. Course Header defines the current enrollment and number of sections in the course. Each section is then summarized indicating: the student progress distribution of completed units of study; the distribution of final grades; and the distribution with respect to the differential pacing options.

3. Section Header - the summary information indicates the enrollment makeup, the distribution of final grades and other general information. In addition, the capability profile distribution is given assuming a nine level distribution (stanine.) in each of five capability categories. Also, the cumulative academic index of the course enrollment is distributed over nine categories.

4. Unit Test Summary - this summary contains information on student completions, repetitions, grade distribution and a question analysis indicating the distribution of correct and incorrect responses of the unit test for each of the fifteen units of the course.

5. Examination Summary - contains Quarterly, Mid-term (and in the near future Final Exam) results similar to that of the Unit Test Summary just described.

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Test and Question Analysis

Course-4011  Test Identification Number-0031        Unit Number- 1        Variation Number  1

For On-Campus Student--Total Number of Responses- 11     Average Grade- 56.2  Standard Deviation-14.2

For Off-Campus Student--Total Number of Responses- 8     Average Grade-    .0  Standard Deviation-   .0

Question Number- 1               Correct Answer-C      Information Category/Definition      Performance Category/HS Rank

Total Number of Responses   39        Total Number of Incorrect Responses     12

Diesribution of Incorrect Responses   A-10  B-0  C-27  D-1  E-0  OMS-0  INV-1
                                   HS Rank      CQTV      CQTN      CQTI     CQTT
Average For Correct Responses        .0         5.3       6.4       6.0      6.1
Average for Incorrect Responses      .0         5.4       5.2       6.0      5.8

Question Number - 2              Correct Answer-A       Information Category/Definition      Performance Category/
                                                                                                         COT-Verbal
Total Number of Responses   39        Total Number of Incorrect Responses    17
Distribution of Incorrect Responses   A-22  B-7  C-9  D-1  E-0  OMS-0  INV-0
                                   HS Rank      CQTV      CQTN      CQTI     CQTT
Average for Correct Responses        .0         5.6       6.6       6.2      6.2
Average for Incorrect Responses      .0         5.1       5.3       5.7      5.7

Question Number - 3
                                 Correct Answer-D       Information Category/Analytical Technique

Total Number of Responses   39        Total Number of Incorrect Responses   21                Performance Category/COT-
Distribution of Incorrect Responses   A-9  B-11  C-1  D-18  E-0  OMS-0  INV-0                            Number
                                   HS Rank      COTV      COTN      COTI     COTT
Average for Correct Responses        .0         5.0       5.4       6.0      5.5
Average for Incorrect Responses      .0         5.6       6.6       6.0      6.4
```

Course Header

Course Number 3011 — Number of Sections 2 — Number of Credits 3

Maximum Number of Students 20 — Number of Active Students 6 — Number of Dropouts 4 — Number of Students in Program X

Resource Codes

1-1234 2 - 4321

Section A Number of Completed Students - 3

Student Progress Distribution

Last Unit Completed -	None	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number of Students	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3

Differential-Pacing Distribution

Program Option -	Less than 8 weeks	8 weeks	10 weeks	12 weeks	14 weeks	16 weeks	18 weeks	20 weeks	22 weeks	over 22
Planned	0	3	0	0	0	0	0	0	0	0
Completed	0	0	0	3	0	0	0	0	0	0

Distribution of Final Grades

Grade -	A	B	C	E	F	Failed Due To, Absence	Withdrawal, Failing	Withdrawal, No Grade	Incomplete
Number of Students	1	1	1	0	0	0	0	0	0

Section B   Number of Completed Students - 3

Student Progress Distribution

Last Unit Completed -	None	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number of Students	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3

Differential-Pacing Distribution

Program Option -	Less than 8 weeks	8 weeks	10 weeks	12weeks	14 weeks	16 weeks	18 weeks	20 weeks	22 weeks	over 22 weeks
Planned	0	3	0	0	0	0	0	0	0	0
Completed	0	0	0	3	0	0	0	0	0	0

Distribution of Final Grades

Grade -	A	B	C	E	F	Failed Due to, Absence	Withdrawal, Failing	Withdrawal, No Grade	Incomplete
Number of Students	1	1	1	0	0	0	0	0	0

Date 12/8/66

Section Header

Course Number 3011	Section A	Campus Old Westbury	Classroom Traditional
Maximum Number of Students 10	Number of Active Students 3	Number of Girls 1	Number of Completed Course Records 3
Number of Student Dropouts 2	Number of Disadvantaged 2	Number in Program X 1	Number of Off-Campus Students 1
Unit Passing Mark 70	Remedial Recommendation 1		

Distribution of Final Grades

Grade -	A	B	C	E	F	Failed Due to, Absence	Withdrawal, Failing	Withdrawal, No Grade	Incomplete
Number of Students	1	1	1						

Number of Teachers 3 Teacher Codes 123, 221 , 321

Teaching Techniques - Guest Lecturer, Field Trip

Capability Profile Distribution

Level	1	2	3	4	5	6	7	8	9
H.S.Rank	1	1			1				
CQT - Verbal			1	1		1			
CQT - Numerical	1			1	1				
CQT - Information	1			1	1				
CQT - Total				1			1	1	

Cumulative Index Distribution

Grade -	Below 1.2	1.3-1.5	1.6-1.8	1.9-2.1	2.2-2.4	2.5-2.7	2.8-3.0	3.1-3.3	3.4-3.6	3.7-4.0
Number of Students	1			1		1				

Unit Test Summary (cont'd)

Question	1	2	3	4	5	6	7	8	9	10
No. of Incorrect Responses	0	0	0	0	0	0	0	0	0	0
No. of Correct Responses	3	3	3	3	3	3	3	3	3	3

Unit Test Summary

Unit No. 1 No. of Completed Students 3 Repeated Unit Test Once 3 Repeated Unit Test More Than Twice 0

Grade Distribution (Initial Test only)

Grade -	Below 30	30	40	50	60	70	80	90	100
Number of Students	0	3	0	0	0	0	0	0	0

Question Analysis

Question	1	2	3	4	5	6	7	8	9	10
No. of Incorrect Responses	0	0	0	0	3	3	3	3	3	3
No. of Correct Respones	3	3	3	3	0	0	0	0	0	0

Unit No. 2 No. of Completed Students 3 Repeated Unit Test Once 0 Repeated Unit Test More than Twice 0

Grade Distribution (Initial Test Only)

Grade -	Below 30	30	40	50	60	70	80	90	100
Number of Students	0	0	0	0	0	0	0	0	0

Question Analysis

Question	1	2	3	4	5	6	7	8	9	10
No. of Incorrect Responses	0	0	3	3	0	0	0	0	0	0
No. of Correct Responses	3	3	0	0	3	3	3	3	3	3

Unit No. 3 No. of Completed Students 3 Repeated Unit Test Once 0 Repeated Unit Test More Than Twice 0

Grade Distribution (Initial Test Only)

Grade -	Below 30	30	40	50	60	70	80	90	100
Number of Students	0	0	0	0	0	0	0	0	3

Question Analysis

(cont'd)