REPORT ON THE ENGINEERING SCHOOL

NORTH CAROLINA STATE COLLEGE

Prepared for the

EDUCATION COMMITTEE

OF THE

ENGINEERS COUNCIL FOR PROFESSIONAL DEVELOPMENT

AGRICULTURAL ENGINEERING CURRICULUM

March 17, 1958

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Report Relating to

AGRICULTURAL ENGINEERING CURRICULUM

School of Engineering

North Carolina State College

Raleigh, North Carolina

Prepared for the

EDUCATION COMMITTEE

ENGINEERS COUNCIL FOR PROFESSIONAL DEVELOPMENT

CURRICULUM REPORT

Submitted by

The School of Engineering

Department of Agricultural Engineering

March 17, 1958

The report of the Engineering School to the Education Committee of the Engineers Council for Professional Development has been made in two parts.

General Report contains information about the School of Engineering and North Carolina State College that applies to all curricula. Included in the General Report are all portions of the ECPD questionnaire except those three pages pertaining to the laboratories, curriculum, and staff of this curriculum.

The Curriculum Report contains information about laboratories, curriculum, and staff for this department, as called for by the ECPD questionnaire. The Curriculum Report also contains other information designed to help the Committee evaluate the curriculum.

The two parts to gether constitute the report of the School of Engineering for this curriculum.

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FOREWORD

FOREWORD

This report supplies information pertinent to an appraisal of the Agricultural Engineering Curriculum for initial accreditation.

The Department of Agricultural Engineering at North Carolina State College was established in 1940. A few years prior to that time a first degree curriculum in this professional specialty was instituted; in 1945 a research program was incorporated with the undergraduate teaching program. Over the years the Department has had a continuous growth until today the teaching and research faculty numbers twenty-one positions.

In order to provide instruction and training more commensurate with the scope of agriculture in this state, two undergraduate curricula were instituted in 1953: A technological course of study leading to the Bachelor of Science in Mechanized Agriculture, and a professional curriculum leading to the Bachelor of Agricultural Engineering. In 1956, upon the recommendation of a faculty committee from the Schools of Agriculture and Engineering, this latter curriculum came under joint administration by these two schools. This two-curricula approach and joint administration for the professional curriculum have permitted more explicit selection of courses for the objectives of each program of study and have allowed better matching of student aptitudes, capabilities, interests, and ambitions with subject matter. Any further reference to the Mechanized Agriculture Curriculum in this report is incidental and in no wise implies that this Curriculum is being presented for accreditation.

The first Master's degree in Agricultural Engineering at North Carolina State College was granted in 1952, and approval to grant the Ph.D degree with a major in Agricultural Engineering was obtained in 1957.

Space facilities have kept pace with the development of these programs, as evidenced by the recent acquisition of a new Agricultural Engineering building.

B

FACULTY

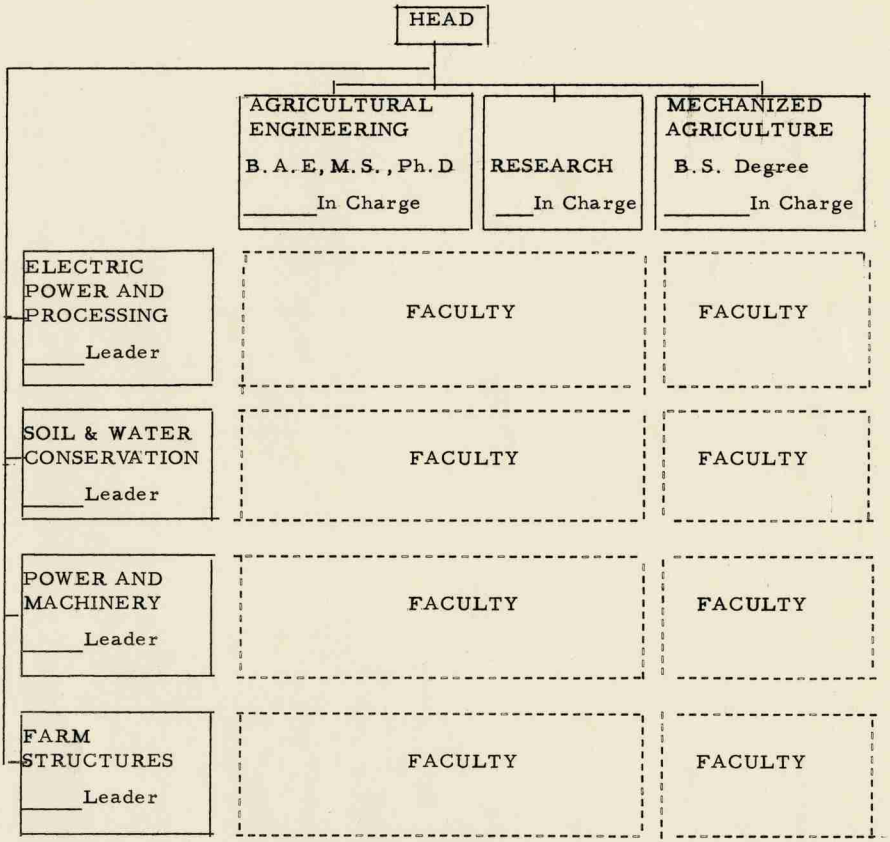
The success of the Agricultural Engineering curriculum to advance learning resides above all in a competent faculty working in a favorable framework of organization. Substantial evidence of mastery of methods and materials of knowledge is found in past performances of the departmental faculty, and the soundness of individual schoolings, background experience, and devotion to scholarship indicate faculty qualifications that connote progressive advancement toward excellence.

While not fully realized at the present time, plans are being fulfilled whereby one faculty group is assigned to provide the instruction in the technological curriculum and a separate faculty is charged with the dual albeit complementary responsibilities of teaching the professional curriculum and engineering research. By this division, the individual faculty member has responsibilities consistent with interests and capabilities that enhance personal development. The present departmental organization is outlined in the diagram on the following page. Individual biographies of the present faculty are included after the diagram.

The fact that the teaching and research faculty is one and the same provides the favorable conditions for greater vitality in the teaching program. Furthermore, since this same faculty serves as advisors to the undergraduates, our students receive the most meaningful counsel when they are taking the basic and engineering sciences in preparation for specialized instruction in Agricultural Engineering. Inasmuch as teaching loads are consistent with institution policies on this matter, the faculty has the opportunity to make the most of their engagements with the students in both teaching and counseling activities.

While our faculty has obtained a healthy consensus on educational processes for the student products of our department, there exists a mutuality of willingness to discuss issues and policies pertaining to the means for accomplishing these ends. The absence of vigorously defended prejudices provides a favorable climate in which to challenge existing policies, to cultivate improvements and to implement desirable changes - a favorable condition for continual self-evaluation.

DEPARTMENTAL ORGANIZATION



Responsibility of Member In Charge: Definition of general philosophy, methods of approach and integration among subject matter fields.

Responsibility of Leader: Definition of problems, direction of resources, guidance and counsel in a subject matter field.

1. Name: George Wallace Giles
2. Department: Agricultural Engineering
3. Age: 48
4. Academic Rank: Professor - Part-time teaching
5. Degrees: B.S., Agricultural Engineering, University of Nebraska, 1933.
   M.S., Agricultural Engineering, University of Missouri, 1935.
6. Date first appointed to this staff: 1936
7. Other teaching experience: Diesel Engineering, Diesel School for Navy Ensigns, N. C. State College, 1943-44.
8. Full-time industrial experience: None
9. Part-time industrial experience: Brown-Manley Plow Company, Malta, Ohio; November 1945; Consulting design engineer.

   John Blue Manufacturing Company, Laurinburg, North Carolina; Jan.-June 1942; Design engineer.
10. Important consulting work: None
11. Principal publications, particularly those of last five years:

    "The Finger Wheel Rake," AGRICULTURAL ENGINEERING, 32:10, 1951.

    "A Progress Report on the Finger Wheel Rake," Information Circular No. 4, page 23. Dept. of Agric. Engr., N. C. Exp. Sta., May, 1951.

    "A New Fertilizer Distributor and Planter for the Southern Farmer," AGRICULTURAL ENGINEERING, 26:109-10, 1945.

    "The Vine-Row Sweet Potato Vine Harvester," N. C. Agr. Exp. Sta. Bulletin No. 358, 1947.

    "Tobacco Harvesting - A Need for Mechanization," Information Circular No. 8, Dept. of Agric. Engr., N. C. Agric. Exp. Sta., 1953.
12. Scientific and professional societies:

    American Society of Agricultural Engineers - Member;

    Sigma Xi, Member; Gamma Sigma Delta; Alpha Zeta

13. Subjects or courses taught this year by terms:

Fall -	AGE 452, Senior Seminar, 1 hr. lec., day	1 contact hr.
	AGE 551, Special Problems, Administration, day	
Spring -	AGE 452, Senior Seminar, 1 hr. lec., day	1 contact hr.
	AGE 551, Special Problems, Administration, day	

14. Other duties performed for regular base salary:

Head of department

15. Other duties performed for extra compensation during academic year: None

1. Name: Julian M. Fore
2. Department: Agricultural Engineering
3. Age: 43
4. Academic Rank: Professor - Part-time teaching
5. Degrees: B.S., Agricultural Engineering, Virginia Polytechnic Institute, 1935.

   M.S., Agricultural Engineering, Purdue University, 1937.
6. Date first appointed to this staff: 1956
7. Other teaching experience: General Engineering Courses, The Engineer School, Ft. Leonard Wood, Missouri, 1942-43; Product Sales and Service Information, Tractor and Implement Division, Ford Motor Company, 1954-55; Farm Power and Machinery, Univ. of Massachusetts, Amherst, Massachusetts, 1955-56.
8. Full-time industrial experience: Aerovent Fan and Equipment, Inc., Lansing, Michigan, Sales and Service Engineer, 1951-54; Ford Motor Company, Birmingham, Michigan, Instructor, Training Dept., 1954-55.
9. Part-time industrial experience: None
10. Important consulting work: Consultant for Extension Services (Agric. Engr.) in Alabama, Georgia, and Tennessee while working for Tennessee Valley Authority, 1940-41 - 1945-51.
11. Principal publications, particularly those of last five years:

    "Irrigating Inbred Lines of Corn," Purdue Exp. Sta. Bulletin, 1937.

    "Demand Characteristics of Dairy Water Heaters," Purdue Exp. Sta. Bulletin, 1938.

    "Brooding Chicks Electrically," Bulletin, Extension Services, Tennessee, Alabama, Mississippi.

    "Wiring and Lighting the Farmstead," Bulletin, Extension Services, Tennessee, Alabama, Georgia, Mississippi.

11. (Continued)

"Farm Water Systems," Bulletin, Extension Services, Georgia, and Tennessee.

"Results of Hotbed Studies," Bulletin, Tennessee Valley Authority, 1947.

"Ventilating Characteristics of Dairies," Tech. Paper for Aerovent Fan and Equipment Company, Inc., 1952.

"Drying Crops with Heated and Unheated Air," Tech. Paper for Aerovent Fan and Equipment Company, Inc., 1952.

12. Scientific and professional societies: Alpha Zeta; Sigma Xi, Associate Member; American Society of Agricultural Engineers, Member.

13. Subjects or courses taught this year by terms:

These courses are not for the professional curriculum:

Fall - AGE 211, Farm Power & Machinery I, 2 hrs. lec., 2 hrs. lab (2 lab secs.) Day. (Service course). — 6 contact hrs.

Spring - AGE 211, Farm Power & Machinery I, 2 hrs. lec., 2 hrs. lab. (3 lab secs.) Day. (Service Course). — 13 contact hrs.

AGE 411, Farm Power & Machinery II-B, 2 hrs. lec., 3 hrs. lab. Day. (Service course).

14. Other duties performed for regular base salary:

In charge Engineering Applications; Organize and conduct in-service training courses for high school teachers of Vocational Agriculture.

15. Other duties performed for extra compensation during academic year: None

1. Name: Francis J. Hassler
2. Department: Agricultural Engineering
3. Age: 36
4. Academic Rank: Professor - Part-time teaching
5. Degrees: B.S., Agricultural Engineering, University of Missouri, 1944.

   M.S., Agricultural Engineering, Michigan State College, 1948.

   Ph.D., Agricultural Engineering, Michigan State College, 1950.
6. Date first appointed to this staff: 1950
7. Other teaching experience: Rural Electrification, Michigan State College, 1946-47.
8. Full-time industrial experience: None
9. Part-time industrial experience: None
10. Important consulting work: None
11. Principal publications, particularly those of last five years:

    "Curing Tobacco with Anthracite," Co-author, N. C. Agric. Exp. Sta. Tech. Bulletin 102, 1953.

    "Supersensitive Thermostat," Principal author, AGRICULTURAL ENGINEERING, 34:841-42, 1953.

    "Leaf Temperature Measurement in Tobacco Curing Research," TOBACCO SCIENCE, 1:64-67, 1957.

    "History of Practices and Research Developments in Bright Leaf Tobacco Curing," Principal author, N. C. Agric. Exp. Sta. Information Circular 12, 1957.

    "Tomorrow's Agricultural Engineers - Their Training," AGRICULTURAL ENGINEERING, 38:9, pages 670-75, 1957.

    "The Objectives of Graduate Training in Agricultural Engineering - Academic Viewpoint," Proceedings of the Agric. Engr. Graduate Training Seminar, Michigan State University, June 27-28, 1957.

    "Effects of Bruising on Tobacco Curability," Co-author, TOBACCO, 145:22, pages 42-44; TOBACCO SCIENCE, 1:177-79, 1957.

11. (Continued)

"Some Determinations Pertinent to Removal of Midrib from Bright Leaf Tobacco During Curing Operations," Co-author, TOBACCO, 145:18, pages 20-24; TOBACCO SCIENCE, 1:164-68, 1957.

"Yellowing Flue Cured Tobacco in the Bulk," Co-author, TOBACCO SCIENCE, In press.

12. Scientific and professional societies:

American Society of Agricultural Engineers, Member; Tau Beta Pi; American Association for the Advancement of Science; Sigma Xi, Member; Pi Mu Epsilon; Sigma Pi Sigma; Gamma Sigma Delta.

13. Subjects or courses taught this year by terms;

Fall - AGE 552, Instrumentation for Agricultural Research and Processing, 2 hrs. lecture-recitation, day. — 2 contact hrs.

14. Other duties performed for regular base salary:

In charge of Graduate Program, Research in and Technical administration of Tobacco Curing Program.

15. Other duties performed for extra compensation during academic year: None

1. Name: John W. Weaver, Jr.
2. Department: Agricultural Engineering
3. Age: 50
4. Academic Rank: Professor - Full-time teaching
5. Degrees: B.S., Agricultural Engineering, Virginia Polytechnic Institute, 1930.
   Completed substantial requirements for M.S. at Virginia Polytechnic Institute.
6. Date first appointed to this staff: 1945
7. Other teaching experience: Virginia Polytechnic Institute, Part-time teaching Rural Electrification classes; Advisor to three graduate students and advisor on miscellaneous senior problems.
8. Full-time industrial experience: Westinghouse Corporation, Pittsburgh, 1930-31, Student Training Course in Rural Electrification. Salisbury, Maryland, 1931-32, Rural Service Engineer with Electric Power Company. Tennessee Valley Authority, Knoxville, Tennessee, 1935-39, Project leader in research and development. Blacksburg, Virginia, 1940-42, Jointly employed by V.P.I. and USDA in Research and Development.
9. Part-time industrial experience: None
10. Important consulting work: Goes on frequently with farmers, seedsmen, dairymen, electrical use advisors, staff at N.C. State College, and other colleges and universities.
11. Principal publications, particularly those of last five years:

    "Low-Cost Hay Drying," Principal author, AGRICULTURAL ENGINEERING, Vol. 20, January 1939.

    "A Study of Egg Cooling Methods," Principal author, AGRICULTURAL ENGINEERING, Vol. 23, July 1942.

    "Drying Baled Hay with Forced Air," Principal author, AGRICULTURAL ENGINEERING, Vol. 28, July 1947.

    "The Development of a Farm Crop Drier," Principal author, AGRICULTURAL ENGINEERING, Vol. 30, October 1949.

"The Platform Hay Drier," Co-author, N.C. Agricultural Extension Service Folder No. 130, 1956.

"Covered Wagon Hay Drying," Principal author, RESEARCH & FARMING, Vol. 16:1, Summer 1957.

12. Scientific and professional societies: American Society of Agricultural Engineers, Member, Vice Pres., Southeast Section and first President of the N. C. Section; Sigma Xi, Member; Raleigh Engineers' Club, Member.

13. Subjects or courses taught this year by terms:

Fall, AGE 341, Farm Elec. & Utilities, 2 hrs. lec, 3 hrs. lab, Day.

AGE 491, Rural Electrification, 3 hrs. lec., 3 hrs. lab (2 lab secs.) Day.

14 contact hrs.

14. Other duties performed for regular base salary:

Research in crop processing; assisting with short courses; assisting with AGE 551, Special Problems.

15. Other duties performed for extra compensation during academic year: None

1. Name: Henry D. Bowen
2. Department: Agricultural Engineering
3. Age: 36
4. Academic Rank: Associate Professor - Part-time teaching
5. Degrees: B.S., Agricultural Engineering, Michigan State College, 1949
   M.S., Agricultural Engineering, Michigan State College, 1951
   Ph.D, Agricultural Engineering, Michigan State College, 1953
6. Date first appointed to this staff: 1953
7. Other teaching experience: None
8. Full-time industrial experience: None
9. Part-time industrial experience: None
10. Important consulting work: None
11. Principal publications, particularly those of last five years:

    "Application of Electrostatic Charging in Dusting Plant Surfaces," AGRICULTURAL ENGINEERING, 33:6, page 347, 1952.

    "Electric and Inertial Forces in Pesticide Application," Dissertation Abstracts, XIV:3, pages 507-8, 1954.

    "Costs of Applying Nitrogen Fertilizer," Principal author, AGRICULTURAL AND FOOD CHEMISTRY, 4:316, 1956

    "Hose Pump for Applying Nitrogen Solutions," Co-author, USDA Farmers' Bulletin No. 2096, 1956.

12. Scientific and professional societies: Tau Beta Pi; Phi Kappa Phi; Sigma Xi, Associate Member; American Society of Agricultural Engineers, Associate Member.
13. Subjects or courses taught this year by terms:

    Fall, AGE 211, Farm Power & Machinery I, 2 hrs. lec., (2 lec. secs.), 2 hrs lab, (3 lab secs.) Day.

    AGE 462, Farm Power & Machinery II-A, 3 hrs lec., 3 hrs. lab, Day.

    16 contact hrs.
14. Other duties performed for regular base salary: Research in cotton mechanization problems, particularly planting and weed control.
15. Other duties performed for extra compensation during academic year: None

1. Name: William E. Splinter
2. Department: Agricultural Engineering
3. Age: 32
4. Academic Rank: Research Associate Professor
5. Degrees: B.S., Agricultural Engineering, University of Nebraska, 1950
   M.S., Agricultural Engineering, Michigan State College, 1951
   Ph.D, Agricultural Engineering, Michigan State College, 1955
6. Date first appointed to this staff: 1954
7. Other teaching experience: Farm Power & Machinery Lab, Michigan State College, Fall, 1951; Agr. Machinery Lecture & Lab, Michigan State College, Fall, 1953; Farm Power & Machinery Lecture & Lab, Michigan State College, Spring, 1954.
8. Full-time industrial experience: None
9. Part-time industrial experience: None
10. Important consulting work: Research Committee National Canners' Association, Washington, D. C.
11. Principal publications, particularly those of last five years:

    "Dirt Removal Devices on Sugar Beet Harvesters," Proceedings of the American Society of Sugar Beet Technologists, 7th Regional Meeting, pages 63-71, 1953.

    "A Fertilizer Placement Drill with Attachment for Placement of Insecticides and Fungicides for Organic Soils," Michigan Agric. Exp. Sta. Bulletin, 36:2, pages 219-25, 1953.

    "Deposition of Aerial Suspensions of Pesticides," Dissertation Abstracts, XV:9, pages 1577-8, 1955.

    "The Effect of Placement of Insecticidally Treated Transplanting Water on the Control of Wireworms in Tobacco," JOURNAL OF ECONOMIC ENTOMOLOGY, 49:2, pages 256-59, 1956.

    "Instrument for Recording Heart Rate for Energy Studies," AGRICULTURAL ENGINEERING, 37:9, pages 618-19, 1956.

    "Time and Energy Analysis of Agricultural Tasks, " AGRICULTURAL ENGINEERING, In Press.

12. Scientific and professional societies: Sigma Tau; Pi Mu Epsilon; American Society of Agricultural Engineers, Member; Society of Automotive Engineers, Member; Sigma Pi Sigma; Sigma Xi, Member; American Association for the Advancement of Science.

13. Subjects or courses taught this year by terms: None

14. Other duties performed for regular base salary:

In charge of research program in tobacco mechanization.

15. Other duties performed for extra compensation during academic year: None

1. Name: Jan van Schilfgaarde
2. Department: Agricultural Engineering
3. Age: 29
4. Academic Rank: Research Associate Professor
5. Degrees: B.S., Agricultural Engineering, Iowa State College, 1949.
   M.S., Agricultural Engineering, Iowa State College, 1950.
   Ph.D, Agricultural Engineering & Soil Physics, Iowa State College, 1954.
6. Date first appointed to this staff: 1954
7. Other teaching experience: Soil & Water, Iowa State College, part-time, 1950-54.
8. Full-time industrial experience: None
9. Part-time industrial experience: Drainage engineer for Hansen Brothers, Contractors, June - Sept. 1951, Sumner, Iowa.
10. Important consulting work: Drainage design as partner in "Agricultural Engineering Service," Ames, Iowa, 1952-54. (On own time while on Iowa State College staff.)
11. Principal publications, particularly those of last five years:

    "A Tile Drainage Field Laboratory," AGRICULTURAL ENGINEERING, 35:474-78, 1954.

    "Analytical & Empirical Evaluation of Water Table Behavior as Affected by Drainage Systems," Ph.D Thesis, Iowa State College, 1954.

    "Physical and Mathematical Theories of Tile and Ditch Drainage and Their Usefulness in Design," Iowa Agric. Exp. Sta. Research Bulletin 436, 1956.

    "Approximate Solutions to Drainage Flow Problems," DRAINAGE OF AGRICULTURAL LANDS, Agronomy Monograph No. 7. 1958.

12. Scientific and professional societies: Pi Mu Epsilon; American Geophysical Union, Member; American Society of Agricultural Engineers, Member; Soil Science Society of America; Soil Conservation Society of America, Member; Gamma Sigma Delta; Sigma Xi, Member; Phi Kappa Phi; Registered Professional Engineer, State of Iowa.

13. Subjects or courses taught this year by terms:

None

14. Other duties performed for regular base salary:

Project leader - drainage research

15. Other duties performed for extra compensation during academic year: None

1. Name: George B. Blum, Jr.
2. Department: Agricultural Engineering
3. Age: 30
4. Academic Rank: Assistant Professor - Full-time teaching
5. Degrees: B.S., Agricultural Engineering, N.C. State College, 1949.
   M. of Agricultural Engineering, N.C. State College, 1955.
6. Date first appointed to this staff: 1950
7. Other teaching experience: Veterans' Farmer Training Program, Middleburg High School, (Part- and full-time) 1947-48. Ass't. lab instructor, Farm Shop, Dept. of Agric. Engr., N.C. State College (part-time) 1948-49. Tractor Maintenance courses for Vocational Agriculture teachers, (off campus) Summer 1957.
8. Full-time industrial experience: None
9. Part-time industrial experience: None
10. Important consulting work: None
11. Principal publications, particularly those of last five years: None
12. Scientific and professional societies:
    American Society of Agricultural Engineers, Associate Member
13. Subjects or courses taught this year by terms:

    Fall, AGE 151, Farm Mechanics, 4 hrs. lec., 4 hrs. lab., (2 secs. lec. & lab.) Day. — 16 contact hrs.

    The following courses are not for the professional curriculum:

    Spring, AGE 201, Farm Shop, 2 hrs. lec., 2 hrs. lab., (3 secs. lec. & lab.) Day.

    AGE 332, Farm Building & Crop Processing, 2 hrs. lec., 4 hrs. lab. Day. — 18 contact hrs.

14. Other duties performed for regular base salary:
    In charge Freshman counseling.
15. Other duties performed for extra compensation during academic year:
    U. S. Naval Reserve - 3 hrs./week.

1. Name: Ezra L. Howell
2. Department: Agricultural Engineering
3. Age: 41
4. Academic Rank: Assistant Professor - Full-time teaching
5. Degrees: B.S. Agricultural Education, N. C. State College, 1947.
   M. of Education, N. C. State College, 1952.
6. Date first appointed to this staff: 1947
7. Other teaching experience: Gunnery, Fort Eustis, Virginia, Replacement Training Center, 1941-42.
8. Full-time industrial experience: None
9. Part-time industrial experience: None
10. Important consulting work: Frequent consultations with Voc. Agric. teachers on problems in farm mechanics.
11. Principal publications, particularly those of last five years:

    "Planning and Equipping a Shop for the Farm," Principal author, Bulletin in press with Interstate Publishing Company.
12. Scientific and professional societies: Kappa Phi Kappa; American Society of Agricultural Engineers, Affiliate Member.
13. Subjects or courses taught this year by terms:

    These courses are not for the professional curriculum:

    Fall, AGE 201, Farm Shop (woodwork), 1 hr. lec., 3 hrs. lab., Day.
    AGE 202, Farm Shop (metalwork), 1 hr. lec., 3 hrs. lab., Day.
    AGE 401, Farm Shop Organization & Management, 2 hrs. lec., 4 hrs. lab. (2 secs. lec. & lab.). Day.
    — 20 contact hrs.

    Spring, AGE 202, Farm Shop (metalwork), 1 hr. lec., 3 hrs. lab., (4 secs. lec. & lab.), Day. — 16 contact hrs.
14. Other duties performed for regular base salary:

    Work with Voc. Agric. teachers on problems in area of farm mechanics.
15. Other duties performed for extra compensation during academic year: None

1. Name: Nathaniel W. Weldon
2. Department: Agricultural Engineering
3. Age: 62
4. Academic Rank: Research Assistant Professor
5. Degrees: B.S., Agriculture, N. C. State College, 1917.
6. First appointed to this staff: 1946
7. Other teaching experience: Voc. Agric. teacher, Vanceboro, N. C., 1917-1919. Voc. Agric. teacher and Principal, Stovall High School, 1919-1924. Principal, Oxford High School, 1924-1944.
8. Full-time industrial experience: None
9. Part-time industrial experience: None
10. Important consulting work: Cooperative program with American Machine & Foundry - Consulting Engineer.
11. Principal publications, particularly those of last five years:

    "Curing Tobacco with Anthracite," Co-author, N. C. Agric. Exp. Sta. Bulletin 102, 1953.

    "History of Practices and Research Developments in Bright Leaf Tobacco Curing," Co-author, N. C. Agric. Exp. Sta. Information Circular 12, 1957.
12. Scientific and professional societies:

    National Education Association; North Carolina Education Association
13. Subjects or courses taught this year by terms: None
14. Other duties performed for regular base salary:

    Full-time research in tobacco curing.
15. Other duties performed for extra compensation during academic year: None

1. Name: James William Dickens
2. Department: Agricultural Engineering
3. Age: 32
4. Academic Rank: Research Instructor
5. Degrees: B.S., Agricultural Engineering, N.C. State College, 1951.
   M.S., Agricultural Engineering, N.C. State College, 1956.
6. Date first appointed to this staff: 1955
7. Other teaching experience: None
8. Full-time industrial experience: None
9. Part-time industrial experience: None
10. Important consulting work: None
11. Principal publications, particularly those of last five years:

    "Bulk Curing of Peanuts Saves Labor but Quality Must be Maintained," PEANUT JOURNAL AND NUT WORLD, 36:12, pages 14-15, Oct., 1957.

    "Observations Related to the Flavor of Bulk Cured Peanuts," Proceedings of the Association of Southern Agricultural Workers, 54th Annual Convention, Page 37, February, 1957.

12. Scientific and professional societies: Phi Theta Kappa; Phi Kappa Phi; Sigma Xi, Associate Member; American Society of Agricultural Engineers, Associate Member.
13. Subjects or courses taught this year by terms:

    None

14. Other duties performed for regular base salary:

    Full-time research in peanut curing and grading.

15. Other duties performed for extra compensation during academic year: None

1. Name: Thomas H. Garner
2. Department: Agricultural Engineering
3. Age: 27
4. Academic Rank: Instructor - Part-time teaching
5. Degrees: B.S., Agricultural Engineering, N.C. State College, 1952.
   M.S., Agricultural Engineering, N.C. State College, 1956.
6. Date first appointed to this staff: 1956
7. Other teaching experience: Chemical, Biological & Atomic Warfare, The Engineer School, Ft. Belvoir, Virginia, Nov. 1952 through April 1954.
8. Full-time industrial experience: None
9. Part-time industrial experience: None
10. Important consulting work: None
11. Principal publications, particularly those of last five years: None
12. Scientific and professional societies: Gamma Sigma Delta; American Society of Agricultural Engineers, Associate Member; Alpha Zeta; Sigma Xi, Associate Member.
13. Subjects or courses taught this year by terms:

    Spring, AGE 211, Farm Power & Machinery I, 2 hrs. lec., 2 hrs. lab. Day.

    The following course is not for the professional curriculum: 12 contact hrs.

    AGE 211, Farm Power & Machinery I (Service Course), 2 hrs. lec., 2 hrs. lab. (3 lab secs.) Day.
14. Other duties performed for regular base salary:

    Research in cotton mechanization - weed control
15. Other duties performed for extra compensation during academic year:

    Two weeks summer camp, U. S. Army Reserve.

1. Name: Wiley H. Henson, Jr.
2. Department: Agricultural Engineering
3. Age: 29
4. Academic Rank: Research Instructor
5. Degrees: B.S., Agricultural Engineering, University of Georgia, 1952
   M.S., Agricultural Engineering, N.C. State College, 1956
6. Date first appointed to this staff: 1956
7. Other teaching experience: None
8. Full-time industrial experience: None
9. Part-time industrial experience: None
10. Important consulting work: None
11. Principal publications, particularly those of last five years:

    "Effects of Bruising on Tobacco Curability," Co-author, TOBACCO, 145:22, pages 42-44; TOBACCO SCIENCE, 1:177-79, 1957.

    "Some Determinations Pertinent to Removal of Midrib from Bright Leaf Tobacco During Curing Operations," Co-author, TOBACCO, 145:18, pages 20-24; TOBACCO SCIENCE, 1:164-68, 1957.

    "Yellowing Flue Cured Tobacco in the Bulk," Principal author, TOBACCO SCIENCE, In Press.

12. Scientific and professional societies:

    Alpha Zeta; American Society of Agricultural Engineers, Associate Member; Sigma Xi, Associate Member.

13. Subjects or courses taught this year by terms:

    None

14. Other duties performed for regular base salary:

    Full-time research in tobacco curing.

15. Other duties performed for extra compensation during academic year:

    None

1. Name: William H. Johnson
2. Department: Agricultural Engineering
3. Age: 25
4. Academic Rank: Research Instructor
5. Degrees: B.S., Agricultural Engineering, N.C. State College, 1954
   M.S., Agricultural Engineering, N.C. State College, 1956
6. Date first appointed to this staff: 1956
7. Other teaching experience: None
8. Full-time industrial experience: None
9. Part-time industrial experience: None
10. Important consulting work: None
11. Principal publications, particularly those of last five years:

    "Effects of Bruising on Tobacco Curability," Co-author, TOBACCO, 145:22, pages 42-44; TOBACCO SCIENCE, 1:177-79, 1957.

    "Some Determinations Pertinent to Removal of Midrib from Bright Leaf Tobacco During Curing Operations," Co-author, TOBACCO, 145:18, pages 20-24; TOBACCO SCIENCE, 1:164-68, 1957.

    "Yellowing Flue Cured Tobacco in the Bulk," Co-author, TOBACCO SCIENCE, In Press.

12. Scientific and professional societies:

    Phi Theta Kappa; Phi Kappa Phi; Tau Beta Pi; Gamma Sigma Delta; Sigma Xi, Associate Member; American Society of Agricultural Engineers, Associate Member.

13. Subjects or courses taught this year by terms:

    None

14. Other duties performed for regular base salary:

    Full-time research in tobacco curing.

15. Other duties performed for extra compensation during academic year:

    None

1. Name: William T. Mills
2. Department: Agricultural Engineering
3. Age: 29
4. Academic Rank: Research Instructor
5. Degrees: B.S., Agricultural Engineering, University of Georgia, 1949
   M.S., Agricultural Engineering, N.C. State College, 1955
6. Date first appointed to this staff: 1955
7. Other teaching experience:
   Surveying & logarithms, Ft. Bragg, N. C., 1952
8. Full-time industrial experience:
   Schroer Implement Company, Valdosta, Georgia, 1949-51, Irrigation Engineer.
9. Part-time industrial experience:
   B.C. Hayne Construction Company, Atlanta, Georgia, Summers 1945-1949, Laying out houses, concrete work, carpentering, block mason.
   University of Georgia, Athens, Georgia, 1945-49, blueprinter.
10. Important consulting work: None
11. Principal publications, particularly those of last five years:
    "Peanut Production Guide," N. C. Extension Circular 257, Revised 1955.
    "Statistical Methods for Evaluating the Functional Components of Farm Machinery," Principal author, AGRICULTURAL ENGINEERING, 39:1, pages 31-33, January 1958.
    "Harvest and Cure the Windrow Way," N. C. Agric. Exp. Sta. Bulletin, In press.
12. Scientific and professional societies: Alpha Zeta; Gamma Sigma Delta; Sigma Xi, Associate Member; Phi Kappa Phi; American Society of Agricultural Engineers, Associate Member.
13. Subjects or courses taught this year by terms:
    None

14. Other duties performed for regular base salary:

Full-time research on mechanization of peanut production.

15. Other duties performed for extra compensation during academic year:

None

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1. Name: Charles W. Suggs
2. Department: Agricultural Engineering
3. Age: 29
4. Academic Rank: Research Instructor
5. Degrees: B.S., Agricultural Engineering, N.C. State College, 1949

   M.S., Agricultural Engineering, N.C. State College, 1955
6. Date first appointed to this staff: 1954
7. Other teaching experience: None
8. Full-time industrial experience: Dearborn Motors, Inc., (Ford Tractor Co.), Detroit, Michigan, 1949, Instructor.

   International Harvester Company, Fort Wayne, Indiana, 1950-51, Ass't. Service Supervisor.
9. Part-time industrial experience: None
10. Important consulting work: None
11. Principal publications, particularly those of last five years:

    "Tobacco Priming Studies," Agricultural Engineering Information Circular 9, Principal author, 1954.

    "Instrument Records Heart Rate for Energy Studies," Co-author, AGRICULTURAL ENGINEERING, 37:9, pages 618-19, 1956.

    "Time and Energy Analysis of Agricultural Tasks," Principal author, AGRICULTURAL ENGINEERING, In Press.
12. Scientific and professional societies: Phi Eta Sigma;

    American Society of Agricultural Engineers, Associate Member;

    Sigma Pi Sigma; Sigma Xi, Associate Member; Gamma Sigma Delta.
13. Subjects or courses taught this year by terms: None
14. Other duties performed for regular base salary:

    Full-time research in tobacco mechanization.
15. Other duties performed for extra compensation during academic year:

    None

1. Name: Edward H. Wiser
2. Department: Agricultural Engineering
3. Age: 27
4. Academic Rank: Instructor - Full-time teaching
5. Degrees: B.S., Agricultural Engineering, Iowa State College, 1953
6. Date first appointed to this staff: 1957
7. Other teaching experience: None
8. Full-time industrial experience: None
9. Part-time industrial experience: None
10. Important consulting work: None
11. Principal publications, particularly those of last five years:

    None

12. Scientific and professional societies:

    Alpha Zeta; American Society of Agricultural Engineers, Associate Member; Tau Beta Pi; Gamma Sigma Delta; Sigma Xi, Associate Member.

13. Subjects or courses taught this year by terms:

    Fall, AGE 371, Soil & Water Conservation Engineering, 3 hrs. lec., 3 hrs. lab. Day.

    The following courses are not for the professional curriculum: 14 contact hrs.

    AGE 321, Irrigation, Terracing & Drainage, 2 hrs. lec., 3 hrs. lab. (2 lab. secs.) Day.

    Spring, AGE 321, Irrigation, Terracing & Drainage, 2 hrs. lec., 3 hrs. lab., (2 lab. secs.) Day. 8 contact hrs.

14. Other duties performed for regular base salary:

    None

15. Other duties performed for extra compensation during academic year:

    None

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CURRICULUM

In the interest of greater effectiveness, the Department's teaching function is continuously examined in relation to three principal criteria: (1) A dynamic agriculture that ever awaits methods of greater production efficiency, (2) An accelerated expansion in scientific knowledge that serves as the potential source for engineering advances, and (3) the challenge to develop in our students those methods of thought whereby science can be applied with understanding and judgment to the solution of new problems. These criteria connote the challenge for promoting efficiency in developing intellects for anticipating, confronting and solving professional problems appropriate to a prosperous but advancing society.

With recognition of the basic studies and engineering sciences as essential prerequisites to all engineering professions, the department accepts the condition that only it has the opportunity to round out an effective program of study for its majors. This points up three main objectives for the Agricultural Engineering curriculum: (1) Strengthen the students' understanding of science, (2) Provide effective experience in analysis and synthesis of problem situation in engineering service to agriculture, and (3) Improve their understanding of communicative skills and of relations in human affairs.

To foster these ends, the department has initiated greater emphasis in counseling students prior to their selection of and during their progress in our professional curriculum. Prospective students are counseled on the basis of professional requirements and expectations in order to help them acquire resolutions and attitudes whereby they will realize greater success in both student and professional life. Throughout their studies in the basic sciences, departmental counseling complements the instruction in these subjects to assist our students to a better appreciation of mathematics and science by relating them to typical professional applications.

In the main, the fourth year is devoted to instruction and training in the specialty of Agricultural Engineering. Here the presentations are turning from the more conventional type of textbook instruction that involves qualitative learning of existing methods such as going from assigned problems to the "correct" answers. Instead, as in course AGE 462, our teaching in professional courses is turning to the type of instruction that emphasizes the analysis of problems on the basis of underlying principles and mathematical methods. Furthermore, this instruction provides experience in making reasonable approximations and valid comparisons of variables in empirical relationships. The students are required to participate in original problems to learn how to deal with such problems by actually dealing with them scientifically. Relationships among physical and biological response parameters serve as the basis of instruction and training in the syntheses of design specifications and the predetermination of performances for systems. The aim is to have the student gain confidence in

the use of scientific knowledge and analytical methods in order that he will enter his profession with concern for profundity rather than a belief in expediency through superficiality.

In addition to organizing all our courses for the professional curriculum to emphasize learning in creative analysis and design, present plans are to have a separate faculty responsible for this area of teaching, in order to give instructors the physical and psychological freedom so essential for excellence. This same faculty will be actively engaged in research that is fundamental to our recognized subject matter and it is the intention to bring the advanced undergraduates into contact with the research endeavors for the enhancement of effective learning. These developments in methods of instruction have precluded the need for the course "Special Problems", AGE 551 in the regular curriculum; therefore, this course will in the future be offered as an elective.

The following pages include:

1. Course program for the Agricultural Engineering curriculum
2. Sequence of course scheduling by semester
3. Syllabi for those departmental courses included in this curriculum

REQUIREMENTS FOR GRADUATION

DEGREE: Bachelor of Agricultural Engineering, in full-time day curricula.

NOTE: Semester Credit Hours are computed by dividing the total numbers of hours of work required in a subject, including preparation and attendance at lectures, recitation, and laboratory but not final examination by 45. One semester credit hour therefore represents 3 total hours of work per week for 15 weeks.

REQUIRED COURSES:	TEXTS USED	REQUIRED SEMESTER CREDIT HRS.
ENGLISH:		
Composition, ENG 111, 112,	Hodges, "Harbrace College Handbook," Harcourt, Brace, 1956 edition.	6
Speech, ENG 231,	Monroe, "Principles of Speech," Scott-Foresman 1951 edition.	3
Literature, Electives		3
ECONOMICS:		
EC 201,	Allen, "Prices, Income, & Job Policies," McGraw-Hill, 1954	3
AGC 212,	Bishop & Toussaint, "Notes for Agricultural Economics 212," authors, 1957.	3
FOREIGN LANGUAGES:		
BUSINESS ADMINISTRATION:		
ELECTIVES IN HUMANITIES & SOCIAL STUDIES:		
PSC 201,	Carr, "American Democracy - Theory & Practice," Rinehart, 1957.	3
HI 261,	Rae, et al, "The U. S. in World History," McGraw-Hill, 1955.	3
RS 301,	Nelson, "Rural Sociology," American Book Company, 1955.	3
Electives		3
MATHEMATICS:		
Analytical Geometry, MA 101, 102,	Rider, "First Year Mathematics for Engineers," MacMillan, 1st ed.	9
Calculus, MA 201, 202,	Smith, Salkover, & Justice, "Unified Calculus, John Wiley, 1st edition.	8
Differential Equations, MA 401,	Kells, "Elementary Differential Equations, McGraw-Hill, 4th edition.	3
PHYSICS:		
PY 201, 202,	Shortley & Williams, "Elements of Physics," Prentice-Hall, 2nd edition.	10

REQUIRED COURSES:	TEXTS USED	REQUIRED SEMESTER CREDIT HRS.
CHEMISTRY:		
General, CH 101,	Wood & Keenan, "General College Chemistry," Harper, 1st edition.	4
Analytical		
Organic, CH 203,	Hart, et al, "A Short Course in Organic Chemistry," Houghton-Mifflin, 1953.	4
Physical		
OTHER SCIENCES:		
AG 101,	Haystead, "Agricultural Regions of the U.S.," Univ. of Oklahoma Press, 1955. Brown, "The Challenge of Man's Future, Viking, 1954.	3
BO 101,	Wilson, "Botany," Dryden, 1957.	3
SOI 200,	Lyon, et al, "The Nature and Properties of Soils," MacMillan 1952.	4
DRAWING & DESCRIPTIVE GEOMETRY:		
ME 101,	Zozzora, "Engineering Drawing," McGraw-Hill, 1st edition. Brown & Leonard, "Basic Exercises in Engineering Graphics," Technical Press, 1st edition.	2
ME 102,	Warner, "Applied Descriptive Geometry," McGraw-Hill, 4th edition.	2
INDUSTRIAL ENGINEERING:		
ENGINEERING MECHANICS & STRENGTH OF MATERIALS:		
EM 311, 312,	Beer & Johnston, "Mechanics for Engineers," McGraw-Hill, 1st edition, 1957.	6
EM 321,	Singer, "Strength of Materials," Harper & Brothers, 1st. edition, 1957.	3
EM 430,	John K. Vannard, "Elementary Fluid Mechanics," John Wiley & Sons, 3rd edition, 1954.	2
SHOP:		
MAJOR BRANCH OF ENGINEERING:		
AGE 151, 152,	Jones, "Shopwork on the Farm," McGraw-Hill, 1955.	4
AGE 211,	Bainer, et al, "Principles of Farm Machinery," John Wiley & Sons, 1955.	3
AGE 371,	Frevert, et al, "Engineering in Soil & Water Conservation," John Wiley & Sons, 1955.	4

REQUIRED COURSES:	TEXTS USED	REQUIRED SEMESTER CREDIT HRS.
MAJOR BRANCH OF ENGINEERING:		
AGE 451	Henderson & Perry, "Agricultural Process Engineering," John Wiley & Sons, 1955.	2
AGE 452	Senior Seminar (No text)	1
AGE 462	Ver Planck, "Engineering Analysis, An Introduction to Professional Methods," John Wiley & Sons, 1954.	4
AGE 481	Barre & Sammett, "Farm Structures," John Wiley & Sons, 1950.	4
AGE 491	Brown, "Farm Electrification," McGraw-Hill, 1956.	4
AGE 552	Aronson, "Electronic Circuitry for Instruments & Equipment," Instrument Publishing Company, 1957.	1
OTHER ENGINEERING:		
CE 201	Kissam, "Surveying Instruments and Methods," McGraw-Hill, 1956.	3
ME 301	Doolittle and Zerban, "Engineering Thermodynamics," International Textbook Company, 2nd edition.	3
EE 320	Pumphrey, "Electrical Engineering," Prentice-Hall, 1953.	4
TECHNICAL AND SCIENTIFIC ELECTIVES:		
ST 361	Hader, "Introduction to Statistics for Engineers," Technical Press, Raleigh, N. C., 1956.	3
PY 407	Semat, "Introduction to Atomic and Nuclear Physics," Rinehart, 1954.	3
REQUIRED COURSES IN MILITARY AND PHYSICAL EDUCATION:		12
FREE ELECTIVES:		6
	TOTAL	154

SEQUENCE OF COURSES IN AGRICULTURAL ENGINEERING CURRICULUM

Year	Number and Name		Credits	
1	AG 101	Agriculture in World Affairs	3	0
	AGE 151, 152	Farm Mechanics	2	2
	CH 101	General Inorganic Chemistry	0	4
	ENG 111, 112	Composition	3	3
	MA 101, 102	First Year Mathematics for Engineers	5	4
	ME 101, 102	Engineering Graphics I., II	2	2
	MS 101, 102	Military Science* or		
	AS 121, 122	Air Science*	2	2
	PE 101, 102	Physical Education*	1	1
			18	18
2	EM 311	Mechanics I	0	3
	CH 203	General and Organic Chemistry	4	0
	CE 201	Surveying I	0	3
	AGE 211	Farm Power & Machinery	3	0
	MA 201, 202	Calculus I, II	4	4
	PY 201, 202	General Physics	5	5
	MS 201, 202	Military Science* or		
	AS 221, 222	Air Science*	2	2
	PE 201, 202	Physical Education *	1	1
			19	18
3	BO 101	General Botany	0	3
	EC 201	Economics	0	3
	EE 320	Elements of Electrical Engineering	4	0
	EM 312	Mechanics II	3	0
	EM 321	Strength of Materials I	3	0
	EM 430	Fluid Mechanics	0	2
	ENG 231	Basic Speaking Skills	0	3
	ME 301	Engineering Thermodynamics I	0	3
	MA 401	Differential Equations	0	3
	SOI 200	Soils	4	0
		English Elective	3	0
		Electives	3	3
			20	20
4	AGC 212	Economics of Agriculture	0	3
	AGE 371	Soil and Water Conservation Engineering	0	4

Sequence of Courses (Continued)

Year	Number and Name		Credits	
4	AGE 481	Farm Structures	0	4
	AGE 451	Curing and Drying of Farm Crops	2	0
	AGE 452	Senior Seminar	1	0
	AGE 462	Farm Power and Machinery IIA	4	0
	AGE 491	Rural Electrification	4	0
	HI 261	The United States in Western Civilization	0	3
	AGE 552	Instrumentation for Agricultural Research and Processing	0	1
	PS 201	The American Governmental System	3	0
	RS 301	Sociology of Rural Life	3	0
		Humanities Elective	0	3
		Electives	3	3
			20	21

A minimum of 154 semester hours is required for graduation.

ST 361, Introduction to Statistics for Engineers, and PY 407, Introduction to Modern Physics, are recommended for electives.

*Students excused from Military or Air Science and/or Physical Education will schedule equivalent credits in courses outside their department.

ECPD 1958 Curriculum
North Carolina State College Agricultural Engineering Department

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TITLE: Farm Mechanics

COURSE NO.: AGE 151 CREDITS: 4 Semester Hours

PREREQUISITES: Enrollment in Agricultural Engineering or Mechanized Agric.

NATURE AND SCOPE OF COURSE:

Farm Mechanics is a course designed to acquaint beginning Agricultural Engineering and Mechanized Agriculture students with various tool and material processes related to the agricultural industries. This course also serves as a period of introduction for new students to the Agricultural Engineering Department. More specifically, the objectives of this course are as follows:

1. To develop the student's ability to recognize and think in terms of some of the manual and managerial skills that we encounter in the study and application in the various fields of endeavor in Agricultural Engineering.

2. To give the student some practical experience in accomplishing the above mentioned skills.

3. To acquaint the student with tools, tool processes, materials, shop procedures, and safety practices.

4. To give the freshman and transfer students contact with the Agricultural Engineering Department during their first year at N. C. State College; thereby supplementing the overall advisory and counselling program in the department.

PROCEDURE:

Farm Mechanics is offered during the fall semester as a four-credit course.* Each class meets eight hours per week - two four-hour sessions. Fifty per cent or more of this time is devoted to classroom discussion, lecture demonstrations, and oral reports by the students. The remainder of the time is devoted to actual student practice in tool and material processes.

The subject matter covered falls into the following four groups (not listed in order of preference):

1. Brief discussions that pertain to various subjects are held to aid the students in becoming better acquainted with the procedures and objectives of obtaining a college education in conjunction with Agricultural Engineering. These discussions follow no set pattern or time schedule. They are presented by the instructor or stimulated by student questions as time allows or the need arises.

AGE 151 (Continued)

2. Oral reports are prepared and presented by students on various topics assigned by the instructor. The topics assigned deal largely with industrial processes and general background that aid the student in thinking through things of an engineering nature from the materials fabrication standpoint. The organizing and presenting of such information aids the student in tying together the practical and theoretical knowledge as well as giving some early experience in speaking before a group. In addition to oral reports, various up-to-date films are used to acquaint the students with industrial processes. Films used recently are: "Forging in Closed Dies", by Pittsburg Forging Co. and "Engineered Timber Construction", by Timber Engineering Co.

3. Classroom discussion and lecture demonstrations dealing with the various areas of farm mechanics are held.

4. In conjunction with the lecture and demonstration topics, some practical laboratory experience is required. This work requires the student to use his creative ability to design, plan and construct various projects of his own choosing. Instructor supervision is given; however, each student is encouraged to think through and solve his own problems. Students are encouraged to incorporate as many shop processes in their laboratory work as possible. Proper planning, accuracy, and neatness are emphasized in grading. Some examples of projects constructed are: Automatic waterers, tool boxes, tractor spray rigs, trailers, drafting tables, work benches, tool cabinets, step ladders, etc.

COURSE OUTLINE AND ASSIGNMENTS FOR AGE 151

TEXT: Mack M. Jones, "Shopwork on the Farm," Second Edition, McGraw-Hill, Inc., New York, 1955.

REFERENCES: 1. Office of Education, "Light Frame House Construction," U.S. Government Printing Office, Washington, 1940.
2. Technical bulletins and books as references for oral report subject matter.

Period	Subject	Reading** Assignments
1	The Home Farm Shop and Dealer Service Shop	1
1	Soldering and Sheet Metal Work	11
2	Properties and Methods of Working Cold Metal	12
3	Metallic arc Welding - Process and Demonstrations	16
3	Ox-acetylene Welding and Cutting Process	17
2	Pipe Work and Plumbing	15
1	Electrical Work - Tools and Materials	19
1	Concrete Work - Producing Quality Concrete & Its Use	10

AGE 151 (Continued)

Period	Subject	Reading** Assignments
1	Concrete Masonry - Availability Specifications & Use	Problem & Review
1	Mid-term Exam	
1	Job Plans and Blueprint Reading - Trade Practices	2
2	Use of Power Wood-working Equipment and Glue	3, pp. 111-12 4, 5
1	Lecture Demonstration on Sharpening of Edge Tools	7
1	Physical Characteristics of Wood, Classification of Wood and Lumber Grades	(1) pp. 185-206
2	The Use of Measuring and Marking Tools, Hand Smoothing Tools, and Drilling Equipment	3, pp. 40-64
1	Wood Fastening Devices	3, pp. 98-111
1	Finishing and Wood Preservation	6
1	Framing Methods and Footings	(1) pp. 3-8
1	Foundations, Sills, and Girders	(1) pp. 11-44
1	Columns, Joists, and Bridging	(1) pp. 47-77 Problem
1	Walls and Partitions	(1) pp. 81-104
1	Roof Types and Roof Framing Methods	(1) pp. 104-114
1	Roof Layout and Stair-stringer Layout	3, pp. 113-135 Problem
1	Exam on Material and Tool Nomenclature	Review

* Tentative plans call for Farm Mechanics to be offered in the future as two 2-credit courses - AGE 151 in the fall and AGE 152 in the spring. This change will not affect the course content or objectives as outlined in this syllabus. The reasons for such a change are as follows:

1. To allow a decrease in total contact hours required of incoming Freshmen.
2. To provide weekly contact between members of the Agricultural Engineering staff and new students in Agricultural Engineering throughout the Freshman year.
3. To provide more efficient use of the Farm Mechanics laboratory facilities.

** Numbers refer to Chapters in Text; numbers in parentheses refer to selected references.

ECPD 1958 Curriculum
North Carolina State College Agricultural Engineering Department

TITLE: Farm Power and Machinery I

COURSE NO.: AGE 211 CREDITS: 3 Semester Hours

PREREQUISITES: PY 201, General Physics or
PY 211, General Physics or concurrently enrolled in either

NATURE AND SCOPE OF COURSE:

Farm Power and Machinery I deals with the engineering considerations involved in the application of machines to farm operations. These considerations include the social, economic, biological, and physical aspects involved in the application of machines to crop production.

The course is designed to develop in the student an understanding of the principles pertaining to the development and use of farm machinery. Maximum utilization is made of the fundamentals of mathematics, physics, and the engineering sciences in developing this understanding, keeping in mind the backgrounds of the students. The superiority of these basic sciences as tools for comprehension is stressed.

It is recognized that the majority of the students have had little or no training in the efficient operation of farm machines; therefore, the laboratory exercises and problems are built around actual machines, whenever possible, to allow the students to obtain firsthand knowledge of general operating procedures. In all cases, however, the emphasis is placed upon the basic principles illustrated.

This course is offered early in the student's training for the purpose of presenting evidence of the "live" application of his basic course work. The future possibilities for farm mechanization are discussed frequently to quicken the student's mind to the importance of his future role in our society.

PROCEDURE:

The class time for this course consists of two 1-hour lectures and one 2-hour laboratory per week. The first two weeks of the course are devoted to a study of the general topic - mechanization. During this time the history of mechanization in the United States is discussed, bringing out the "why", the "how", and the effects of this advancement. The overall future of mechanization is also considered.

Following these introductory lessons, the discussions turn to specific problems in farm machinery. It is virtually impossible to cover, in any detail, all items of equipment that are employed. Therefore, the functions performed by farm machines are generalized to allow greater depth of coverage. One of these functions may be included in many different machines. The study of functions

AGE 211 (Continued)

usually begins with a general principle and leads up to the applications of that principle. Student thought on new applications of principles is encouraged.

Finally, near the end of the course, approximately two weeks are devoted to a study of the economics of farm machinery use.

Classroom instruction is of the conference type, with extensive use of training aids and demonstrations.

The laboratories are used to expand the classroom material with practical examples. The students are allowed to work on their own with assistance from the instructor when needed.

COURSE OUTLINE AND ASSIGNMENTS FOR AGE 211

TEXT: Bainer, Kepner, and Barger, "Principles of Farm Machinery," John Wiley & Sons, Inc., New York, 1955.

REFERENCES: 1. Barger, Carleton, McKibben, and Bainer, "Tractors and Their Power Units," John Wiley & Sons, Inc., N.Y., 1952.
2. "Farm Tractors", Engineering Bulletin No. FT 53, American Oil Company, N. Y.
3. Selected articles in ASAE Journals.

Period	Subject	Assignments Reading*	Problem**
1	Introduction of Course and History of Farm Mechanization	1	(1)
1	The "Why" of Mechanization	I	(2)
1	The "How" of Mechanization	Sup. Mat. 7,15,17	(3)
1	Generalization of Farm Machinery Functions	Sup. Mat. Review	(4) (5) (6)
1	Power and Farm Machinery	(2)pp. 9-23	(7)
1	Utilization of Energy	(2)pp. 23-43	(8)
1	Performance of Farm Tractor Engines	Review	
1	Quiz		
1	Application of Statics	(1) Sec. 18.1-18.9	
1	Mechanics of Farm Tractor Chassis	(1) Sec. 18.10-18.16	(9)
1	Mechanics of Farm Tractor Chassis and Transmission of Power	4	4.1, 4.2

AGE 211 (Continued)

Period	Subject	Assignments Reading*	Problem**
1	Mechanics of Farm Tractor Chassis and Transmission of Power	4	4.1, 4.2
1	Rotary Power Transmission	4, 5 Sec. 5.17-5.19	4.7a, 5.4
1	Problems in Rotary Power Transmission	5 Sec. 5.1-5.5	5.2
1	Other Means for Transferring Power	Review	
1	Quiz		
1	Orientation	7 Sec. 7.1-7.17	(10)
1	Non-human Methods for Orientation	14 Sec. 14.4-14.10 14.14-14.20	14.1, (11)
1	Mobilization	14 Sec. 14.21-14.33	14.2
1	Unitizing and Reduction	(3) V37, Nov. '56 14 Sec. 14.21-14.33 15 Sec. 15.1-15.17	14.5, 15.1
1	Methods Utilized for Unitizing and Reduction & Their Influence on Labor Requirements	Review	
1	Quiz	16	
1	Separation of Particles	16	(12)
1	Separation Problems	11, Sec. 11.1-11.3, 11.6 13, Sec. 13.8-13.10	11.1, 11.4
1	Metering	17 Sec. 17.1-17.11	
2	Dissociation	18 Sec. 18.1-18.11 Review	(13)
1	Quiz	2 Sec. 2.1-2.10	2.1
1	Economics of Farm Machinery Use	2 Sec. 2.11-2.23	(14)
2	Cost Analyses	Review	14

*Numbers refer to Chapters in Text; Numbers in parentheses refer to selected references.

** Numbers refer to Problems from Text; Numbers in parentheses refer to problems handed out by the instructor.

AGE 211 (Continued)

Laboratory Schedule:

Period	Subject
1	Research Procedure
1	Generalization of Farm Machinery Functions
1	Operation and Maintenance of Farm Tractor Engines
1	Engine Efficiency - Calculation and Measurement
1	Mechanics of Farm Tractor Chassis
1	Elementary Tillage Forces and Mechanics of Implement Hitching
1	Power Transmission
1	Problems in Orientation
1	Mowers and Rakes (As Machinery for Mobilization)
1	Balers - Methods for Unitizing
1	Forage Choppers as Machines for Reduction
1	Separation of Particles
1	Metering
1	Grain Harvesting Machinery
1	Cost Analysis

ECPD 1958 Curriculum
North Carolina State College Agricultural Engineering Department

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TITLE: Soil and Water Conservation Engineering

COURSE NO: AGE 371 CREDITS: 4 Semester Hours

PREREQUISITES: CE 201, Surveying
SOI 200, Soils
EM 430, Fluid Mechanics (To be added in the near future)

GENERAL NATURE AND SCOPE OF COURSE:

Soil and Water Conservation Engineering concerns the integration of plant science, soil science and engineering principles into management systems that optimize the efficiency of use of our natural resources, land and water.

In this course, it is attempted to develop in the student a general awareness and a basic understanding of those processes that affect the hydrologic cycle and related phenomena - climate, run-off, infiltration, soil-water-plant relations and flow theory -, as well as of those processes that affect erosion. It is emphasized that such phenomena can nearly always be explained and described in terms of concepts from engineering mechanics and physics, although rational mathematical expression is often not feasible.

The above principles are applied to the study of problems and practices in erosion control, reclamation, drainage, irrigation and flood control. It is shown to what extent rational analysis leads to solutions of specific problems and where factors of judgment and experience must be relied upon. By stressing the uniformity of principle rather than the diversity of special design techniques, the student is given confidence in his ability to satisfactorily handle new problems with which he may be confronted.

PROCEDURE:

Three lectures and one laboratory period per week are devoted to this course. In the lectures, the material is presented in the conventional order. The students are held responsible for the text material, but the presentation is not restricted to that covered in the text. Students are frequently reminded of the need for philosophical considerations of the social and economic aspects of conservation measures. The availability of and need for a theoretical base for many of the design practices is stressed, even where the level of student development does not permit thorough discussion of these theories. The places where design data are available and the occasions where they need to be used are offered as an indispensable tool of the practicing engineer.

The laboratory periods are used in two ways. Early in the term they are planned primarily as an opportunity to acquaint the students with the problem area of conservation engineering through the completion of routine problems in design. Later, the creative ability of the student is awakened by challenging him to find reasonable solutions to some actual field problems; with supervision but

without direction, he is expected to analyze his assigned problem, conceive and develop a solution and defend his decisions.

An example of how this teaching procedure has actually been carried out in practice is found in the following course outline and list of assignments for this course as it was taught in the fall of 1956.

COURSE OUTLINE AND ASSIGNMENTS FOR AGE 371

TEXT: R.K. Frevert, G.O. Schwab, T.W. Edminster and K.K. Barnes, "Soil and Water Conservation Engineering," New York, Wiley, 1955.

REFERENCES:

1. H.W. King, "Handbook of Hydraulics," Fourth Edition, New York, McGraw-Hill.
2. O.W. Israelsen, "Irrigation Principles and Practices," Second Edition, New York, Wiley, 1950.

Periods	Subject	Assignments Reading*	Problems
1	Introduction - The Hydrologic Cycle	None	
2	Elementary Meterology	1,2	P.42
1	Variations in Climatic Conditions	None	
2	Disposition of Rainfall	3 and Supplementary Material	
1	Factors Influencing Surface Runoff	4, pp. 56-59	
2	Methods of Estimating Runoff	4, pp. 59-77	4.1, 2, 3, 4
2	Fundamental Soil and Water Relationships	5	5.1, 2, 3, 4
3	Hydraulics of Fluid Flow	Supplementary Material	
1	Test No. 1		
1	Erosion Processes	6	
1	Factors Influencing Erosion	7	
3	Methods of Controlling Erosion	8, 9, 10	10.5
1	Gully Control	11	
3	Farm Ponds - Locations, Surveys, Dam Spec.	12	12.1
1	Flood Routing and Control	13	13.1
1	Planning Water Disposal Systems	None	
1	Land Clearing and Use of Explosives	21	
1	Use of Explosives	None	
1	Benefit of Drainage; Drainage Properties of Soils	5	
1	Methods and Types of Drainage	14, 15	14.1, 15.1
1	Theory of Tile Depths and Spacings	16	16.5
1	Design of Tile Drainage Systems	17	17.1
1	Economic Considerations, Installation, Maint.	18	18.1
1	Pumping for Drainage	19	
1	Test No. 2		
1	Drought-frequency Records in Southeast	Supplementary Material	

AGE 371 (Continued)

Periods	Subject	Assignments Reading*	Problems
1	Soil-Water-Plant Relationships	Supplementary Material	
1	Methods of Irrigation	Supplementary Material	
1	Sources of Water for Irrigation	Supplementary Material	
2	Pumps & Power Units for Sprinkler Irrigation	19, 20	19.1, 19.3
3	Sprinkler Irrigation Design Requirements	20	20.1, 4

Laboratory Schedule:

1	Process and plot rainfall and runoff data
1	Make hydrograph analysis of data plotted
1	Work runoff problems
1	Exercise on fundamental relationships
1	Exercise on flow of water in conduits and open channels
1	Laying out terraces
1	Constructing and checking terraces
3	Survey site, prepare plans and specifications for pond
2	Plan tile drainage system
2	Plan sprinkler irrigation system

* Numbers refer to chapters in text.

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Curriculum
Agricultural Engineering Department

TITLE: Curing and Drying of Farm Crops

COURSE NO.: AGE 451 CREDITS: 2 Semester Hours

PREREQUISITES: ME 301, Engineering Thermodynamics I
E. M. 430, Fluid Mechanics

NATURE AND SCOPE OF COURSE:

The course is introduced by a consideration of the engineering approach to an effective study of operations in the curing and drying of major native crops for local use and commerce. Since forced air is the common transport medium for heat and moisture transfers, the principles and methods of fluid flow analyses are presented as pertains to curing and drying systems. The dynamic characteristics of applicable fans are studied in some detail.

The principles of heat transfer are fundamental to this subject and considerable study is directed to developing an adequate understanding of heat transfer principles in relation to operational systems. The thermodynamic properties of air-moisture vapor mixtures are related to the theory of drying processes in order to round out the analytical functions essential to an energy balance analysis of drying systems.

Design specifications and predetermined performance for a system are derived from a matching of both physical and biological response parameters. In the main, the study is concerned with pertinent generalized technology in order to provide the student with a confident ability on which to develop an understanding and judgment for effective approaches to the solution of new problem situations.

PROCEDURE:

The course is scheduled as one 1-hour lecture and one 2-hour recitation-laboratory per week. Reading and problem assignments are elaborated during the respective lecture periods to provide a physical interpretation of the principles employed and to relate them, as a basis for analysis, to the systems under study. Laboratory work offers first-hand experience in the investigation and design of operational units; this activity includes instruction in appropriate instrumentation.

COURSE OUTLINE AND ASSIGNMENTS FOR AGE 451

TEXT: S.M. Henderson and R.L. Perry, "Agricultural Process Engineering," John Wiley & Sons, Inc., New York, N. Y., 1955.

REFERENCES: J.H. Perry, Editor, "Chemical Engineers Handbook," McGraw-Hill, New York, N. Y.

Periods	Subject	Assignments Reading*	Problem
1	Introduction		
1	Fluid Flow	1, pp. 22-38	5, 6
1	Pressure Measurements	3, pp. 40-51	1, 2
1	Velocity Measurements	3, pp. 51-67	3, 6
1	Flow Measurements	3, pp. 67-76	7
1	Centrifugal Pumps	3, pp. 85-88 94-97	2, 3
2	Fans	5	1, 2
1	Test No. 1		
1	Conduction	9, pp. 210-18	1, 3
1	Free Convection	9, pp. 225-29	7
1	Forced Convection	9, pp. 229-34	12
1	Radiant Heat Exchange	9, pp. 234-42	10
1	Heat Exchangers	9, pp. 243-50	13
1	Pressure-temp-volume Relations and Psychrometric Chart	10, pp. 254-59	1, 3
1	Psychrometric Chart & Total Heat	10, pp. 260-65	4, 5
1	Psychrometric Chart Uses	10, pp. 265-70	6, 7, 8
1	Test No. 2		
1	Moisture Content and Determination	11, pp. 273-79	1
2	Drying Processes	11, pp. 279-90	3, 6
1	Types of Dryers	11, pp. 290-300	

Laboratory Schedule:

2	Local Drying Installations
1	Fluid-flow Measurements
1	Heat Transfer Problems
1	Heat Transfer Measurement
1	Energy Balance on Drying System

ECPD 1958 Curriculum
North Carolina State College Agricultural Engineering Department

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TITLE: Senior Seminar

COURSE NO.: AGE 452 CREDITS: 1 Semester Hour

PREREQUISITES: Seniors in Agricultural Engineering & Mechanized Agriculture

NATURE AND SCOPE OF COURSE:

This course is to awaken and otherwise stimulate student interest in and a feeling of responsibility for the real problems of this profession in order to assist him in the transition from student to professional life. The methods are designed to develop the student's appreciation of engineering problems in agriculture, to teach him to think effectively on these problems in terms of technological and scientific knowledge, and to provide supervised experience in both written and oral descriptions of appropriate engineering situations.

Technological and scientific articles, progress reports and research in the field are reviewed and submitted to written and oral presentations. An effort is made to avoid the hazard of allowing familiarity with current practices to obviate student curiosity and interest in original, creative approaches.

PROCEDURE:

There are two general phases: Classroom presentation and field observation. The classroom phase consists of two presentations by each student on an engineering problem in agriculture. The first, of five minute duration, is a preliminary presentation to evaluate the organization (including visuals where applicable) and oral delivery. The second, of one hour duration, consists of approximately twenty-five minutes delivery with the remainder of the period for discussion. Topics and assignments for the school year are arrived at through a discussion with each student, and outlines are required two weeks in advance of the scheduled presentation. At least three members from the teaching, research and extension staff, who are well informed on the particular subject, are present to grade the student and participate in the discussion. A standard grading form is used to evaluate each student's performance.

The field phase consists of a trip to at least three selected points in North Carolina to observe and discuss the application of engineering to a segment of our agricultural industry. An effort is made to visit an organization employing one or more of our graduates. Examples are: Agricultural Research Station Farm, Farm Machinery Manufacturing Company, Soil Conservation District, Mechanized Farming Operation and Electric Power Cooperative serving farms with power and engineering consultation. A written report is required on the objectives and scope of the operations plus definitions of the significant problems observed and a recommendation for courses of action leading to a solution.

ECPD 1958
North Carolina State College

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Agricultural Engineering Department

TITLE: Farm Power and Machinery IIA

COURSE NO.: AGE 462 CREDITS: 4 Semester Hours

PREREQUISITES: AGE 211, Farm Power and Machinery I
E. M. 321, Strength of Materials I

NATURE AND SCOPE OF COURSE:

The main objectives of the course are:(1) to develop the students' capabilities for treating new problem situations in a professional manner,(2) to develop an appreciation and an interest in the several aspects of creative ideation and its use in engineering and (3) to stimulate an interest in current and future problems in Agricultural Engineering in the power and machinery field.

The course is predicated on the assumption that the student has acquired a reasonable proficiency in solving the idealized textbook-type problems as used for exposition of principles and concept in his basic mathematics, physics, and engineering sciences. The presentation is designed to develop methods of thought and student competence for interpreting and translating the real engineering situations in agriculture into idealizations that can be readily solved by methods of previous courses.

PROCEDURE:

There are three 1-hour lecture periods and one 3-hour laboratory period available to the instructor for presentation of the course.

The course naturally divides itself into three phases. The first phase deals largely with a study of and practice in problem analysis after the general scheme of the text for the first part of the course "Engineering Analysis" by Ver Planck and Teare. Both teacher and students do assigned problems. An attempt is made to keep the problem scope small enough so that each one can be completed in one week. Usually the laboratory period is used for discussing the problem for the preceding week. The first phase lasts for about six weeks during which reading assignments are made in the text, and discussion and demonstration of points are held during lecture.

The second phase originally planned for approximately three weeks is a study of the creative aspects of problem solving with lectures and discussions aimed at awakening in the student the recognition that his creativity can be developed. Much of the lecture material and discussion are around material drawn from "Applied Imagination" by Osborne and "Essentials in Problem Solving" by Kogan. An attempt is made to generalize the ideas presented by Ver Planck, Osborne and Kogan and to extract the uniqueness from each of their points of view. During this period a field trip and several laboratories are devoted to the orientation and data gathering phase required in the design of an improved

harvesting machine. Several sessions of group ideation are held to demonstrate the validity of many of the propositions held by the three authors mentioned.

The third phase is an attempt to apply the techniques and attitudes learned in the first two phases to the solution of Agricultural Engineering problems and to develop through this means a true recognition of the problems that face the Agricultural Engineer in the power and machinery field and how they may be approached.

COURSE OUTLINE AND ASSIGNMENTS FOR AGE 462

TEXT: Ver Planck and Teare, "Engineering Analysis," John Wiley & Sons, Inc. 1954.

REFERENCES:

1. E. Bright Wilson, Jr., "An Introduction to Scientific Research," McGraw-Hill, 1952.
2. George W. Snedecor, "Statistical Methods," Iowa State College Press, 1937.
3. Alex F. Osborne,"Applied Imagination, Principles, and Procedures of Creative Thinking, Chas. F. Scribner's Sons, 1953.
4. Zuce Kogan, "Essentials in Problem Solving, Pub. by Kogan, 1951.
5. Bainer et al, "Principles of Farm Machinery," John Wiley & Sons, 1954.
6. Faires, "Design of Machine Elements," MacMillan, 3rd Edition, 1955.
7. Barger et al, "Tractors and Their Power Units," John Wiley & Sons, 1952.

Periods	Subject	Assignments Reading*	Problems**
1	Introduction to Course	(1)	
1	Elementary Scientific Method	(1)	
1	Design of Experiments	(2)	
1	Sampling	(2)	
1	Analysis of Data	Review for Quiz	
1	Quiz	1	(1)
1	Definitions of Problem	1, 2	
1	Planning of Problem		
1	Checking of Problem		(2)
1	Discussion of Problem 1	(2) pp. 214-26	
3	Analyzing of Field Data	1, 2	(3)
1	Discussion of Problem 2	(2) pp. 253-71	
1	Generalizing and Learning		(4)
1	Discussion of Problem 3	3 pp. 85-87	
1	Working from Fundamentals		

AGE 462 (Continued)

Periods	Subject	Assignments Reading*	Problem**
1	Analyzing Data		(5)
1	Discussion of Problem 4	3, pp. 97-110	
2	Working from Fundamentals	3, pp. 129-39	
2	Discussion of Problems		
1	Review	4, pp. 140-47	(6)
3	Translation into Mathematics	4, pp. 147-73	
1	Discussion of Problem 6	5, pp. 174-84	
1	Graph Solution of Differential Equation	6, pp. 229-42	
2	Checking	6, pp. 242-50	
3	Interpretation of Math	7	
1	Discussion of Kogan's Method	(3)	
1	Judgment and Creativity	(3), (4)	
1	Association and Generalization	(3), (4)	
1	Group Ideation	(3), (4)	
1	Test No. 1		
3	A Study of the Generalized Functions of Farm Machines and Systems		
3	A Study of Farm Machines and Systems as Groups of Generalized Functions		

Laboratory Schedule:

1	Design, Execution and Analysis of A Simple Experiment
1	Go Through Sample Problem Using Professional Method
5	Field Test of Experimental Peanut Harvester[1]
1	Quiz
6	Students Work on Problems and Experiments They Devise

* Numbers refer to Chapters in Text; numbers in parentheses indicate selected references.

** Problems are generally selected in current research areas for originality.

[1] Because of weather limitations, field tests are scheduled over the entire peanut harvesting season. In all probability weather will limit the field labs to 2 or 3. Laboratory tests will be conducted in case of inclement weather.

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TITLE: Farm Structures

COURSE NO. AGE 481

CREDITS: 4 Semester Hours

PREREQUISITES: E. M. 321, Strength of Materials I
AGE 451, Curing and Drying of Farm Crops

NATURE AND SCOPE OF COURSE:

The introduction deals with the relationship of farm structures to a dynamic agriculture, which directs attention to the importance of functional, structural and aesthetic requirements. Materials of construction are compared on the basis of: (1) Availability, (2) physical properties in terms of thermal, strength, and durability parameters, and (3) economics. Reference is made to the commercial classification of materials - quality grades and stock dimensions.

Functionality is defined by environmental requirements of crops and animals, and time and effort efficiency in operations. With the fundamental requirements of biological systems available, analyses of means to establish the desired conditions through mass and energy transfers are based on the sciences of thermodynamics and mechanics. Satisfying these relationships with the principles of structural design constitutes the instruction in the synthesis of solutions to structure's problems. Some study of the appropriate methods of economic analysis is included.

PROCEDURE:

Three 1-hour lecture periods per week are devoted to the discussion of regular reading and problem assignments. During these periods the principles of appropriate engineering sciences are related to farm structures so as to elucidate effective methods of analysis and design.

One 3-hour laboratory period per week is given to practice in the approach to practical problem situations.

COURSE OUTLINE AND ASSIGNMENTS FOR AGE 481

TEXT: H.J. Barre and L. L. Sammett, "Farm Structures," John Wiley & Sons, Inc., New York, N. Y., 1950.

REFERENCES:

1. "Making Quality Concrete for Farm Improvement," Portland Cement Association.
2. "Sewage and Garbage Disposal on the Farm," USDA, Farmers' Bulletin No. 1950.
3. "The High Cost of Cheap Construction," Weyerhaeuser Sales Company, St. Paul 1, Minn.
4. American Institute of Steel Construction Manual.
5. "Building Concrete Farm Structures," Portland Cement Association.
6. Teco Design Manual for Teco Timber Connector Construction, Timber Engineering Company, Washington 6, D. C.
7. "Farm Buildings," Chapter 22, By Dean G. Carter, or "Planning Farm Buildings," Chapter 3, by John C. Wooley, 3rd Edition.
8. "Selecting and Applying Paints," Iowa State College Extension Cir. 261.

Periods	Subject	Assignments Reading*	Problem**
1	Importance and Value of Farm Structures	1	
1	Functions and Trends of Farm Structures		
1	The Nature of Farm Building Problems		
1	Functional Planning	21	
1	Properties of Building Materials	2,(1)	
1	Selecting Structural Materials	3	
1	Selecting Covering Materials	4	
1	Heat Transfer	6	6.2
1	Test No. 1		
1	Heat Flow and Insulation	8	8.5
1	Estimating Heat Load	9	9.7
1	Air-vapor Mixtures	7	7.6,11,12,15
1	Temperature and Vapor Pressure Gradients	10	10.3,5,7
1	Ventilation	11	11.1,a,b,c
1	Animal Environment	12	
1	Test No. 2		
1	Dairy Requirements	13	(1)
1	Poultry Requirements	14	(2)
1	Crop and Food Preservation	15	
1	Vegetable and Fruit Storage	16	
1	Grain Storage	17	

AGE 481 (Continued)

Periods	Subject	Assignments Reading*	Problem**
1	Farm Residence	18	
1	Sewage Disposal and Sanitation	(2)	
1	Test No. 3		
1	Types of Wood Frames	5	
1	Construction Principles	(3)	
1	Design Loads	22, 23	23.6
1	Allowable Unit Stresses	25	25.3, 4
1	Algebraic Analysis of Trusses	24, 1-8	24.3a
1	Graphical Analysis of Trusses	24, 9-13	
1	Tension Members and Steel Columns	26, 1-8, 17	26.1
1	Wood Columns and Studs	26, 9-12	(3)
1	Lightweight Steel Design	27, 1-8(4)	(4)
1	Wood Beams and Joists	27, 9-12	27.10, 11, (5)
1	Combined Bending and Axial Loads	29, 3	(6)
1	Test No. 4		
1	Reinforced Concrete	27, 12-15	
1	Masonry Design	(5)	
1	Nails, Spikes, and Screws	28, 6	28.12a, b
1	Bolts	28, 7	28.12c, 13
1	Timber Connectors and Glue	28, 8(b)	28.15, (7)
1	Construction Costs	19	(8)
1	Evaluation and Depreciation	(7)	
1	Annual Costs	20	(9)
1	Repair and Remodeling		
1	Paints and Preservatives	(8)	
1	Miscellaneous Problems	29	
1	Sources of Information		
1	Test No. 5		

Laboratory Schedule:

1	Building Materials
1	Heat Flow Calculations
1	Condensation Calculations
1	Field Trip
1	Farmstead Planning
2	Poultry Problem
1	Design Loads
1	Graphical Analysis of Trusses
2	Dairy Layout
3	Design Problem

* Numbers refer to Chapters in Text; numbers in parentheses indicate selected references.

** Problem assignments in parentheses are mimeographed problems prepared by the instructor.

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North Carolina State College

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TITLE: Rural Electrification

COURSE NO.: AGE 491

CREDITS: 4 Semester Hours

PREREQUISITES: EE 320, Elements of Electrical Engineering

NATURE AND SCOPE OF COURSE:

Beginning with a brief study of history and developments - problems encountered and benefits derived - in the generation, transmission and distribution of electricity to farm and rural communities, the course moves rapidly into a review of fundamantal electricity. At this stage and following on through the course, the students are continually encouraged to ask questions regarding any phase of the presentations.

Emphasis is placed on single phase AC circuits and characteristics although an increasing amount of time is devoted to three phase since it is becoming more generally available in rural areas.

The latter portion of the course is devoted to studies of principles of engineering - heat, light, electricity, hydraulics, refrigeration, etc. - as they are used, individually and collectively, in providing labor and time-saving equipment and systems for the modern farm or rural industry.

PROCEDURE:

The time devoted to this course consists of 3 hours lecture and 3 hours laboratory per week. The general procedure is one of formal lectures with problem assignments and discussion of problems with occasional quizzes. It is impossible to cover in detail the many items of electrical equipment and applications. It is therefore frequently necessary to establish generalizations of functions, principles, etc. to which more time can be devoted.

The laboratories are used to exemplify and enlarge upon the more important phases covered in lecture. Several laboratory sessions are used for local field trips to study pertinent practices and facilities. One 2-day field trip is usually made during the term wherein both steam and hydro generating plants are toured in small groups with well-informed personnel as guides for each group. Several small rural industries are toured as well as a number of selected farms.

A report of each laboratory and field trip is required of each student.

COURSE OUTLINE AND ASSIGNMENTS FOR AGE 491

TEXT: Robert H. Brown, "Farm Electrification," McGraw-Hill, N.Y., 1956.

REFERENCES:

1. Mimeo text material furnished by the department.
2. Fairbanks, "Catechism of Electrical Machinery," Morse Company.
3. Other technical publications from the electrical and allied industries.
4. Pender, Del Mar, "Electrical Engineers Handbook," John Wiley & Sons.

Periods	Subject	Assignments Reading*	Problem
1	Historical Development - State and National	(1)	
2	Electricity and Its Characteristics	(1)	Assigned
4	Understanding Alternating Current	(1)	Assigned
1	Single and Three Phase Circuits	(2)	
2	Alternators, Transformers, & Sub-stations	(2),(3)	Assigned
1	Test		
2	Transmission & Distribution Lines	Supplementary Mat.	
2	Rates & Economics of Supplying Electricity	2	2 (4,5,7,9)
2	Electrical Wiring Practices	3	3 (6,7,9,10)
2	Wiring the Farm Residence	4	4 (6,7,8,11)
2	The Farmstead Distribution System	5	5 (1,3,8,9)
1	Wiring Farm Buildings	6	6 (2,3,5,8)
1	Test		
3	Electricity for Light	7	7 (3,4,6)
2	Electrical Relays & Controls	8	8 (4,6)
3	Electricity for Heat	9	9 (5,8,11)
4	Farm Electric Motors	10	10 (4,5,8,12)
1	Test		
2	Electric Water Systems	11	11 (5,7,8,10)
3	Electricity for Cooling	12	12(2,3,5)
3	Special Farm Electrical Equipment	13	
1	Organizations with Opportunities for Graduates		

LABORATORY SCHEDULE:

1	A study and review of common electrical instruments and meters - their care, accessories, and proper use.
1	Use of thermo couples for detecting temperatures throughout test of milk cooler.
1	Observe, analyze and plot electrical characteristics of an AC circuit containing inductance.
1	Visit and tour the Method sub-station of the Carolina Power & Light Company with station supervisor; sketch its layout and report its functions.

LABORATORY SCHEDULE: (Continued)

1	Design and prepare the plan of a wiring and lighting layout for a farm shop and implement shed.
1	A local field trip where features of transmission, feeder and distribution lines and fixtures are pointed out.
1	Study, test, and report at least three types of modern electric water systems.
1	Tear down and study, then reassemble at least four types of electric motors.
1	Study and test a modern farm electric feed grinder, determining the physical properties of ground material.
1	Determine what is adequate wire size with a wiring panel.
2	A two day field trip visiting generating stations, rural industries and farm electrical installations. A detailed report is required.
1	Review.

*Numbers refer to Chapters in Text; Numbers in Parentheses refer to selected references.

TITLE: Special Problems

COURSE NO.: AGE 551 CREDITS: By Arrangement

PREREQUISITES: Senior or Graduate Standing in Agricultural Engineering

NATURE AND SCOPE OF COURSE:

This course is designed to develop in the student a general understanding of a systematic approach to solving an engineering problem, a confidence in his ability to handle engineering problems on a professional level and a greater effectiveness in report writing. From the broad areas of professional interests, the student defines a specific problem and, after outlining a method of study, he prosecutes a systematic investigation with the purpose of reporting effectively some contribution to the solution of this problem. Throughout this experience timely advice and constructive criticism are given by the faculty.

PROCEDURE:

This course has six sequential phases which are itemized and briefly elaborated as follows:

1. Selection of a problem.
   The student meets first with the head of the department for discussing and assigning a problem area and a staff adviser. The students' perceptiveness of problems in this profession are drawn out during this discussion. Thus, together with suggestions of areas in which the staff are now engaged, we arrive at an area of mutual interest. Secondly, the student meets with the staff adviser for formulating more specific objectives that are manageable for the time available.

2. Survey of Literature.
   The student is encouraged and instructed in the importance and the mechanics of making a search and recording pertinent material.

3. Plans for the Investigation.
   The student formulates a proposed outline of plans consisting of objectives, criteria for determining objectives, elements and operations of the problem and time schedule. This plan must be well thought out and approved by the adviser by the end of the fifth week of the semester. In some instances preliminary tests are coordinated to stimulate questions and thinking for better insight to the formulation of plans.

AGE 551 (Continued)

4. Conduction of Research.

The research shop, laboratories, and equipment are made available at hours convenient to the student. He is encouraged to take the initiative and be resourceful in gathering together needed equipment, while at the same time fully aware of his responsibilities to seek and secure proper authorization and instruction in its use.

5. Preparation of Report.

The report is organized and prepared to meet, generally, the thesis regulations of the Graduate School. A preliminary draft is due no later than two weeks prior to the day final examinations start. At this time any inadequacy in analysis, poor organization, ineffectiveness of the written word and illustration are pointed out and discussed with the student. The final report is due on the day examinations start.

6. Grading.

The final report is graded by at least two staff members and upon five factors: Grammar, quality, clearness, originality, and neatness. In addition, the character of the student is evaluated and becomes a part of the final grade. A specially prepared grade sheet becomes a permanent part of the file copy. This grade is for the course. No examinations are given.

REFERENCES:

1. "Regulations for Special Problems - AGE 551". Instructions supplied by the Department of Agricultural Engineering in ditto form.

2. Selected references assigned by the staff adviser depending upon the area (Power and Machinery, Soil and Water, etc.) and nature of the problem.

3. Other references are secured by the student by searching the literature.

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Agricultural Engineering Department

TITLE: Instrumentation for Agricultural Research And Processing

COURSE NO.: 552

CREDITS: 1 Semester Hour

PREREQUISITES: E.E. 320, Elements of Electrical Engineering
MA. 401, Differential Equations

GENERAL NATURE AND SCOPE OF COURSE:

Starting with a brief review of the electrical nature of matter and the electrical response of circuits elements - resistance, capacitance, inductance - the course leads immediately to a qualitative presentation of vacuum tube theory. Study is then directed to the principles of combining circuit elements and vacuum tubes into generalized circuits - bridge, rectification, amplification, oscillation, and signal shaping.

Attention is given to the theory of primary sensing elements and to the principles of matching these elements with bridge and potentiometer measuring circuits for calibration of input signals as a function of physical variables. The feed-back principle is related to applications and the theory and application of semi-conductor elements are introduced.

Rather than attempt to develop competence in design and skills, the objective of this course is to expose the student to modern instrumentation so as to provide him a working appreciation of the efficacy and limitation of commercial equipment and a confidence on which to expand his understanding as interests and needs dictate.

PROCEDURE:

The course is programmed as a one 2-hour recitation-demonstration period per week. In addition to reading assignments, each student is required to complete a project pertinent to electronic instrumentation during the academic year. Assignments include schematic circuits of typical instruments and controls for classroom discussion and analysis. Appropriate apparatus are employed to demonstrate and to provide experience with equipment used for indicating, recording and/or controlling process variables. Quizzes are given at irregular intervals in order to measure student progress.

COURSE OUTLINE AND ASSIGNMENTS FOR AGE 552

TEXT: Milton H. Aronson, "Electronic Circuitry for Instruments and Equipment," Revised Second Printing, Instruments Publishing Company, Inc., Pa., 1957.

REFERENCES:

1. H.L. Van Velzer, Editor, "A Dictionary of Electronic Terms," Allied Radio Corporation, Chicago, Ill., 1952.
2. E.E. Lynch and A.J. Corson, "Primary Detectors for Measurements," AIEE Technical Paper No. 48-104, 1948.
3. RCA Transistors and Semiconductor Diodes, 1957.
4. Technical bulletins from major instrument manufacturers.
5. RCA Receiving Tube Manual.
6. F. Langford-Smith, Radiotron Designer's Handbook, Fourth Edition, Harrison, N. J., Radio Corporation of America, 1956.

Periods	Subject	Reading Assignment*
1	(a) Electrical Nature of Matter (b) Circuit Elements	1, 2
1	(a) Impedance Resorance (b) Signals and Simple Circuits	3, 4
1	(a) Vacuum Tubes (b) Rectification and Power Supplies	5, 7
1	Amplifier Circuits	8
1	Oscillator Circuits	10
1	Signal-shaping Circuits	11
1	Electrical and Electronic Test Equipment	12
1	Classification of Primary Sensing Elements and Transducers	14, PP. 233-42 & (3)
1	Feed-back Principle in Automatic Null-balance Instruments	14, PP. 242-47 & (5)
1	Transistors and Semiconductor Diodes	(4)
4	Electronic Systems for Indicating, Recording and Controlling Variables in Research and Processing	(5)

* Numbers refer to Chapters in Text; numbers in parentheses indicate selected references.

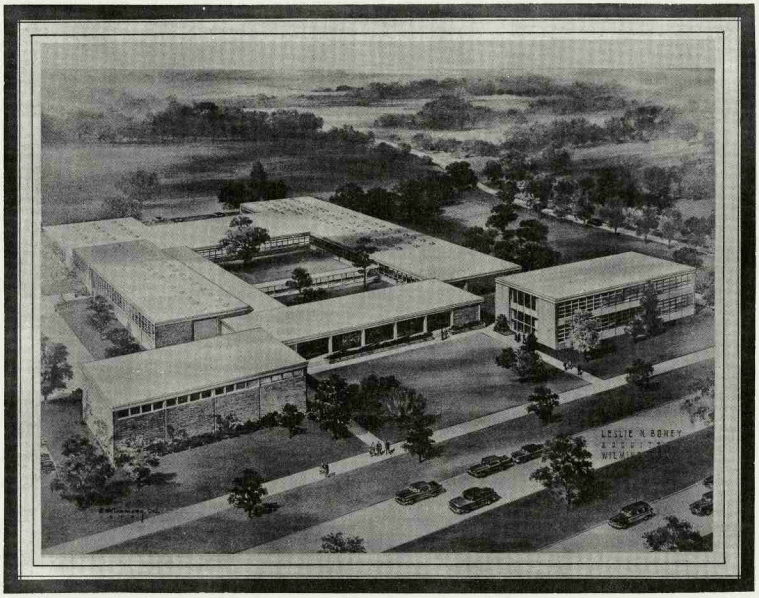
D

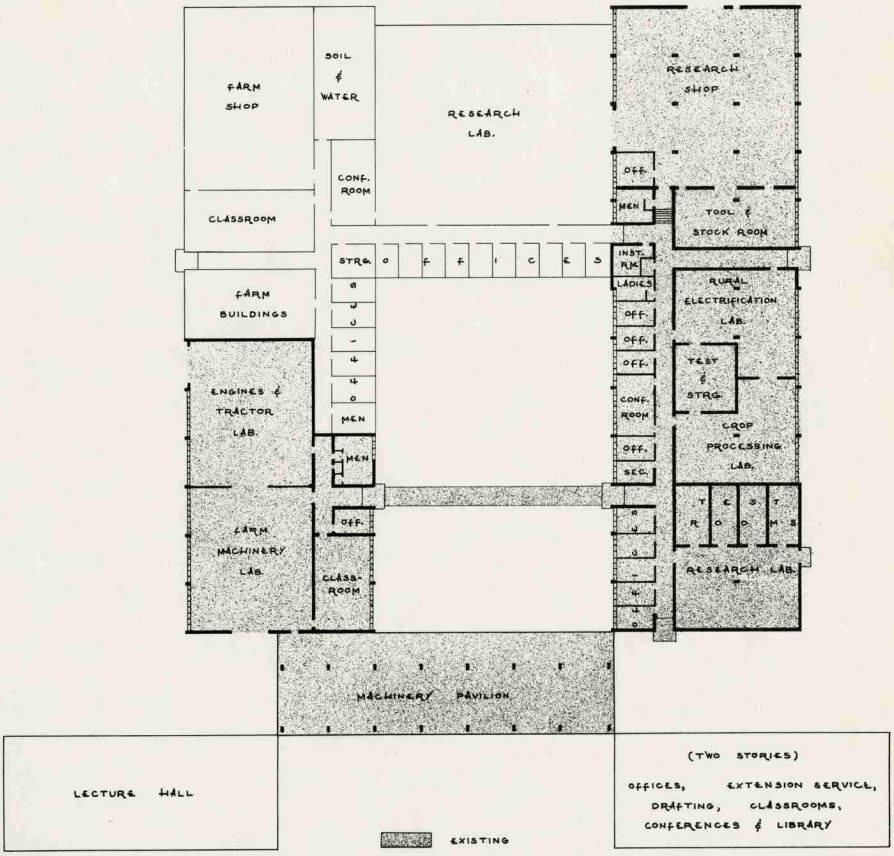
FACILITIES

Physical facilities for the department have kept pace with developments in the academic program. While adequate space is now provided in separate buildings, recent appropriations will provide housing for all functions in one building. The illustrations on the following pages point out that part of a new Agricultural Engineering Building presently in use as well as the planned additions.

The lists of major laboratories and equipment follow the illustrations.

Agricultural engineering building




FARM SHOP
SOIL & WATER
RESEARCH LAB.
RESEARCH SHOP
CONF. ROOM
OFF.
MEN
TOOL & STOCK ROOM
CLASSROOM
STRG.
OFFICES
INST. RM.
LADIES
FARM BUILDINGS
RURAL ELECTRIFICATION LAB.
OFF.
OFF.
OFF.
TEST & STRG.
ENGINES & TRACTOR LAB.
MEN
CONF. ROOM
CROP PROCESSING LAB.
MEN
OFF.
SEC.
TRUCK
FARM MACHINERY LAB.
OFF.
CLASS-ROOM
RESEARCH LAB.
MACHINERY PAVILION
LECTURE HALL
(TWO STORIES)
OFFICES, EXTENSION SERVICE, DRAFTING, CLASSROOMS, CONFERENCES & LIBRARY
EXISTING

DATE: March 17, 1958

MAJOR LABORATORIES:

	AREA SQ. FT.	HEAD ROOM FT.	IN.
Engines and Tractors Laboratory	3340	15	0
Farm Machinery Laboratory	3340	15	0
Research Laboratory (with temperature and humidity controlled environment)	1590	9	11
Research Test Rooms (four rooms with temperature and humidity control throughout a wide range)	1118	9	11
Crop Processing Laboratory	2005	9	11
Rural Electrification & Farm Convenience Laboratory	2063	9	11
Tobacco Mechanization Research Laboratory	589	12	0
Farm Machinery Research Laboratory	1790	12	0
Soil and Water Laboratory	1790	12	0
Structures Research Laboratory	880	10	0
Structures Teaching Laboratory	1785	10	0
Drainage Laboratory	156	12	0
Research Shop	5862	14	0
Farm Shop - General Metal	1600	11	4
Welding	1050	11	4
Wood	1600	11	4

PRINCIPLE LABORATORY EQUIPMENT:

1. Near-complete line of latest farm machinery and equipment, principally on loan from Equipment Dealers.

2. Comprehensive list of metal working and machine-tool equipment.

3. Full complement of woodworking tools and equipment.

4. Tractor dynamometer, motor analyzer, and valve refacing-reseating tools.

5. Time and Effort Laboratory: Climatic chamber, bicycle-ergometer, oxygen-carbon dioxide analyzers, telemetering equipment, pneumotachograph, cardiotachometer.

6. Strain-gauge equipment: Twin-channel oscillograph, 2 D.C. amplifiers and transducers.

PRINCIPAL LABORATORY EQUIPMENT (Continued):

7. Brown "Electronik" instruments, plus transducers:

   1 - 16 pt. adjustable span recorder
   1 - single pt. adjustable span recorder
   1 - 144 pt. multi-logger
   2 - 16 pt. equivalent bridge recorders
   2 - single pt. recorders
   1 - narrow span circular chart recorder
   1 - circular chart, electronic relay controller

8. Tektronix High Gain Oscilloscope and 3 others.

9. Boonton Q-meter, Scalar radiation counter plus accessories, "Photovolt" Microlumen meter, 1 Eppley thermopile and Pyrheliometer each.

10. Levels, transits, and miscellaneous surveying equipment.

11. Numerous conventional meters for evaluating electrical circuits and component.

E

GRADUATE PROGRAM
AND
RESEARCH

Professional leadership requires men of broad interests, sound judgment, and clear perspective for unceasing appraisal of methods, developments, efforts, and proposals, as well as for the responsibility of contributing worthy ideas to the total human enterprise. This combination of responsibilities requires the highest type of training available and for this reason the academic phase of the Agricultural Engineering profession must administer vital graduate programs to develop young men with minds trained in critical, independent thinking.

The function of formal study is the imaginative acquisition of knowledge, and apart from this importance of the imagination, there is little justification for advanced formal study since Agricultural Engineers, as others, should be able to pick up their facts bit by bit by experience as they need them for particular problem situations. It is the discipline of knowledge that represents the change from amateurs to professionals and, since scientific theory is far outrunning common sense, the full realization of the power of professionalism requires the use of the scientific method, by which abstract knowledge can be connected with technology. This method is the means by which the foresight obtained from knowledge is blended with versatility in application. To achieve this aim we are confronted with two major contentions: As engineers our principal concern must be the utility of knowledge and it is well to recognize that an intense period of imaginative design lies between the scientific idea and the ultimate product. The other pertains to the hazard of confusing information with knowledge in the learning process. On the one hand, seekers of informational-type learning will find an unlimited amount of it - so much so that they can remember but a very small part. On the other hand, knowledge is concerned with concepts, theories, relationships and in its generalizations can be reduced to the following major ideas: Field concept and potential theory, energy conversion, theory of evolution, and quantum physics; which brings us to the realization that scientific knowledge is a product of the human intellect, and therefore can be utilized only by rational thinking.

The uniqueness of engineering problems in agriculture amplifies the demands placed on the professional engineer in this area. First, there is the necessity of integrating the response characteristics of biological systems or a knowledge of the life sciences with the forces, energy and materials interpreted by the physical sciences. Secondly, in many instances advancement in technology means the substitution of a mechanical device for the facility of the human hand. While this connotes complexity and refinement in design, such devices must be economically practical for enterprises that demand their use even less than one week per year.

In all these endeavors the first and foremost hurdle is the question, "What is the real problem?" And at this stage the human mind, the individual ability,

is irreplaceable. Even with all possible instruments available, the problem has to be formulated understandably, unequivocally, and in all its aspects, considering all possible significant variables.

The scope of learning implied in the above requirements for forceful workers and leaders in this discipline is tantamount to the acceptance of the fact that only a part of this competence can be obtained by the student during the time allotted to graduate study. Accordingly, the primary concern of a graduate program in Agricultural Engineering must be to impart to the student 1) a comprehensive appreciation of scientific knowledge, of where it lies and sufficient confidence in his ability to seek it out for a critical study of the various problems as they arise, and 2) a direction to his interests and scholarly aspirations so that he may dedicate his life's work to advancing the effectiveness and dignity of this profession.

Based on the above interpretations of needs, opportunities and requirements, the department has since 1950 programmed graduate study at the Master's level leading to either of two degrees: Master of Agricultural Engineering and Master of Science in Agricultural Engineering. The former program is designed to afford advanced training in engineering technology pertinent to agriculture. The course of study is appropriate to those primarily interested in extension-type work and as representatives of industry in sales and services responsibilities. This is a terminal-type degree and future plans include a change that will designate this degree as a Master of Mechanized Agriculture.

The program of study for the Master of Science in Agricultural Engineering is directed to the training of engineering scientists. Little, if any, formal study is devoted to technology; instead, course programs for this degree are for the purpose of advancing students' competence in mathematical and theoretical forms of knowledge. Thesis investigations are designed to provide training in the formal and instrumental aspects of scientific research.

The Master of Science degree is considered as preliminary for further formal study, and beginning with the fall of 1957 the department is authorized to offer work leading to the Ph. D. degree with a major in Agricultural Engineering. This provides the opportunity, in combination with advanced training in research, to lead our students to a real appreciation of the unity in scientific knowledge - that but a few basic concepts and mathematical principles serve as the common theoretical base for the interpretations of the many natural phenomena. Through formal study at the advanced level of physical theories the student can readily appreciate the analogies among the various formulations in field theory (dynamics, electromagnetism, thermodynamics) and obtain a background in quantum physics.

The objectives for this total graduate program leading to the Ph. D. degree is to so instruct and train the individual intellect for its greatest realization in a lifetime of work and learning.

The following advanced courses are offered in the Department of Agricultural Engineering. The descriptions are as found in the current graduate catalog for this institution.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES:

TITLE: AGE 551, Special Problems

CREDITS: By Arrangement

PREREQUISITES: Senior or Graduate standing in Agricultural Engineering

Each student will select a subject on which he will do research and write a technical report on his results. He may choose a subject pertaining to his particular interest in any area of study in Agricultural Engineering.

Mr. Giles and Staff

TITLE: AGE 552, Instrumentation for Agricultural Research & Processing

CREDITS: 1 or 1

PREREQUISITES: E.E. 320, Elements of Electrical Engineering
MA 401, Differential Equations

Elaboration of the theory and principles of various primary sensing elements. Relate the output signal of electrical transducers to wheatstone bridge and potentiometer measuring circuits for calibration of the signal with the variable under study. Will extend the instruction to include the principles and mechanisms used for indicating, recording, and/or controlling process variables. Representative equipment will be employed whenever feasible.

Mr. Hassler

COURSES FOR GRADUATES ONLY:

TITLE: AGE 651, Research in Agricultural Engineering

CREDITS: By Arrangement

PREREQUISITES: Graduate Standing in Agricultural Engineering

A maximum of six credits is allowed toward a Master's degree; no limitation on credits for Doctorate program.

Performance of a particular investigation of concern to Agricultural Engineering. The study will begin with the selection of a problem and culminate with the presentation of a thesis.

Staff

COURSES FOR GRADUATES ONLY: (Continued)

TITLE: AGE 652, Seminar

CREDITS: 1 or 1

PREREQUISITES: Graduate standing

A maximum of two credits is allowed.

Elaboration of the subject areas, techniques and methods peculiar to professional interest through presentations of personal and published works; opportunity for students to present and defend (critically) ideas, concepts, and inferences. Discussions to point up analytical solutions and analogies between problems in Agricultural Engineering and other technologies, and to present the relationship of Agricultural Engineering to the socioeconomic enterprise.

Mr. Hassler

TITLE: AGE 654, Agricultural Process Engineering

CREDITS: 3 or 3

PREREQUISITES: AGE 451, Curing & Drying of Farm Crops
PY 402, Intermediate Physics I
MA 511, Advanced Calculus I

A study of operations employed during processing for maximizing consumer quality and economic gain. Agricultural processing operations are analyzed on a "unit operations" basis, taking into consideration physical and chemical changes. Generalized physical theory will be presented as it relates to idealizations in Agricultural Processing.

Mr. Hassler

TITLE: AGE 661, Analysis of Function and Design of Farm Machinery

CREDITS: 3 or 3

PREREQUISITES: AGE 462, Farm Power & Machinery IIA
MA 401, Differential Equations
PY 401, Intermediate Physics I

Methods and tools used in determining the functional requirements of machine components; writing of machine specifications in terms of fundamental parameters; introduction of the principles of descriminate and indescriminate mechanical selection of agricultural products with emphasis on the theory of servo-systems.

Mr. Bowen

COURSES FOR GRADUATES ONLY: (Continued)

TITLE: AGE 671, Theory of Drainage, Irrigation and Erosion Control

CREDITS: 4 or 4

PREREQUISITES: AGE 371, Soil & Water Conservation Engineering
EM 430, Fluid Mechanics
MA 401, Differential Equations

Emphasis is placed on the physical and mathematical aspects of problems in conservation engineering and an attempt is made to rationalize procedures which have often come about through experience rather than through analytical considerations. Examples are presented of cases where such an analytical approach has already improved, or shows promise of improving, design criteria and procedures.

Mr. Van Schilfgaarde

TITLE: AGE 681, Analysis of Function and Design of Farm Buildings

CREDITS: 4 or 4

PREREQUISITES: AGE 481, Farm Structures
PY 402, Intermediate Physics I

A study of the functional requirements of farm structures with respect to man, animals, and crops and development of the means for providing structures which fulfill the functional requirements. Applications of the science and art of engineering in the solution of environmental problems. Advanced planning in the integration of structural and environmental design.

The scope of the department's research program encompasses projects directed to the elucidation of original ideas and to investigations for testing the feasibility of these ideas in the practical sense. While the overall objective is the advancement of developments in systems and operations for greater production efficiencies, major effort is being devoted to the formulation of basic relations from which to perceive of new approaches in the application of energy and power to agriculture.

The nature of research under a cotton mechanization project is to interpret, quantitatively as well as qualitatively, the relationship of the microenvironment to cotton seed germination and seedling development as a basis for establishing the functional requirements of a cotton planter. This approach recognizes the importance of variables such as the temperature of the seed, the soil moisture near the seed, soil compaction around the seed, and the availability of oxygen and light radiation to the seed. A major phase of this project is the development of adequate instrumentation for measuring such variables in relation to seeds and seedlings under operational conditions. Within the scope of this project investigations are conducted to provide a more fundamental understanding on which to develop more effective weed control measures through physical and chemical treatments.

Research and development in overall tobacco meachnization represents a major effort that is directed toward the development of methods and machines by which the efficiency of human effort may be increased in the production of tobacco, one of the last of the major crops still utilizing predominantly human and animal power in its operations. Rather than developing machines for direct replacement of conventional operations, (plant production, transplanting, cultural practices, topping and suckering, harvesting, curing, and marketing), efforts are being directed toward the analysis and evaluation of the functional requirements basic to the production of a marketable product with emphasis on the circumvention or simplification of time honored techniques.

Studies of the response of tobacco seed to temperature, moisture and light of certain wave lengths have been initiated to isolate and define the limiting as well as the optimum conditions of germination with the prospects of direct field planting.

Studies of the harvesting operation have resulted in the development of devices which will mechanically prime or remove the ripe leaves from the stalk at ground speeds up to three miles per hour.

The research work in tobacco curing can be described in general as consisting of the analysis of curing properties of tobacco leaves, of the nature of pertinent biological phenomena and of energy transfers and conversions. These investigations employ considerable instrumentation peculiar to the particular observations sought.

Results are furnishing alternative methods for advancing operational practices in tobacco processing. Within these methods, various elements are continuously under study in the interest of circumvention or simplication by the introduction of new engineering principles which will reduce human labor and provide other economic efficiencies and social improvements.

A comprehensive program in land drainage research is underway to answer both physio-mechanical and biological problems. The present program dealing with the physics of drainage consists of an attempt to measure in the field 1) the boundaries of the flow regions into drain tile placed at various depths and spacings, 2) the distribution of potential throughout these flow regions, and 3) those properties of the soil which affect the flow of fluids through it. These determinations will serve to check the adequacy of theoretical analyses of equivalent problems. In order to make the determinations, it is necessary to develop adequate measuring techniques and to determine their reliability. This involves, besides field testing, also some laboratory investigations and, in some cases, the use of electric analogue models to verify or complete the field methods.

As to the research work dealing with the biological aspects of drainage, a laboratory is under construction for testing the response of plants growing in soil to different behavior patterns of the water table. These tests will be carried out under closely controlled environmental conditions. Numerous problems in instrumentation need to be solved to adequately control the test conditions and simultaneously measure the pertinent variables without disturbing the progress of the tests. For example, work on the development of a multiple unit, continuously recording, soil moisture tension meter will continue.

Considerable resources are directed to peanut mechanization research with major emphasis centered on the harvesting and curing operations in order to develop methods and equipment for greater production efficiency and for improved quality control. In addition to the problem of excessive hand labor and other inefficiencies in the conventional harvesting operations, the present practice of dependency on field drying exposes the crop to the hazards of inclement weather.

The investigations in harvesting research are concerned with the fundamentals in the application of forces and energy for removing the peanuts from the ground and detaching them from the foliage. Mechanical relationships derived from these studies are tested for feasibility by incorporating them in experimental machines that are evaluated on the basis of comparative operational advantages. Work to date has proved the possibilities of the "once-over" harvesting concept. Much analytical and experimental work on the basic requirements are still to be carried out before satisfactory refinement can be achieved.

Peanut curing research is directed to investigations of the bio-physical response to environments in order to formulate engineering principles fundamental to the design of processing systems. The requirements here, in addition

to economic design, are to produce artificially cured peanuts that have the physical and chemical properties desired by the trade.

Research in the drying and preservation of forage crops likewise has two distinct but integrated functions: 1) Fundamental studies on a laboratory scale to determine the effects of different drying environments on certain dependent variables, and 2) the translation of the pertinent basic relationships into design specifications and their evaluation under operational procedures. Here again the overall objective is to promote developments that increase productive power and enhance the quality of forage crops for farm use and commerce.

Farm structures research is concerned primarily with maximizing the economic gain from livestock and poultry enterprises through the development of designs that combine environmental controls to better satisfy the fundamental requirement of farm animals with methods and procedures for increasing labor efficiency in operations.

A research project basic to the overall program is an investigation of principles and instrumentation for the determination of the human effort requirements of various tasks. Time and motion studies indicate that one method of performing a task may be faster than another but no indication of the relative difficulties is obtained, nor can a comparison be made if the tasks are entirely dissimilar. Studies have therefore been initiated to determine the energy expenditures of the body and their relationships to the physiological processes. Observations of heart rate and oxygen consumption for tasks performed in the field and under laboratory conditions of controlled temperature and humidity are being carried out. To record the data in field studies, portable telemetering and recording devices are being developed.

A recently completed irrigation research program evaluated the efficiency of water use in growing tobacco. Future plans have as objectives the formulation of criteria for establishing adequate farm sources of water and for efficient means of applying supplemental water to plants in order to maximize returns.