AGRICULTURAL EDUCATION COURSE DESCRIPTIONS    Revised 09/20/00

AGRICULTURAL EDUCATION
(511 IAC 6-7-6, 511 IAC 6.1-5-10.1, 511 IAC 6.1-5-3.5)

INTRODUCTION

Agricultural Education is an active part of the curriculum for many high schools in Indiana. This program area combines the home, the school, and the community as the means of education in agriculture. The courses provide students with a solid foundation of academic knowledge and ample opportunities to apply this knowledge through classroom activities, laboratory experiments and project applications, supervised agricultural experiences, and the FFA.

The vision and mission of Agricultural Education is: that all people value and understand the vital role of agriculture, food, fiber, and natural resource systems in advancing personal and global well-being; and that students are prepared for successful careers and a lifetime of informed choices in agriculture.

The goals for Agricultural Science and Business students focus on providing learning experiences which will allow them to:

- demonstrate desirable work ethics and work habits.
- apply the basic agricultural competencies and the basic background knowledge in agriculture and related occupations.
- analyze entrepreneurial, business, and management skills needed by students preparing to enter agriculture and related occupations.
- expand leadership and participatory skills necessary for the development of productive and contributing citizens in our democratic society.
- gain effective social and interpersonal communication skills.
- be aware of career opportunities in agriculture and set career objectives.
- acquire job-seeking, employability, and job-retention skills.
- advance in a career through a program of continuing education and life-long learning.
- apply the basic learning skills in reading, writing, thinking, mathematics, communicating, listening, and studying.
- recognize the interaction of agriculture with governments and economic systems at the local, state, national, and international levels.
- recognize how new technologies impact agriculture and how agriculture impacts the environment.

It is important to understand and reaffirm that vocational-technical experiences do not preclude students from going on to higher education, and in fact, participation actually enhances the opportunity. A growing number of students are combining both college preparation and workplace experiences in their high school preparation. Agricultural Science and Business and the FFA programs have a long history of successfully preparing students for entry level careers and further education and training in the science, business and technology of agriculture. The programs combine classroom instruction and hands-on career focused learning to develop students' potential for premier leadership, personal growth, and career success.

FFA

The FFA is the career and technical education student organization which is an integral part of the vocational program of instruction in agricultural education. The many activities of the FFA parallel the methodology of the instructional program and are directly related to the occupational goals and objectives. As an integral part of the instructional program, district and state level FFA activities provide students opportunities to demonstrate their proficiency in the knowledge, skills, and attitudes they have acquired in the agricultural science and agricultural business education program of instruction. Students shall be rewarded and recognized for their competence. Agricultural education students demonstrating a high degree of competence in state level FFA activities are highly encouraged to represent their local communities, districts, and state by participating in national FFA activities.

Instructional activities of the FFA require participation of Agricultural Science and Agricultural Business Education students as an integral part of an Agricultural Education course of instruction and, therefore, may be considered an appropriate use of the allotted instructional time; however, vocational student organization activities may not disrupt the instructional time of other academic courses.
Indiana Young Farmers' Association (IYFA)

The Indiana Young Farmers' Association was founded in 1962 and is dedicated to furthering the educational, social, and personal opportunities of all individuals interested or involved in the agricultural industry. It acts as an avenue for continuous educational experiences for adults, so that they can take full advantage of the possibilities available in the world of agriculture. IYFA supports the needs of agricultural-based, rural communities by providing worthwhile community services, effective leadership training, and wholesome social and recreational activities for the entire family.

MIDDLE LEVEL
EXPLORING AGRICULTURAL SCIENCE AND BUSINESS
(GRADES 7 AND 8, OR GRADES 6, 7, AND 8)

0496

The Agricultural Science and Business curriculum for middle level students is locally driven allowing considerable flexibility in content. The primary objective is to introduce students to the dynamic industry of agriculture while gaining an awareness of the importance, impact, and diversity of careers in agricultural science and business. The content provides a hands-on exploratory, science-based approach to agriscience as well as providing a broad-based coverage of horticulture, animal science, environmental science, and biotechnology.

FUNDAMENTALS OF AGRICULTURAL SCIENCE AND BUSINESS

5056
CIP Code: 01.0101

Fundamentals of Agricultural Science and Business is a year long course that is highly recommended as a prerequisite and foundation for all other agricultural classes. The nature of this course is to provide students with an introduction to the fundamentals of agricultural science and business. Topics to be covered include: animal science, plant and soil science, food science, horticultural science, farm and agribusiness management, landscape management, natural resources management, agricultural mechanization, and supervised agricultural experience which includes units on career and leadership development. An activity and project based approach is used along with team building to enhance the effectiveness of the student learning activities.

Four-year career plans and personal and career portfolios should be developed, reviewed regularly, and upgraded, utilizing a local school counselor and other school and community persons or resources.

- Suggested Grade Levels: 9 or by permission of the teacher
- Recommended Prerequisite: None
- A two credit/two semester course.
- A Core 40 directed elective as part of a technical career area.
- Competencies and learning activities defined.
- This course is included as a component of the Agriculture and Natural Resources career cluster and may also be included as a component of the Engineering, Science, and Technologies career cluster.
ANIMAL SCIENCE

5008
CIP Code: 02.0201

This course is a year long program that provides students with an overview of the field of animal science. Students participate in a large variety of activities and laboratory work including real and simulated animal science experiences and projects. All areas that the students study can be applied to both large and small animals. Topics to be addressed include: anatomy and physiology, genetics, reproduction; nutrition, aquaculture, careers in animal science, common diseases and parasites, social and political issues related to the industry, and management practices for the care and maintenance of animals.

- Suggested Grade Levels: 10-12
- Recommended Prerequisite: Fundamentals of Agricultural Science and Business or by permission of the teacher
- A two credit/two semester course. This course can be offered for a second full year at an advanced level and may also be offered in a two or three hour block with a maximum of six credit hours.
- This course may fulfill up to two credits of the minimum science requirement for graduation.
- Animal Science may be offered as a small animal/large animal course and/or include an advanced, local content specific application such as aquaculture.
- A Core 40 directed elective as part of a technical career area.
- Competencies and learning activities defined.
- This course is included as a component of the Agriculture and Natural Resources career cluster and may also be included as a component of the Engineering, Science, and Technologies, and Health Services career clusters.

FOOD SCIENCE

5102
CIP Code: 02.0301

This course is a year long program that provides students with an overview of food science and its importance. Introduction to principles of food processing, food chemistry, nutrition, food packaging, food commodities, food regulations, and careers in the food science industry help students understand the role that food science plays in the securing of a safe, nutritious, and adequate food supply. A project-based approach is utilized along with laboratory, team building and problem solving activities to enhance student learning.

- Suggested Grade Levels: 11-12
- Recommended Prerequisite: Fundamentals of Agricultural Science and Business or by permission of the teacher
- A two credit/two semester course.
- This course may fulfill up to two credits of the minimum science requirement for graduation.
- A Core 40 directed elective as part of a technical career area.
- Competencies and learning activities defined.
- This course is included as a component of the Agriculture and Natural Resources career cluster and may also be included as a component of the Engineering, Science, and Technologies, and Personal and Commercial Services career clusters.
HORTICULTURAL SCIENCE

5132
CIP Code: 01.0601

Horticultural Science is a year long course designed to give students a background in the field of horticulture and its many career opportunities. It addresses the biology and technology involved in the production, processing, and marketing of horticultural plants and products. Topics covered include: reproduction and propagation of plants, plant growth, growth media, floriculture, management practices for field and greenhouse production, marketing concepts, production of herbaceous, woody, and nursery stock, fruit, nut, and vegetable production, and pest management. Students participate in a variety of activities including extensive laboratory work usually in a school greenhouse.

- Suggested Grade Levels: 10-12
- Recommended Prerequisite: Fundamentals of Agricultural Science and Business or by permission of the teacher
- A two credit/two semester course. This course can be offered for a second full year at an advanced level and may also be offered in a two or three hour block for four semesters with a maximum of twelve credit hours.
- This course may fulfill up to two credits of the minimum science requirement for graduation.
- A Core 40 directed elective as part of a technical career area.
- Competencies and learning activities defined.
- This course is included as a component of the Agriculture and Natural Resources career cluster and may also be included as a component of the Engineering, Science, and Technologies career cluster.

PLANT AND SOIL SCIENCE

5170
CIP Code: 02.0401

Plant and Soil Science is a year long course that provides students with opportunities to participate in a variety of activities including laboratory work. Topics covered include: the taxonomy of plants, the various plant components and their functions, plant growth, plant reproduction and propagation, photosynthesis and respiration, environmental factors affecting plant growth, diseases and pests of plants and their management, biotechnology, the basic components and types of soil, calculation of fertilizer application rates and procedures for application, soil tillage and conservation, irrigation and drainage, land measurement, cropping systems, precision agriculture, principles and benefits of global positioning systems, harvesting, and career opportunities in the field of plant and soil science.

- Suggested Grade Levels: 10-12
- Recommended Prerequisite: Fundamentals of Agricultural Science and Business or by permission of the teacher
- A two credit/two semester course.
- This course may fulfill up to two credits of the minimum science requirement for graduation.
- A Core 40 directed elective as part of a technical career area.
- Competencies and learning activities defined.
- This course is included as a component of the Agriculture and Natural Resources career cluster and may also be included as a component of the Engineering, Science, and Technologies career cluster.
AGRIBUSINESS MANAGEMENT

5002
CIP Code: 01.0102

Agribusiness Management is a year long course that presents the concepts necessary for managing an agriculture-related business from a local and global perspective. Concepts covered in the course include: identification of careers in agribusiness, global visioning, safety management, entrepreneurship, the planning, organizing, controlling, and directing of an agribusiness, effects of government organizations on agribusiness, economic principles, credit, record keeping, budgeting, fundamentals of cash flow, taxation and the tax system, insurance, marketing, cooperatives, purchasing, the utilization of technology in agribusiness, human resource management, customer service, and employer-employee relations and responsibilities.

- Suggested Grade Levels: 11-12
- Recommended Prerequisite: Fundamentals of Agricultural Science and Business or permission of the teacher
- A two credit/two semester course.
- A Core 40 directed elective as part of a technical career area.
- Competencies and learning activities defined.
- This course is included as a component of the Agriculture and Natural Resources career cluster and may also be included as a component of the Business, Management and Finance career cluster.

AGRICULTURAL MECHANIZATION

5088
CIP Code: 01.0201

Agricultural Mechanization is a year long, lab intensive course in which students develop an understanding of basic principles of selection, operation, maintenance, and management of agricultural equipment in concert with the utilization of technology. Topics covered include: small and large gas and diesel engine repair, power transfer systems including hydraulic and pneumatic systems, arc, shielded gas and gas welding, concrete, wood, metal, electricity and electronics, recirculating aquaculture systems, hydroponics systems, precision farming equipment and global positioning systems equipment, agriculture related buildings and structure: including greenhouses, agricultural industry communications and customer relations, safety and safety resources, and career opportunities in the area of agricultural mechanization.

- Suggested Grade Levels: 10-12
- Recommended Prerequisite: Fundamentals of Agricultural Science and Business or permission of the teacher
- A two credit/two semester course. This course can be offered for a second full year at an advanced level and may also be offered in a two- or three-hour block for four semesters with a maximum of twelve credit hours.
- A Core 40 directed elective as part of a technical career area.
- Competencies and learning activities defined.
- This course is included as a component of the Agriculture and Natural Resources career cluster and may also be included as a component of the Mechanical Repair and Precision Crafts career cluster.
FARM MANAGEMENT

5022
CIP Code: 01.0104

Farm Management is a year long course that introduces students to the principles of farm organization and management with the utilization of technology. It covers the effects of good and poor management on a farm, economic principles, decision-making, methods for organizing and planning, getting started in the farming business, farm record keeping, risk management, and career opportunities in the field of farm management.

- Suggested Grade Levels: 11-12
- Recommended Prerequisite: Fundamentals of Agricultural Science and Business or permission of the teacher
- A two credit/two semester course.
- A Core 40 directed elective as part of a technical career area.
- Competencies and learning activities defined.
- This course is included as a component of the Agriculture and Natural Resources career cluster and may also be included as a component of the Business, Management and Finance career cluster.

LANDSCAPE MANAGEMENT

5136
CIP Code: 01.0605

Landscape Management is a year long course that provides the student with an overview of the many career opportunities in the diverse field of landscape management. Students are introduced to the procedures used in the planning and design of a landscape using current technology practices, the principles and procedures involved with landscape construction, the determination of maintenance schedules, communications and management skills necessary in landscaping operations, and the care and use of equipment utilized by landscapers. Upon completion of the program, students have the opportunity to seek an industry approved State Certificate of Mastery in Landscape Management.

- Recommended Grade Levels: 10-12
- Recommended Prerequisite: None
- A two credit/two semester course. This course can be offered for a second full year at an advanced level and may also be offered in a two- or three-hour block for four semesters with a maximum of twelve credit hours.
- A Core 40 directed elective as part of a technical career area.
- Competencies and learning activities defined.
- This course is included as a component of the Agriculture and Natural Resources career cluster and may also be included as a component of the Art, Media, and Communications and Business, Management and Finance career clusters.
NATURAL RESOURCE MANAGEMENT

5180
CIP Code: 03.0299

This course is a year long program that provides students with a background in natural resource management. Students are introduced to career opportunities in natural resource management and related industries, the history of the forest industry and forest policy, the importance and uses of forest plants, factors that influence the development of forests, forest improvement and best management practices, proper care and use of forest tools and equipment, effects of management practices on the environment, soil conservation practices, water and its importance to natural resource management, hazardous waste management, native wildlife, waterfowl, fish, wetlands and pond management, surveying and map use, management of recreational areas, outdoor safety, and weather. "Hands-on" learning activities encourage students to investigate areas of environmental concern including: identification and management of ecosystems, management of waste, chemicals and the environment, soil conservation, land uses, regulations, and ordinances, water quality, and air quality.

- Suggested Grade Levels: 10-12
- Recommended Prerequisite: None
- A two credit/two semester course.
- A Core 40 directed elective as part of a technical career area.
- Competencies and learning activities defined.
- This course is included as a component of the Agriculture and Natural Resources career cluster.

SUPERVISED AGRICULTURAL EXPERIENCE (SAE)

5228
CIP Code: Cooperative Education 01.0000
CIP Code: Non-Cooperative 01.4000

Supervised Agricultural Experience (SAE) is designed to provide students with opportunities to gain experience in the agriculture field(s) in which they are interested. Students should experience and apply what is learned in the classroom, laboratory, and training site to real-life situations. Students work closely with their agricultural science and business teacher(s), parents, and/or employers to get the most out of their SAE program. This course should be offered each semester as well as during the summer session. SAE may be offered as a Cooperative Education Program. Curriculum content and competencies should be varied so that school year and summer session experiences are not duplicated. The course may be offered on an independent study basis.

- Suggested Grade Levels: 10-12
- Recommended Prerequisite: Fundamentals of Agricultural Science and Business
- A maximum of eight credits can be earned in this course when offered as a one hour course/eight semesters, some of which can be earned during summer sessions. Curriculum content and competencies should not be duplicated when multiple credits are being earned.
- As Cooperative Education: one credit related instruction, two credits on the job training/four semesters = 12 credit hours (on the job training credit hours may be increased in approved situations).
- A Core 40 directed elective as part of a technical career area.
- Competencies and learning activities defined.
- This course is included as a component of the Agriculture and Natural Resources career cluster and may also be included as a component of the Art, Media, and Communications; Engineering, Science and Technologies; Mechanical Repair and Precision Crafts; Business, Management and Finance; and Health Services career clusters.
Agricultural Education
High School - Agricultural Business

Specific Proficiency Statements

Through learning opportunities provided in Agricultural Business at the high school level, students should:

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| 1. | a. identify sources of information (reference sources, periodicals, electronic access data bases, etc.) appropriate for various agricultural problems and issues.  
b. use appropriate checks to discern the validity of any information source.  
c. use appropriate research skills. |
| 2. | a. evaluate new technological applications in terms of effect on production, labor and decision-making.  
b. determine the knowledge and skills needed for various jobs.  
c. explain and illustrate the characteristics of an effective and responsible citizen, employee, and manager.  
d. identify the differences between financial resources and human resources in agricultural business. |
| 3. | a. utilize graphs, charts, and tables in making management decisions.  
b. determine assets, liabilities, and net worth using proper documentation.  
c. organize the data necessary to monitor on-going activities, increase effectiveness and efficiency, provide financial history and accountability, and determine profit and loss. |
| 4. | a. use computers, graphs, charts, and tables in making agribusiness decisions.  
b. use appropriate technologies for effective production, processing, and marketing of agricultural products and services. |
Specific Proficiency Statements

5. interpret and communicate the interrelated and interdependent nature of agriculture.

Sample Indicators

- a. explain the impact of new agricultural products such as pesticides, hybrids, medicines, and feed additives.
- b. explain marketing theories, laws, or principles orally, in writing, graphically, or with models.
- c. plot data to detect trends, perceive discrepancies, and make predictions.
- d. analyze the relationship between agricultural activities and socioeconomic factors such as rural development, family structures, consumer buying patterns, transportation, environmental quality, global climate, and labor markets.
- e. extrapolate existing data to predict events such as changes in government subsidy programs, market fluctuations, amount of food produced, land values, etc.
- f. predict future conditions based on exponential relationships, e.g., population, land productivity, and new technology.

6. analyze the role of governments and economic systems for their impact on regional and global agricultural policies and practices.

Sample Indicators

- a. describe the processes used in establishing agricultural policy.
- b. explain and evaluate the effect of national and global economies on agriculture.
- c. analyze the ways in which international, national, and state (Indiana) policies and practices affect agriculture.
- d. analyze the costs and benefits of government programs.
- e. project how various agricultural policies could affect benefits to the farmer and consumer.
- f. explain the importance of supply and demand in making management decisions.
Specific Proficiency Statements

7. use a systematic approach to problem-solving in agriculture.

Sample Indicators

a. identify possible causes, design tests to check out each and propose solutions to problems based on the results.

b. propose and evaluate alternative courses of action to reduce local agricultural issues such as tax policies, zoning, corporate management, etc.

c. use computer assistance to analyze results obtained from records and simulations.

d. develop appropriate problem-solving strategies through the use of modeling, simulations and trend analysis.

e. critically analyze information to develop, consider, and evaluate alternatives; draw conclusions; make decisions; design presentations; take actions; evaluate actions; and modify decisions if necessary.

f. use case studies, projects, etc. to demonstrate the skills required to work through the problem-solving approach used in agriculture.

8. demonstrate effective interpersonal skills in group problem-solving activities.

Sample Indicators

a. demonstrate tolerance and respect for differences of opinion.

b. show respect for classroom, school, self, and community.

c. participate in cooperative, leadership, and community service activities which develop skills necessary for responsible interpersonal relationships.

9. communicate business and management issues about agriculture.

Sample Indicators

a. explain marketing and management theories, laws, or principles orally, in writing, graphically, or with models.

b. organize and graphically display agricultural information.

c. plot agricultural data in order to detect trends, perceive discrepancies, and make predictions.

d. record acquired agricultural data to an appropriate precision.

e. report on the management procedure in sufficient detail for its replication to verify findings.

f. develop oral or visual presentations designed to convince specific audiences (farm owners, farm workers, governmental units, chamber of commerce, etc.) to change behaviors and/or change policies needed to solve agricultural problems.
Specific Proficiency Statements

10. gather and use appropriate information in projecting career paths.

Sample Indicators

a. describe how technological developments have and will impact the job market.
b. identify the specific agricultural training required for entry into various careers.
c. access a variety of reliable career data bases.
d. explore possible careers in agriculture and agriculture-related fields.
Specific Proficiency Statements

Through learning opportunities provided in Agricultural Science at the high school level, students should:

1. access reliable information relating to agricultural science and technology of the past, present, and future.
   - a. identify sources of information (reference sources, periodicals, electronic access data bases, etc.) appropriate for various agricultural problems and issues.
   - b. use appropriate checks to discern the validity of any information source.
   - c. use appropriate research skills.

2. apply the scientific knowledge and processes to agricultural concepts and principles.
   - a. analyze records of a flock, herd, etc. to identify adjustments that might improve productivity.
   - b. analyze soil nutrients that have been available for crops, turf, ornamental plants, etc. and propose adjustments for increasing future productivity.
   - c. analyze crop rotation patterns and make adjustments that might improve yield.
   - d. analyze food processing systems and make adjustments to improve food quality.
   - e. analyze forest, conservation, and wildlife management procedures and make adjustments that might improve production.
   - f. evaluate the consequences of utilizing agricultural chemicals such as pesticides, growth regulators, etc. based on knowledge of the chemical composition and reaction to plants, animals, humans and the environment.
   - g. explain how knowledge of biotechnology can affect the solutions one might propose for world energy or food problems.
Specific Proficiency Statements

3. use a systematic approach to problem solving in agriculture.

Sample Indicators

a. identify possible causes, design tests to check out each and propose solutions to problems based on the results.
b. propose and evaluate alternative courses of action to reduce local agricultural problems such as soil erosion, ground water contamination, use of pesticides, etc.
c. use computer assistance to analyze results obtained by observation and experimentation.
d. develop appropriate problem-solving strategies through the use of test plot analysis, modeling, and laboratory experimentation.
e. critically analyze information to develop, consider, and evaluate alternatives; draw conclusions; make decisions; design presentations; take actions; evaluate actions, and modify decisions if necessary.
f. use case studies, projects, etc., to demonstrate the skills required to work through the problem-solving approach used in agriculture.

4. communicate scientific and technological issues about agriculture.

Sample Indicators

a. organize and graphically display agricultural information.
b. plot agricultural data in order to detect trends, perceive discrepancies, and make predictions.
c. record experimentally acquired agricultural data to an appropriate precision.
d. explain scientific agricultural theories, laws, or principles orally, in writing, graphically, or with models.
e. report on the experimental procedure in sufficient detail for its replication to verify findings.
f. prepare original written and oral reports and presentations.
g. develop oral or visual presentations designed to convince specific audiences (farm owners, farm workers, governmental units, chamber of commerce, etc.) to change behaviors and/or change policies needed to solve agricultural problems.
Specific Proficiency Statements

5. recognize that knowledge about agriculture is dynamic rather than static.

Sample Indicators

a. draw time lines to illustrate the sequences of events leading to various scientific or technological breakthroughs in agriculture.
b. describe how various scientific understandings and beliefs have changed agriculture.
c. project future modifications in resource utilization, production methods, genetic engineering, etc.
d. identify key examples of past agricultural and technological ideas and/or procedures which are no longer considered valid and/or relevant.
e. list examples of how their own views and practices have changed as they have studied agriculture.

6. safely use appropriate technology to implement agricultural practices.

Sample Indicators

a. select and properly use appropriate instruments, equipment and materials when implementing agricultural practices and measurements.
b. observe appropriate safety precautions when implementing agricultural practices and measurements.

7. use scientific and technological information about agriculture.

Sample Indicators

a. use scientific and technological information in selecting agricultural items for purchase and use.
b. identify the specific agricultural training required for entry into various agricultural careers and develop personal career plans.
c. analyze the viewpoints of political action groups, public figures, or political platforms on key agricultural issues.
d. discuss the ethical issues that should be considered in using chemicals, biological controls, genetic engineering, etc.
e. use scientific and technological information in making management decisions.

8. demonstrate effective interpersonal skills in group problem solving activities.

Sample Indicators

a. demonstrate tolerance and respect for differences of opinion.
b. show respect for classroom, school, self, and community.
c. participate in cooperative, leadership, and community service activities which develop skills necessary for responsible interpersonal relationships.
Agribusiness Management

A-1. Students shall analyze how basic economic principles relate to agribusiness management decisions.

1. Describe the basic economic factors that affect farm and agribusiness management decisions.

2. Give evidence of how supply and demand affect prices.

3. Other than supply and demand, analyze factors that affect prices.

4. Distinguish among supplementary, complementary, competitive and independent enterprises.

5. Describe the concept of diminishing returns.

6. Distinguish between fixed and variable costs.

7. Distinguish between and calculate marginal cost and marginal return.

8. Describe the monetary system and its implications in agribusiness management.

9. Calculate the estimated fixed costs and variable costs for an agricultural commodity.

A-2. Students shall examine and evaluate the advantages and disadvantages of diversification and specialization.

1. Evaluate the advantages and disadvantages of diversification and specialization.

A-3. Students shall investigate the Gross National Product and total global economy and assess their importance to agribusiness.

1. Investigate the importance of agribusiness and its impact upon the Gross National Product and the total global economy.

A-4. Students shall identify and evaluate the decision-making tools used in agribusiness management.

1. Describe economic decision-making tools that can be used to help determine the profitability of agricultural enterprises.

A-5. Students shall examine the U.S. Monetary System and its relationship to agribusiness.

1. Investigate the operation of the U.S. Monetary System.

2. Describe the relationship of agribusiness and the United States Monetary System.

B-1. Students shall identify and evaluate the primary governmental agencies involved with agriculture.
1. Identify and describe the primary agencies involved with agriculture and the services they provide.

B-2. Students shall analyze how government policies and laws affect an agribusiness.

1. Identify the provisions of the current U.S. Farm Bill and compare to previous legislation.
2. List the characteristics regarding regulatory laws and agriculture.
3. Identify the provisions of federal, state, and local legislation in regards to environmental regulations.

B-3. Students shall examine and explain the purposes of agricultural contracts and leases.

1. List the purpose and components of agricultural contracts and leases.

B-4. Students shall examine the agricultural laws and regulations governing agribusiness.

1. Describe the property rights of agricultural landowners and agribusinesses.

B-5. Students shall examine and evaluate the systems for taxing agribusiness.

1. Evaluate the purposes of taxes.
2. Describe the purposes of tax planning and list records and information helpful for tax management.
3. Distinguish between taxable and non-taxable items.
4. List examples of deductible business expenses.
5. Analyze the various types of tax credits.
6. Discuss the Homestead Act and how it affects agribusiness.

C-1. Students shall identify and utilize the different management factors that need to be considered to start and operate an agribusiness.

1. Describe what is meant by agribusiness management.
2. Explain the role of a manager.
3. Synthesize the functions of organizing, directing, planning, coordinating and controlling in agribusiness management.

C-2. Students shall evaluate the necessity for setting goals and objectives.

1. Discuss the importance of setting goals and objectives.
C-3. Students shall examine the processes involved in locating a successful business, organizing proposals, and promoting a product or service.

1. Utilize market analysis to determine business potential.
2. Appraise business locations.
3. Organize a business proposal.
4. Formulate a plan to promote a product or service.

C-4. Students shall identify and evaluate the various types of ownership found in agribusiness.

1. Compare and contrast the main characteristics of individual proprietorships, partnerships and corporations.
2. Define entrepreneur.
3. Recognize personal potential as an entrepreneur.
4. Examine career opportunities for entrepreneurs in agribusiness.

C-5. Students shall identify and evaluate the different sources of credit.

1. Analyze the role of credit in agriculture.
2. Define specific kinds of credit and list factors to consider in selecting an appropriate source of credit.
3. Match sources of credit to a list of advantages and disadvantages.
4. Analyze factors affecting repayment capacity.
5. Distinguish among various types of assets and liabilities.
6. Analyze factors that affect cost of credit.

C-6. Students shall examine and evaluate the various methods of obtaining equipment, land, and supplies.

1. List advantages and disadvantages of purchasing new versus used equipment.
2. Compare and contrast advantages and disadvantages of leasing.
3. List factors to consider in purchasing seed, fertilizer, fuel, repairs, and other services.
4. List the advantages and disadvantages of co-ownership.

C-7. Students shall examine all decision-making aids available for agribusiness management.
1. Utilize the management decision-making aids available (e.g., microcomputer, publications).

2. Describe the latest aids available in marketing crops or livestock.

3. Identify guidelines for selecting a suitable computer system.

4. Utilize decision aid software and computerized recordkeeping systems.

C-8. Students shall examine and evaluate the different types of insurance available to an agribusiness.

   1. Describe the impact of various types of insurance on risk management.

C-9. Students shall evaluate safety procedures used in farm and agricultural industry.

   1. List factors which contribute to farm and agricultural industry accidents.
   2. Describe management's responsibility in farm and agricultural industry safety.
   3. Identify sources of safety information.

D-1. Students shall explain the function and importance of farm cooperatives in the agricultural sector.

   1. Describe the basis for the original formation of farm cooperatives and how they were organized.
   2. Describe some of the changes which have taken place within the coop structure.

D-2. Students shall examine and evaluate the advantages and disadvantages of cooperatives.

   1. Detail how cooperatives have acted as pacesetters and power balancers in agribusiness.

D-3. Students shall examine the organization of cooperatives and the basic principles utilized to ensure their success.

   1. Explain how local and regional cooperatives are organized and identify the basic principles that ensure that cooperatives serve the needs of member-patrons.

D-4. Students shall identify the challenges and opportunities offered to agricultural cooperatives.

   1. Examine some of the challenges and opportunities that face agricultural cooperatives.

E-1. Students shall compare and contrast the two methods of accounting.

   1. Compare and contrast between the two methods of accounting.
E-2. Students shall examine the reasons for keeping an inventory and the value of depreciation schedules.
   1. Describe, complete, and use inventory and depreciation schedules.
   2. List the purposes of an inventory.

E-3. Students shall evaluate the concept of depreciation and the various methods used to calculate depreciation.
   1. Describe, complete, and use inventory and depreciation schedules.
   2. Distinguish among the straight-line, declining balance, and sum-of-the-years digit methods of calculating depreciation, and government regulations.

E-4. Students shall examine the different types of budgeting.
   1. Analyze the different types and purposes of budgets.
   2. Arrange in order the steps in developing a budget.
   3. Describe the purposes of enterprise records.
   4. Demonstrate the ability to complete an enterprise budget for an agribusiness.

E-5. Students shall examine the various factors involved in constructing a balance sheet and an income statement.
   1. Calculate fixed and operating costs.
   2. Analyze benefits of cash flow planning and deduce methods of altering cash flow.
   3. Complete a cash flow statement.
   4. Develop a working knowledge of how financial statements aid the agribusiness management decision-making process.
   5. Develop a balance sheet and analyze its uses.
   6. Develop an income statement and describe its purposes.
   7. Show a complete repayment plan.

E-6. Students shall analyze a financial statement.
   1. List steps in finding and correcting errors in records.
   2. Complete a break-even analysis for an enterprise.
   3. Analyze the various financial ratios.
F-1. Students shall investigate how marketing and marketing concepts affect an agribusiness.
   1. Explain what is meant by the term, free enterprise system.
   2. Compare and contrast the types of markets.
   3. Evaluate the importance of grades and standards.
   4. Analyze purpose and function of local markets.
   5. Compare and contrast global and domestic markets for agricultural products.
   6. Explain the difference between a command economy and a market economy.

F-2. Students shall examine the factors involved in marketing and the different cycles involved.
   1. Describe key factors involved in marketing.
   2. Describe price and market cycles on various commodities.

F-3. Students shall investigate the reasons for and methods used in commodity futures and options trading.
   1. Investigate commodity futures and options trading.
   2. Distinguish between hedging and speculation.
   3. Develop a marketing plan for a commodity.

G-1. Students shall identify and examine the career opportunities in agribusiness.
   1. Describe how to prepare for a career in agribusiness.
   2. Examine the career opportunities available in agribusiness.
   3. Develop a systematic approach for finding and getting a job in agribusiness.

G-2. Students shall identify and exhibit the personal skills required to be successful in different areas of agribusiness.
   1. Identify factors affecting self-image.
   2. Develop social skills necessary for success in agribusiness.
   3. Propose a plan for improving your professional image.
   4. Establish personal goals and list steps necessary to achieve those goals.

G-3. Students shall evaluate the methods used in recruiting and keeping desirable employees.
   1. Compare methods of staffing an organization.
2. Develop employee orientation/training procedures.
3. Analyze employee benefits.
4. Describe the employer/employee relationship.

G-4. Students shall identify the importance of communication in a successful agribusiness.
1. Recognize the importance of work related ethics.
2. Effectively associate with co-workers.
3. Recognize employer responsibilities.
4. Recognize the importance of business related ethics.
5. Utilize business practices to improve written, verbal, and non-verbal communications.
6. Actively participate in group discussions.
7. Organize and conduct a successful meeting.
8. Exhibit the ability to work with diverse groups.
9. Identify and remove barriers to communication.
10. Identify effective listening techniques in group and in personal situations.

G-5. Students shall investigate work programs and time management strategies.
1. Investigate employer expectations.
2. Develop a program of work.
3. Organize group activities and programs.
4. Recognize and apply various time management strategies.

G-6. Students shall evaluate the methods used in problem-solving in agribusiness management.
1. Evaluate job applicants and employee performance.
2. Develop an effective complaint and appeals procedure.
3. Exhibit the ability to solve problems that arise in an agribusiness.
4. Demonstrate the decision-making skills needed to facilitate the operation of an agribusiness.
Agricultural Mechanization

A. Students shall analyze and implement safe work practices which apply to agricultural mechanics.

1. Explain the importance of safety in agricultural mechanics.
2. Identify and differentiate between safe and unsafe work practices.
3. Describe the methods utilized to implement safe work practices.
4. Identify and explain the purpose of signals and symbols in agricultural safety.
5. Explain the importance and function of an operator's manual.

B. Students shall recognize the importance of, identify and implement safe work practices in the agricultural shop.

1. Evaluate the importance of shop safety.
2. Identify and explain the role that various agencies play in regulating shop safety.
3. Identify and demonstrate the proper use of safety equipment which should be worn in the agricultural shop.
4. Locate and demonstrate the proper uses of the first aid and emergency equipment found in an agricultural shop.
5. Develop proper safety skills to use for hand and power tools.

C. Students shall examine the scope of career opportunities in and the importance of agricultural mechanics.

1. Evaluate the career opportunities in and the criteria to achieve in order to satisfy the requirements for an agricultural mechanics occupation.
2. Assess the factors involved in career decision making.
3. Examine the various SAE programs which are related to agricultural mechanics.
4. Perform a career self-analysis.

D. Students shall identify, select, utilize, and maintain hand tools, power tools, and measuring and marking devices.

1. Identify the hand tools utilized in agricultural mechanics.
2. Demonstrate the proper techniques to employ when utilizing hand tools.
3. Identify the power tools utilized in agricultural mechanics.
4. Demonstrate the proper techniques to employ when utilizing power tools.
5. Identify and demonstrate the correct use of measuring and marking devices.
6. Demonstrate the correct procedures to follow when preparing to grind and sharpen equipment.

7. Identify the correct methods for and demonstrate the proper techniques to employ when reconditioning hand tools such as hammers, twist drills, chisels, punches, and screwdrivers.

8. Identify the correct methods for and demonstrate the proper techniques to employ when reconditioning keen edge wood cutting tools.

9. Identify the correct methods for and demonstrate the proper techniques to employ when reconditioning keen edge metal cutting tools.

E. Students shall investigate and demonstrate the procedures used in basic electric wiring.

1. Define basic electrical terminology.

2. Identify and explain the basic principles of electricity.

3. Develop the abilities needed in order to read schematics and sketch wiring circuits.

4. Demonstrate a proficiency in safe wiring practices and basic wiring skills.

5. Explain and demonstrate the methods used to attach conductors to terminals, install attachment plugs, and install cord connector bodies.

6. Explain and demonstrate the methods used to make proper splices and connections.

7. Explain and demonstrate the methods used to measure electrical circuits for voltage, amperage, resistance, and wattage.

8. Explain and demonstrate the methods used to install electrical circuits, switching devices, and appliances.

9. Explain and demonstrate the methods used to install ground-fault circuit interrupters.
F. Students shall investigate and demonstrate the procedures used in basic plumbing.
1. Define basic plumbing terminology.
2. Demonstrate the proper procedures for cutting and assembling plastic pipe.
3. Demonstrate the proper procedures for cutting, threading, and assembling steel pipe.
4. Demonstrate the proper procedures utilized to connect flare and compression fittings.
5. Demonstrate the proper procedures to utilize when soldering copper fittings.
6. Demonstrate the proper procedures to follow when assembling dissimilar plumbing materials.
7. Explain the proper procedures to follow in order to maintain a water system.

G. Students shall investigate and demonstrate the proper application of basic concrete principles.
1. Define basic concrete terminology.
2. Identify and develop a list of necessary materials.
3. Demonstrate the proper methods used to construct forms.
4. Prepare a site for concrete and masonry construction.
5. Demonstrate the proper methods used to lay out a building foundation.
6. Calculate the cost and amounts of materials needed to formulate a concrete or mortar mix.
7. Explain and demonstrate the methods used to determine moisture content in sand.
8. Demonstrate the methods used to mix concrete or mortar on the job site.
9. Demonstrate the necessary techniques for conducting and evaluating a slump test.
10. Explain the necessity for and the proper procedures to use when placing concrete or masonry reinforcement.
11. Demonstrate how to properly make control and construction joints.
12. Explain and demonstrate all of the necessary steps to place, consolidate, finish, and cure concrete.
13. Explain the need for and demonstrate how to produce special finishes on concrete.
14. Demonstrate the proper methods for use and maintenance of concrete and masonry finishing tools and equipment.

H. Students shall investigate and demonstrate proficiency in basic carpentry skills.
1. Define basic carpentry terminology.
2. Identify and explain the uses for the various building materials.
3. Demonstrate the proper methods for planning cost effective construction.
4. Demonstrate the proper methods for laying out a building foundation.
5. Identify, select, and apply construction fasteners.
6. Demonstrate the proper methods for constructing buildings or building components.
7. Demonstrate the proper methods for laying out and cutting structural components.
8. Demonstrate the proper methods for construction of trusses from different types of building materials.
9. Demonstrate the proper methods for the installation of composition shingles as well as, metal and fiberglass roofing materials.

I. Students shall investigate the proper selection and application of paints and preservatives.
   1. Identify and explain the uses of the materials which are needed.
   2. Explain and demonstrate the correct techniques for brush painting.
   3. Explain and demonstrate the correct techniques for spray painting.
   4. Explain and demonstrate the proper methods of application of different types of finishing materials.

J. Students shall investigate the various methods of fencing.
   1. Identify, explain the uses of, and determine the amount of materials which are needed.
   2. Select fencing materials which are appropriate for the type of fence which is being built.
   3. Develop a plan for the construction of a fence.
   4. Demonstrate the proper method of putting up fences.

K. Students shall investigate and demonstrate hot and cold metal skills.
   1. Define the basic terminology.
   2. Correctly identify the different types of metal.
   3. Explain and demonstrate how to correctly cut, file, shape, and drill metal.
   4. Explain and demonstrate the methods used to correctly solder copper joints, sheet metal, and electrical connections.
   5. Explain and demonstrate the correct use of heat treating tools.
6. Explain and demonstrate how to join metals with appropriate fasteners.
7. Explain and demonstrate the proper procedures for cutting threads with taps and dies.
8. Explain and demonstrate the methods utilized to lay out and drill holes with a twist drill.
9. Explain and demonstrate how to bend sheet and strap steel to angles or shapes.
10. Explain and demonstrate the proper procedures for repairing damaged threads.
11. Identify and explain the uses for the equipment needed for electric arc welding.
12. Demonstrate how to correctly operate electric arc welding equipment.
13. Explain and demonstrate the proper procedures for laying out and preparing metal for arc welding.
14. Demonstrate proficiency in the proper methods utilized to weld basic joints in all positions.
15. Demonstrate the methods used to join pipes by welding.
16. Demonstrate the procedures to follow when preparing for and applying hard surfacing alloys.
17. Identify and explain the uses for the equipment needed for oxy-fuel welding and cutting.
18. Demonstrate how to correctly operate oxy-fuel welding and cutting equipment.
19. Explain and demonstrate the need to light and adjust the torch flame for specific welding or cutting operations.
20. Demonstrate the procedures to follow when laying out and preparing metal for welding or cutting.
21. Compare and contrast fusion and braze welding joints on mild steel and cast iron.
22. Demonstrate the proper methods for cutting mild steel, including pipe.
23. Demonstrate the proper methods utilized to join steel pipe, tubing or shapes by welding.

I. Students shall investigate the operation of small engines.

1. Identify and explain the function of the following systems and components:
   a. Air and fuel intake and carburetion system
   b. Ignition system
   c. Cooling components
   d. Lubrication system
   e. Combustion components

2. Explain and demonstrate how to service and maintain fuel, air intake, exhaust, cooling, and lubrication systems.
3. Explain the methods used in the generation of electricity and the production of a timed spark.

4. Explain the methods used in the combustion of fuel and the generation of usable energy.

5. Identify the individual parts of a small engine.

6. Describe the function of the following:
   a. Engine governor
   b. Hot vs. cold spark plug
   c. Air cleaner
   d. Cooling fins
   e. Crankcase breather
   f. Carburetor choke
   g. Condenser
   h. Breaker points
   i. Engine oil
   j. Cam shaft
   k. Connecting rod
   l. Piston and rings

7. Compare and contrast a 4 stroke-cycle and a 2 stroke-cycle engine.

8. Explain and demonstrate the proper methods for using engine overhaul equipment, including valve, cylinder, piston, seal, and bearing tools.

9. Explain and demonstrate proficiency in the use of measuring tools and test instruments such as micrometer, thickness gauge, telescoping and small hole gauge, dial indicator, compression tester, torque wrench, tachometer, coil-condenser tester, ignition timing tester, ignition circuit tester, and VOA (volt-ohm-amp)-meter or DMM (digital multi-meter).

10. Explain and demonstrate the methods for assembling and adjusting ignition and fuel systems.

11. Demonstrate the proper methods for operating an engine and adjust or check ignition timing, engine speed, and carburetor adjustments.

12. Troubleshoot, evaluate and replace valves, electrical, governor, and carburetion parts.
Animal Science

A-1. Students shall examine the circulatory and respiratory systems of animals.
   1. Discuss the pathway of blood through the heart and circulatory system.
   2. Describe and compare the functions of veins, arteries, and capillaries.
   3. Explain how the circulatory system affects body temperature in warm-blooded animals.
   4. Describe the primary and secondary functions of the respiratory system.
   5. Discuss the roles of the nose and diaphragm in respiration. Address differences in the breathing mechanisms in common farm and companion animals.

A-2. Students shall explore the animal endocrine and nervous systems.
   1. Explain the role of the endocrine system and discuss the unique feature of the glands.
   2. Explain the "fight or flight" phenomenon.
   3. Discuss how the endocrine and nervous systems interact.
   4. Describe the functions of the peripheral nervous system in both domestic animals and humans.
   5. Discuss what modifications can be made to epithelial tissues.
   6. Describe the principal outer coverings of animals and the functions of these coverings.

A-3. Students shall examine the muscular and skeletal systems of animals.
   1. Describe the three forms of muscles and their functions for six different species.
   2. Discuss the production and dissipation of energy in the contraction of a muscle.
   3. Explain the function of bones and how bone is reabsorbed in the body.

A-4. Students shall investigate the digestive and excretory systems.
   1. Distinguish between the monogastric and ruminant digestive systems and give examples of each.
   2. Describe how the mouth assists in the digestive process.
   3. Discuss how the monogastric digestive system differs from an avian digestive system.
   4. Explain how the shape of the kidneys differs from species to species and conjecture about the reason for this difference.
B-1. Students shall explore the process of sexual reproduction.

1. Discuss how gender is determined in the process of reproduction for agricultural livestock.

2. Examine mitosis and meiosis and relate appropriate aspects of each process to the male and female gametes of domestic animals.

3. Discuss puberty and its relation to the sexual maturation and breeding of livestock.

4. Explain the preparation required for the breeding of a female animal and relate to the idea of "grading up".

5. Explain estrous as it relates to the mating of animals.

6. Discuss parturition and how to detect when it is about to occur.

7. Examine the different systems of mating and suggest the optimum method for the common domestic animals.

B-2. Students shall investigate the role of the male in reproduction.

1. Describe the various organs and functions of the male animal reproductive system and relate to the human anatomy.

2. Discuss the similarities and differences between the male reproductive systems of species of agricultural livestock. Develop a possible rationale for the differences.

3. Describe the functions of the male hormones and identify characteristics of too much and too little male hormone in the body.

B-3. Students shall examine the role of the female in reproduction.

1. Describe the various organs and functions of the female animal reproductive system and relate to the human anatomy.

2. Discuss the similarities and differences between the female reproductive systems of species of agricultural livestock. Develop a possible rationale for the differences.

3. Describe the functions of the female hormones in the estrous cycle and compare this process to that of human females.

B-4. Students shall examine the processes of artificial insemination and embryo transfer and their practical and social implications.

1. Describe the equipment and procedures involved in the artificial insemination of cattle and hogs. Examine the advantages and disadvantages of artificial insemination in livestock.

2. Discuss motility in sperm and the factors affecting it and other aspects of sperm production.
3. Describe the process of embryo transfer and the advantages and disadvantages of its use.

4. Address the social implications and concerns involved in reproductive and genetic manipulation in animals.

5. Discuss similarities in advances in animal reproduction and human infertility treatments.

C. Students shall examine the genetics of animal breeding.

1. Differentiate between genotype and phenotype. Address the appearance and the genetics of the animal.

2. Explain the law of segregation and the law of independent assortment. Cite examples of each and relate to Gregor Mendel's original experiments.

3. Describe the function of chromosomes and genes in the context of RNA and DNA information.

4. Address the factors involved in dominant and recessive characteristics of canine genotype. Describe how these are important in the breeding of pedigreed dogs.

5. Describe the process of complete and incomplete dominance. Identify physical characteristics of example animals in each category.

6. Explain how an animal's sex is genetically predetermined. Compare poultry with other domestics animals and humans.

7. Describe and calculate heritability estimates for economically important traits in agricultural livestock.

8. Discuss sex linked characteristics in both animals and humans. Cite examples in animals and humans and relate to decisions about reproduction in general.

9. Explain genetic cross-over and mutation. Address the possible physical outcomes for the progeny.

10. Describe inbreeding and its positive and negative effects. Discuss its use in changing the size and facial characteristics of dogs such as the bulldog.

11. Describe expected progeny differences and how they relate to the genetic make-up of an individual. Devise and perform an experiment to test the conjecture.

D. Students shall analyze the diseases and parasites that affect animals.

1. Differentiate among viral, bacterial, fungal, and protozoa diseases and cite specific examples of each.

2. Describe diseases common to the various species of livestock and their mode of infection, symptoms, and effects on the animal.

3. Cite several diseases for swine, sheep, and cattle and apply the principles of proper animal management to the prevention and control of these diseases.
4. Describe host and life cycle as it relates to parasites. Discuss appropriate treatments based upon the parasitic life cycle.

5. Compare the methods of administering medication and vaccines to animals. Discuss the preferred method for several specific treatments.

6. Describe the symptoms of and effects of internal parasites on their various hosts. Cite management practices that will avoid problems.

7. Discuss the problems involved in the treatment of diseases and parasites. Address issues related to cost, profitability, animal rights and the role of veterinarians in farm animal health.

E. Students shall explore proper animal nutrition.

1. Relate the classification of nutrients of livestock feeds to the process of synthesizing of nutrients by animals. Cite examples from specific feed labels.

2. Explain the purpose and function of minerals and water in the body.

3. Discuss feeds based upon vitamins, their functions, fiber content and total digestible nutrients. Include examples of good and inappropriate animal feeds.

4. Classify concentrates on the basis of composition and feeding value and generate an evaluation system for commercially produced animal feeds.

5. Discuss the processing of by-products used in feed and relate to sources of plant proteins and animal proteins available in livestock feeds.

6. Distinguish among the various classes of feed additives and production stimulants used for the various species. Address concerns of environmentalists about the effects of these chemicals on consumers.

7. Explain the process of digestion in ruminant, monogastric, and avian species. Relate the differences to appropriate feeding regimens.

8. Discuss the nutritional requirements for several classes and species of livestock, select appropriate feed for various ages, and compute balanced rations for five different domestic animals based on the Pearson Square Method.

F. Students shall explore careers in the animal industry.

1. Evaluate the types of careers related to the animal industry based upon educational requirements, employment opportunities, working conditions, type of pay, and advancement opportunities. Generate criteria for determining the relative strengths of each occupation in the current economy.

2. Discuss how jobs related to the animal industry have changed over the past one hundred years. Address how scientific advancements have impacted the agricultural job market.

3. Predict a scenario for animal industry jobs of the future. Discuss how worldwide population growth will influence plant versus animal food production.
G. Students shall analyze social and political issues in the animal industry.

1. Examine animal rights issues and choose three on which to make a stand. Identify and support a position both in writing and verbally.

2. Discuss modern production practices that relate to animal rights issues from the perspective of both producers and animal rights groups.

3. Formulate a position related to the debate between vegetarians and livestock producers about the best use of land and grains.

4. Discuss the economic ramifications for both the consumer and producer of altering production practices related to livestock animals.

H. Students shall examine management practices in the care and maintenance of animals.

1. Discuss the appropriate land, housing, pens, fencing, and watering facilities needed for the proper care of a given livestock species.

2. Discuss the procedures necessary for the technical maintenance of livestock and pets, such as yearly vaccinations, castration, and dehorning. Respond to those concerned with the so-called mutilation of the animal with a cogent argument.

3. Relate the requirements for "good conformation" in farm livestock with the specific purpose for which the animal is being raised.

4. Discuss the USDA standards by which meat is graded and inspected for all species. Devise a set of recommendations for how these standards could be improved.

5. Examine the recommended procedures for proper animal sanitation. Address the difficulties that need to be overcome and cite specific examples of good practice.

6. Given a specific number of hogs, plan and construct a model of appropriate livestock facilities for handling the hogs if there is high capital available.

I. Students shall examine aquaculture and other new technological animal production systems.

1. Describe the history of aquaculture and relate it to the impact of aquaculture on the economy of the United States and foreign markets.

2. Explain the appropriate environment that fish require and the chemicals and fertilizers used in fish production. Address the effect chemicals have on the quality of meat produced.

3. Discuss the different types of fish reproduction, egg collections, and fertilization. Relate the characteristics of fish reproduction to those of warm-blooded domestic animals.

4. Describe the most popular species of fish breeds and identify the diseases and most prescribed treatments. Address recent news reports of the lack of freshness of fish for the consumer.

5. Examine career options in aquaculture and identify the requirements for entry-level positions and career advancement.
6. Discuss why the National Aquaculture Act was passed and explain how it has impacted the industry.

7. Predict other species in which technological advances might allow concentrated production of animals for human consumption. Justify your reasoning and indicate possible problems with environmental or conservation groups.
A. Students shall examine the scope of career opportunities in and the importance of agriculture to the economy.

1. Discuss agriculture and agribusiness and their role in the economy.

2. Evaluate the career opportunities in and the criteria to achieve in order to satisfy the requirements for an agriculture production occupation.

3. Evaluate the career opportunities in and the criteria to achieve in order to satisfy the requirements for an agriculture supplies and services occupation.

4. Evaluate the career opportunities in and the criteria to achieve in order to satisfy the requirements for an agriculture mechanization occupation.

5. Evaluate the career opportunities in and the criteria to achieve in order to satisfy the requirements for an agriculture processing and marketing occupation.

6. Evaluate the career opportunities in and the criteria to achieve in order to satisfy the requirements for an ornamental horticulture occupation.

7. Evaluate the career opportunities in and the criteria to achieve in order to satisfy the requirements for a forestry and natural resources occupation.

8. Compare and contrast the opportunities in agricultural production and non-traditional/non-production employment.

9. Describe the role that agriculture plays in determining the overall economic situation of the American economy.

10. Describe the international impact of agriculture on the world economy.

B. Students shall acquire and practice leadership skills.

1. Summarize the characteristics of a leader.

2. Explain the significance of effective leadership in agriculture.

3. Describe the divers opportunities for developing leadership skills in the FFA.

4. Acquire, or refine previously acquired, communication skills such as writing, public speaking, and listening.

5. Demonstrate expertise in the areas of leadership, employability, communications and human relations.

6. Discuss the role of the FFA in the development of leadership, education, employability, communications and human relations skills.

7. Understand the process of setting goals and develop a comprehensive set of attainable goals.
8. Explain the role of the Indiana Young Farmers in the further development of leadership, education, employability, communications, and human relations skills.

9. Exhibit proficiency in the proper usage of parliamentary procedure.

C. Students shall investigate the necessity and identify the procedures for developing a Supervised Agricultural Experience Program (SAEP)

1. Explain the nature of and become familiar with those terms related to an SAE program.

2. Justify the purposes for instituting an SAE.

3. Identify the numerous possibilities for an SAE program which a student might develop.

4. Identify the opportunities for an SAE within the local community.

5. Begin the implementation of an SAE program suited to the requirements of the student.

D. Students shall investigate the necessity and pertinence of plant and soil science as a component of agriculture.

1. Examine and develop a presentation to explain the basic principles in crop production.

2. Given a group of different species of plants, categorize them by utilizing a taxonomic key.

3. Differentiate between sexual and asexual plant reproduction.

4. Develop a list of plants which distinguishes the differences between asexual and sexual reproduction.

5. Describe the process of photosynthesis and explain how it affects the environment.

6. Devise an experiment which will illustrate how soil type and pH affect plant growth. Predict and verify the results.

7. Develop a presentation which will illustrate the role of plants in the basic food chain and their effects on the surrounding environment.

8. Analyze the importance of the relationship between plant life and air quality.

9. Given the life cycle of a plant develop a scenario that explains the importance of each stage.

10. Identify the basic parts of a plant and their functions.

11. Utilizing knowledge gained through previous exercises illustrate the major agricultural uses for land and soil in Indiana.

E. Students shall recognize the importance of preserving and replenishing our natural resources through natural resource management.

1. Identify and define the terms associated with natural resource management.
2. Explain the characteristics of resources in agricultural development.

3. Evaluate the various types of natural resources.

4. Given the past and current relationship between wildlife and humans predict the changes which are likely to occur.

5. Explain the effect that natural resource management has on the quality of our environment.

6. Describe the interrelationship between agriculture and the environment.

7. Develop and implement a project that involves the improvement of our environment.

8. Describe the necessity and importance of conserving natural resources.

9. Identify the major factors causing soil erosion and create a scenario in which no attempt is made to control these factors.

10. Develop a demonstration to illustrate the effects of soil erosion.

11. Identify the methods for conserving water. Predict which method, or methods, would be most effective locally.

F. Students shall investigate the necessity and pertinence of horticulture and landscape management as a component of agriculture.

1. Identify and define the terms associated with horticulture and landscape management.

2. Compare and contrast the various methods of plant propagation. Prepare a demonstration illustrating one of these methods.

3. Generate a list of plants which are propagated by each of the different methods of plant propagation.

4. Evaluate the use of indoor plants and how they affect the air quality and indoor environment.

5. Propagate plants utilizing each of the various methods of plant propagation.

6. Discuss the popular theories on the growth and development of turfgrass.

7. Explain how trees and shrubs are used for outdoor landscaping, improved air quality and pollution control.

8. Develop and implement a model landscape design.

9. Discuss the basic requirements needed to plan a garden or orchard.

10. Identify and explain the elements of a successful lawn care program in the local area.

G. Students shall investigate the necessity for and importance of the modern animal science industry.

1. Recognize and define the terms associated with the animal science industry.
2. Given information about the essential elements needed for growth successfully identify common nutritional deficiencies.

3. Develop a program that illustrates the basic skills necessary for proper animal care.

4. Devise an experiment which utilizes the basic principles of genetics.

5. Discuss the different types of breeding systems and the reasons for their implementation in given situations.

6. Prepare a presentation which illustrates the uses, care and management of small animals.

7. Illustrate the uses, care and management of the various breeds of horses.

8. Describe the similarities and differences in the uses, care and management of dairy, beef, swine, sheep, and other types of livestock.

9. Demonstrate the process involved in marketing animals and animal by-products.

10. Describe the responsibilities of the animal industry regarding animal care and welfare.

11. Given the life cycle of an animal develop a scenario that explains the importance of each stage.

12. Describe the role and importance of animals to society.

H. Students shall investigate the basic economic principles which are used in agribusiness and farm management.

1. Identify and define the terms associated with agribusiness and farm management.

2. Identify the factors involved in proper management and discuss their importance.

3. Illustrate and explain the eight steps involved in decision-making.

4. Compare and contrast the different forms of agricultural record systems.

I. Students shall investigate the necessity and pertinence of the various aspects of the food science industry.

1. Identify and define the terms associated with the food science industry.

2. Identify the major food groups that are presently recognized and discuss the changes made as nutritional requirements have been altered.

3. Describe the interrelationship between food quality and inspection standards.

4. Utilize knowledge to explain biotechnology and predict possible future developments.

J. Students shall develop and demonstrate a basic knowledge of agricultural mechanics and physical science.

1. Recognize and define the terms associated with agricultural mechanics.
2. Complete a project which utilizes the basic principles of plumbing.
3. Complete a project which utilizes the basic principles of electricity.
4. Complete a project which utilizes the basic principles of structural design.
5. Demonstrate a familiarity with irrigation and water structures.
6. Demonstrate the principles of small engine systems.
7. Identify and illustrate the uses for common power and hand tools.
8. Explain the need for safety in agricultural mechanics and physical science.
9. Demonstrate proper safety procedures to follow in the various areas associated with agricultural mechanics.
Farm Management

A-1. Students shall examine management in and the importance of decisions on the operation of a farm.

1. Describe the management process.
2. Identify the basic resources utilized in management.
3. Understand how good management can make a considerable difference in the profitability of a farm.
4. Analyze the differences in farm and non-farm management.

A-2. Students shall examine goal setting and the importance of setting both personal and farm goals.

1. Explain the importance of goal setting in farm management.
2. Distinguish the characteristics of an achievable goal.
3. Outline the areas of goal attainment.
4. Differentiate between short-term and long-term goals and discuss their interrelationship.
5. Understand the process utilized in setting goals.
6. Establish and evaluate personal and professional goals.

B. Students shall analyze basic economic principles and their relationship to farm management.

1. Analyze, explain, and provide examples of the applications of basic economic principles to farm management.

C-1. Students shall be able to describe the decision-making process and the steps involved, as they apply to farm management.

1. Identify that a problem exists.
2. Examine the importance of setting priorities in management.
3. Recognize and evaluate the impact that decision making has on the day-to-day operations of a farm.
4. Identify the steps in problem solving methods.

C-2. Students shall analyze the role of budgets as a tool used for decision making.

1. Explain the importance of a budget.
2. Identify the best sources of information to use when formulating a budget.

3. Differentiate between the following kinds of budgets and analyze the value of each:
   a. Partial
   b. Enterprise
   c. Cash Flow
   d. Total Farm
   e. Linear Programs

D-1. Students shall analyze, explain, and utilize one of the available methods to organize and plan a farm business.

   1. Evaluate the factors that affect farm profit.
   2. Explain the effects that enterprise choice can have on a farm.
   3. Evaluate crop, livestock, labor, and power efficiency.
   4. Recognize the methods utilized in measuring and increasing farm size.
   5. Explain why larger volume operations are more efficient.
   6. Explore the advantages or disadvantages to alternative agriculture production and value-adding enterprises.

D-2. Students shall analyze the different cropping systems utilized by farm managers.

   1. Analyze each crop that could be used in the farming program.
   2. Describe the advantages and disadvantages of crop rotations.
   3. Demonstrate the use of soil maps in establishing a cropping program.
   4. Diagram the most efficient layout of fields and the farming practices which should be utilized.
   5. Examine the feasibility of double cropping for the local area.
   6. Identify the philosophy behind the current government program.
   7. Identify the various resources that can be utilized in planning a cropping program - both government and non-government.
   8. Describe the interrelationship between tillage systems and cropping systems.

D-3. Students shall examine the concepts involved in fertility planning and pest management.

   1. Explain the importance of proper fertilization and pesticide use.
   2. Analyze the various processes by which soils lose nutrients.
   3. Evaluate the importance of soil testing in a fertility program.
4. Describe the factors which affect the amount of fertilizer applied to a field.

5. Evaluate the various management systems which relate to fertility planning and pest management.

6. Analyze the advantages and disadvantages of each management system.

7. Evaluate the various methods utilized in reduction of fertilizer costs.

8. Identify the major factors that influence the use of pesticides.

9. Describe the steps involved in selecting a chemical pesticide.

D-4. Students shall determine the factors involved in developing a livestock program.

1. Evaluate the advantages and disadvantages of integrating livestock production into a farming program.

2. Identify the factors that determine the type of livestock to produce on a specific farm.

3. Evaluate the economic characteristics of raising the various types of livestock.

4. Explain the factors involved in deciding upon the number of livestock to raise on a farm.

5. Analyze the advantages and disadvantages of specialization.

6. Identify the factors utilized in selecting the type and amount of livestock for a specific farm.

D-5. Students shall identify the process used to select and design the buildings necessary for a farming operation.

1. Explain the factors that make investment in buildings unique.

2. Compare and contrast high investment, low labor buildings and low investment, high labor buildings.

3. Analyze the factors which should be considered when deciding to add new buildings.

4. Assess the advantages and disadvantages of the following alternatives to new building construction:
   a. Remodel old buildings
   b. Providing your own labor versus hiring the construction done
   c. Renting buildings

5. Identify the cash flow needs in building construction.

6. Explain and demonstrate how to calculate the ownership costs of buildings.

D-6. Students shall investigate the decisions utilized in the management of agricultural machinery and equipment.
1. Evaluate the factors to consider when selecting the amount and size of equipment to purchase.

2. Identify and explain the costs involved in owning and using machinery.

3. Evaluate the following management problems as they relate to machinery:
   a. Deciding when to trade
   b. New versus used machinery
   c. Custom work
   d. Joint ownership of machinery
   e. Leasing machinery

4. Identify the factors that farm managers can utilize in reducing costs and improving the efficiency when using machinery.

D-7. Students shall examine the methods utilized and their importance in managing farm labor.

1. Explain the importance of labor management and labor efficiency.

2. Identify the factors to consider when deciding to add more labor to the farm business.

3. Identify the methods used in finding and retaining good farm labor.

4. Compare and contrast the various types of incentive plans.

5. Identify the methods which can be used in order to comply with the various farm labor laws.

E-1. Students shall explore the factors to consider when making the decision to join the family farm.

1. Analyze the family farm business to determine whether or not it is capable of providing sufficient income for two or more families.

2. Explain the following methods of sharing income:
   a. Wages
   b. Wages plus sharing of profits
   c. Partnership
   d. Corporation

3. Explain the importance of written contracts.

4. Assess the factors that may affect a person's entry into the family farm business.

5. Explain the role of record keeping in any farm agreement.

6. Identify the necessity for estate planning.

E-2. Students shall identify and evaluate the factors which need to be considered when renting land.

1. Evaluate the advantages and disadvantages of renting land compared to land ownership.
2. Identify and explain the factors involved in a good landlord-tenant relationship.

3. Analyze the different types of lease agreements.

4. Describe the importance of providing a fair lease agreement and identify the methods used to produce such an agreement.

E-3. Students shall identify and evaluate the factors to consider when buying a farm.

1. Identify and assess the various methods of land appraisal.

2. Identify the factors to consider and evaluate the economic feasibility of buying land.

3. Evaluate the factors which should be considered before purchasing a farm.

4. Describe the steps involved in buying land.

5. Determine the necessary steps to take when closing the sale.

6. Describe the different types of deeds.

7. Evaluate the two methods of financing land purchases.

F-1. Students shall recognize the importance of keeping records and identify the kinds of records which should be kept.

1. Analyze the various reasons for farmers to keep records.

2. Describe the following kinds of records:
   a. Balance sheet
   b. Profit/loss statement
   c. Cash flow statements
   d. Enterprise accounts
   e. Production records
   f. Personal records
   g. Hired labor records
   h. Inventory

F-2. Students shall recognize the importance of and become adept in the manipulation of data bases and filing systems.

1. Analyze the concept and compare the differences between data bases and filing systems.

2. Examine the necessity for data management.

F-3. Students shall identify and explain the uses for computer hardware and software.

1. Compare and contrast the differences between computer hardware and software.

2. Identify hardware and software and explain how they are utilized.
F-4. Students shall recognize the importance of and become adept in the utilization of a word processing system.

1. Explain the concept of word processing.
2. Define the basic word processing functions.
3. Demonstrate the uses of a spell check.
4. Discuss the advantages and disadvantages of using word processors as contrasted to using other modes of written communication.

F-5. Students shall recognize the importance of and become adept in the use of spreadsheets.

1. Identify and explain the objectives of spreadsheets.
2. Describe the basic elements of a spreadsheet.
3. Identify and explain the functional commands used to construct and manipulate a computer spreadsheet.
G-1. Students shall recognize and analyze the impact of the various kinds of risks.
   1. Identify, explain, and provide examples of the various kinds of risks involved in farm management.

G-2. Students shall assess the importance of insurance as it is used to reduce risks.
   1. Identify and provide examples of risk and loss and their relationship to insurance.
   2. Define liability and property insurance.
   3. Assess the importance of life and health insurance to a farm operation.
   4. Identify and evaluate the reasons for having crop insurance.
   5. Utilizing a cash flow projection, compute the amount of insurance that a operation would need.
   6. Explain the Government Commodity Program.

G-3. Students shall investigate a market plan to reduce risks.
   1. Explain the importance of planning a market strategy.
   2. Evaluate the affect that a small change in price would have upon net farm profits.
   3. Identify and discuss the factors which affect the supply and demand of farm products.
   4. Determine how price is discovered.
   5. Evaluate and explain how to utilize the following in reducing price risks in farming:
      a. Forward cash contracts
      b. Hedging
      c. Options

G-4. Students shall investigate the use of credit to reduce risks.
   1. Assess the importance of good credit to farming.
   2. Identify and explain the principles of good credit use.
   3. Compare and contrast the various types of credit.
   4. Evaluate the various methods of interest calculators.
   5. Identify the characteristics that creditors look for in borrowers.
   6. Identify and evaluate the various sources of farm credit.

H. Students shall assess and evaluate a complete farming operation.
   1. This unit is intended to be used in one of the following ways:
a. As a final exam for the course
b. As a review for a final exam
c. As preparation for a State and/or National Farm Business Management Contest
Food Science

Unit 1: Consumer Education

Lesson 1: Food Labeling

1. Identify the major components of a food label.

2. Identify and classify functions of chemicals, additives, and ingredients which are found on food labels.

3. Explain the functions of specific elements of a food label.

4. Identify and explain the responsibility of food processors and the role that food labels have in the production of a food product.

5. Read a label and compare nutrition information of various food ingredients.

   Activity 1: Labeling the Ultimate Pizza
   1. Identify the important parts of a label and explain the reason for food labeling.

   Activity 2: What's in a Label?
   1. Describe the various functions of additives in our food products.

Lesson 2: Food Economics

1. Indicate the size and scope of the food industry in the U.S.

2. Explain how the Consumer Price Index (CPI) is calculated.

3. Explain how money is spent within the food industry.

4. Explain the food industry system, farm to retail.

   Activity 1: Comparison Shopping
   1. Compare the prices between fast foods and foods prepared at home.

   Activity 2: Consumer Price Index
   1. Determine price changes in the market and identify and explain factors which influenced these changes.

Unit 2: Careers in Food Science

Lesson 1: Careers in Food Science

1. Identify various food science careers and their educational requirements.

2. Discuss the different food science occupations involved in the production of a food product.
3. Identify post secondary institutions that have a food science program.

4. Identify local food science/processing companies.

Activity 1: IFT Video "In Good Taste"

1. Become aware of career opportunities in the food science industry.

Activity 2: Sensory Evaluation

1. Discriminate between processed poultry and meat products using basic sensory evaluation techniques.

Unit 3: Food Processing/Engineering

Lesson 1: Food Processing

1. Identify and explain the food processing procedures used in the U.S. to maintain and preserve foods.

2. Explain the conditions necessary for microbial growth and the role processing plays in retarding this growth.

3. Define the important terms for processing foods.

4. Explain the process for making a cultured dairy product. Explain the difference between "good" and "harmful" bacteria and how these bacteria are controlled in the production of dairy products.

   Activity 1: Dairy Products Lab

   1. Explain the basic emulsion principles used when butter, cheese, and ice cream are made.

   Activity 2: Making Yogurt

   1. Explain the difference between "good" and "harmful" bacteria and how these bacteria are controlled in the production of yogurt.

Lesson 2: Heat Processing and Food Irradiation

1. Identify and explain the various types of processes used to preserve and protect foods through the use of thermal procedures.

2. Explain how to safely can foods using heat processing.

3. Explain food irradiation and how it is being used in the food industry and the controversy that surrounds this issue.

4. Explain how food dehydration works.

5. Identify and explain the terminology associated with heat processing.

   Activity 1: Food Dehydration

   1. Observe the effects of dehydration on food as a method of preservation.
Lesson 3: Frozen Foods

1. Identify and explain terminology relating to freezing of foods.

2. Determine the procedures to use when purchasing and storing foods in the home freezer and the problems (microorganisms which can grow at or near freezing temperature).

3. Identify and explain what happens to food when it is stored in a freezer with improper wrapping.

4. Explain refrigerator load and calculate BTUs needed given the parameters of specific foods.

5. Explain the relationship between temperature and chemical reactions within foods.

   Activity 1: Freezing Experiment
   1. Examine the effects of packaging a food with a variety of common packaging materials.

   Activity 2: Calculation of Refrigeration Load
   1. Calculate the amount of BTUs required to cool a food product.

Lesson 4: Packaging

1. Identify and explain the requirements and functions of food containers.

2. Explain the importance packaging has on protecting the quality and safety of foods we consume.

3. Explain the effect packaging materials have on environmental concerns.

4. Explain the value of packaging in the marketing of food products.

5. Design a laminated popcorn package that will improve and explain popping rate.

   Activity 1: Effects of Light on Food Flavor
   1. Observe and sample the effect light has on the flavor of corn chips stored in different ways for various periods of time.

   Activity 2: Popcorn Packaging
   1. Investigate the technology behind the POP! in microwave popcorn.

   Activity 3: Archeology Food Container Dig
   1. Discover the impact food packages have on the environment.

Unit 4: Food Microbiology

Lesson 1: Undesirable Microbial Growth in Foods - Spoilage

1. Explain the concept of available water and its relation to food spoilage/preservation.
2. Describe the morphology and cellular arrangement of microorganisms.
3. Write the chemical equation for the action of catalase.
4. Name three distinguishing characteristics of spoilage bacteria.
5. Define the characteristics of thermophilic, psychrotropic, and mesophilic bacteria.
6. List three basic conditions that promote bacterial growth.

Activity 1: Spoilage

1. Present the various undesirable microorganisms and spoilage patterns in food products with low and high water activity.

Lesson 2: Undesirable Microbial Growth in Foods - Subsurface Mold Growth in Foods

1. Identify the structural parts of common molds.
2. Discuss the difference between aerial and submerged mold growth.
3. Name several methods of food processing used to control mold growth.

Activity 1: Subsurface Mold Growth in Foods

1. Determine the difference between aerial and submerged mold growth and their respective relationship to food safety and spoilage.

Lesson 3: Methods of Preventing Microbial Growth in Foods - Control of Molds in Foods

1. Determine conditions that contribute to mold growth in foods.
2. Identify organic and non-organic preservatives used in the processing/preparation of food.
3. Identify common food preservatives which are best for preventing mold growth in common food products (bread).
4. Differentiate between Penicillium or Aspergillus mold.
Activity 1: Subsurface Mold Growth in Food - Control of Molds in Breads

1. Differentiate and distinguish the role of molds in spoilage of bread.

Lesson 4: Desirable Microbial Growth in Foods - Experimental Modification of Pickle Fermentation

1. Discuss ways of controlling unwanted microorganisms in food.
2. Discuss salting as a preservative method.
3. Name three pickled vegetable products.
4. Modify factors that impact on pickle fermentation and quality of finished product.

Activity 1: Experimental Modification of Pickle Fermentation

1. Modify one or more factors that would have a major impact on the pickle fermentation, and therefore, on the quality of the finished product.

Lesson 5: Desirable Microbial Growth in Foods - Yeast Fermentation

1. Describe the role of bacteria, mold(s) and yeast(s) in food processing and/or production.
2. Evaluate baked products through selected criteria that reflect variations in ingredients and preparation techniques.
3. Describe the morphology and chemical aspect of the fermentation process.
4. Name five foods which are processed via yeast fermentation.
5. List the three basic conditions which bacteria need to grow.

Activity 1: Yeast Fermentation

1. Observe the function of a yeast and compare the density of fermented dough with control (non-fermented dough).

Activity 2: Variation in Carbon Dioxide (CO2) Production

1. Observe and compare the development of carbon dioxide from yeast, water and varying amounts of sugar.
Food Safety

Unit 5: Consumer Education

Lesson 1: Quality/Abundance/Choice

1. Identify the types of food eaten in the past.
2. Compare and contrast the eating habits of Americans in the 1990's versus Americans in the Pre World Ware II era.
3. Estimate the total amount of money spent on food during a typical week.
4. Describe the importance of chemicals and technology to food production.

Activity 1: A One-Week Look at My Food Consumption and Cost
1. Evaluate the type and quantity of food consumed during one week.

Activity 2: A Blast to the Past
1. Become familiar with the ways that Americans eating habits have changed during the 20th century.

Lesson 2: Storage/Transportation/Packaging

1. Explain how people work together to ensure a safe food supply.
2. Describe the proper procedures for food storage and increase the storage time of certain food products.
3. Describe how to safely pack a cooler for a trip or vacation.
4. Explain the importance of proper food packaging.

Activity 1: Potato Chips and Oxidative Rancidity
1. Explain the presence of off-flavors in food products caused by oxidative rancidity
2. Identify practices for controlling oxidative rancidity.
3. Predict deteriorative changes in food products containing high amounts of unsaturated and polyunsaturated fats given certain conditions of processing and storage.

Activity 2: Bacteria Are Found Everywhere
1. Comprehend that microorganisms are found everywhere and can grow under favorable conditions.
Unit 6: Biotechnology

Lesson 1: Biotechnology in Food Safety

1. Define biotechnology and provide examples of where biotechnology is utilized in production of food processing, production and the development of food and fiber.

2. Explain the impact of biotechnology on food safety, human health and wellness.

3. Define three examples of microbial biotechnology related to food safety.

4. Identify the economic and ethical advantages and disadvantages of using biotechnology to produce, process and preserve food products.

   Activity 1: A Bioengineered Food Product

   1. Explain the use of biotechnology in the efficient and economical production of food products.

   2. Process hard curd (the primary step in cheese production) using rennin.

   Activity 2: Isolation of DNA From Yeast

   1. Simulate the isolation of DNA from an agricultural product.

Unit 7: Risk Assessment

Lesson 1: What is Risk?

1. Explain what risk is and compare it to known events.

2. Identify and explain the real risks associated with life experiences.

3. Explain the risks associated with potential carcinogenic hazards.

4. Explain risk and benefits of using pesticides to produce foods.

   Activity 1: Risk/Benefit

   1. Identify risks/threats to our food supply and to describe possible causes and remedies to those threats/risks.

   Activity 2: Personal Control of Risk

   1. Explain how we can control actions which may lead to a premature cause of death.

Lesson 2: Food Safety Decisions

1. Identify and explain the differences between the public's ranking of food safety concerns and the FDA's ranking of food safety concerns.

2. Explain how pesticides can be effectively reduced in the diet.

3. Evaluate, analyze, and compare messages which are sent to the consumer concerning food safety issues.
4. Identify what signals to be aware of in food safety messages which might be "loaded."

5. Determine the amount of iron supplement which is added to the diet, as well as the input this product can have on human health safety.

6. Explain the "zero risk" concept, identify and evaluate the threats to our food supply, causes for these threats and possible remedies.

   Activity 1: Understanding the Media - Food Safety Decisions
   1. Develop analytical skills needed to evaluate the messages consumers receive about food safety issues in the media.

   Activity 2: Nitrates in Meat - Food Safety Decisions
   1. Observe the differences between fresh red meat with and without sodium nitrate added, and observe the changes after both samples are heated.

Unit 8: Toxicology
Lesson 1: Toxicology
1. Explain the level of chemical residues found on foods.

2. Explain the legal use and restrictions of pesticides on food crops.

3. Explain how plants and animals are used to evaluate the amount of chemical residues present in foods.

4. Explain how animals are used to test for carcinogenic substances.
   Activity 1: Testing Pesticide Residue
   1. Examine the effects of a residual chemical on the water flea, Daphnia magna.

   Activity 2: Pesticide Residue Testing Using Black-Eyed Peas
   1. Perform a simulated test for the presence of pesticide residues.

Lesson 2: Natural Toxins
1. Identify common substances which are toxic to humans.

2. Define toxicity and explain the role moderation has in our lives.

3. Identify common food allergies that are hazardous to certain individuals.

4. Explain conditions under which natural toxins can cause negative consequences.

5. Experiment with natural toxins to develop a pesticide.
   Activity 1: Naturally Occurring Toxin Poster
   1. Develop a poster that students can share with others to inform them of the potential problems associated with naturally occurring toxins.
Activity 2: Natural Toxicants - Testing for Toxicants

1. Determine the level of natural food toxicant solanine which is lethal to the water flea, Daphnia magna.

Unit 9: Regulations that Protect Our Food Supply

Lesson 1: Regulations that Protect Our Food Supply

1. Identify the agencies that determine food safety regulations.
2. Identify regulations that food processing companies follow to produce a safe food product.
3. Describe the process of inspecting a food facility for safe sanitation practices.
4. Collect and analyze data on a food facility's sanitation process and compare with that of peers and ideal standard.

Activity 1: Food Products - Who Regulates Them?

1. Become familiar with the regulatory process of food products.

Activity 2: Inspecting A Food Warehouse Facility - The Checks For Success

1. Become familiar with the inspection procedures of a food warehouse facility.

Unit 10: Production's Effect on Food Safety

Lesson 1: Organic Farming

1. Identify what constitutes an organic food and how they are regulated.
2. Differentiate the cost of organic and conventionally grown foods.
3. Determine if organic foods are more nutritious than conventional counterparts.
4. Determine whether organic foods are safer than foods grown with the help of agrichemicals.
Activity 1: Becoming Familiar With the Agrichemical Industry

1. Comprehend how modern food production relies on agrichemicals to provide safe and healthy foods with a major concern toward the environment, humans and animals.

Activity 2: Comparing the Growth of Organically-Grown to Conventionally-Grown Plants

1. Identify whether livestock wastes can be used as an alternative fertilizer resource, producing the same growth and development characteristics as compared to plants that have been treated with an inorganic or commercial fertilizer.

Lesson 2: Processing and Field Packaging

1. Understand that proper food processing improves food quality.
2. Realize that nutrient retention is enhanced through food processing.
3. Learn the importance and methods of food processing.
4. Determine how fruits and vegetables are packaged and stored.
5. Develop an understanding of how potatoes are harvested and stored.

Activity 1: Preserving Foods

1. Describe how molds can be controlled through the use of organic acid which act as preservatives.

Activity 2: Effects of Various Cooling Methods on Fruit and Vegetable Tissue Quality

1. Determine the effect of various cooling methods on fruit and vegetable tissue quality as determined by their appearance and weight loss.

Unit 11: Safe Handling of Food

Lesson 1: Safe Handling Beyond the Retail and Wholesale Shelf

1. Identify food handling conditions that are potential antecedents to a food borne illness(es).
2. List five food handling practices that will reduce the incidence or potential of food borne illness(es).
3. Conduct bacteriological examination of food equipment and eating utensils.
4. Conduct chemical analysis of milk samples stored/handled several different ways.
5. Identify five food purchasing safety practices.
6. Identify five food storage safety practices.
Activity 1: Bacteriological Examination of Food Equipment and Eating Utensils

1. Emphasize the importance of clean equipment and sanitary practices in food preparation and processing.

Activity 2: Bacteria in Milk - A Chemical Analysis

1. Emphasize the importance of sanitary and safe handling practices in milk handling and processing.

Unit 12: Nutrition

Lesson 1: Consumer Education

1. Identify and list the information provided by a label on a retail food product.
2. Evaluate the influence of the media in communicating nutritional facts and myths.
3. Identify the scientific basis for refuting the claims of food companies in promoting specific foods or additives to foods to improve one's health.
4. Collect and analyze the nutritional components of daily dietary intake and compare with that of peers and ideal standard.

Activity 1: Reading Labels on Products Containing Sugar

1. Become familiar with labeling on processed foods.

Activity 2: Designing a Package for a Food Product

1. Identify and list the information necessary on a retail food label.

Unit 13: Basic Components of Food

Lesson 1: Basic Components of Food

1. Identify food components and describe their nutritional contribution to diet.
2. Quantify the amount of water and fat in various food products.
3. Describe the nutritional value of selected food products.
4. Describe how food scientists have altered food's basic components to develop innovative products in meeting consumer demands.

Activity 1: Identifying Basic Components of Food

1. Determine the presence of complex carbohydrates, simple carbohydrates, protein, fat, minerals, and vitamin C in common foods.

Activity 2: Effects of Changing to a Low Fat Milk

1. Quantify how many calories and how many grams of fat would be saved by changing to lower fat milk.
Unit 14: Effects of Food on Health

Lesson 1: Effects of Food on Health

1. Describe the effects of current diet in relation to daily activities.
2. Describe the effects of diets on long term health.
3. Describe the cause and effect relationship between food intake and wellness.
4. Explain the specific effects of nutritional deficiencies in human diets.

Activity 1: Nutritious Oatmeal Cookies

1. Prepare oatmeal cookies with varying levels of soy flour in order to produce a cookie that is more nutritious than the traditional recipe, but still tastes good.

Activity 2: Dining at McDonald's

1. Evaluate the nutritional impact of eating at McDonald's for a full day.

Lesson 2: Enhancing the Nutritional Value of Our Foods

1. Identify examples of what the food industry has done to enhance the nutritional value of our diets.
2. Describe the scientific methods used by the food industry to enhance the nutritional value of processed foods.
3. Describe the sequence of events that occur during the development of a low fat food product.

Activity 1: Preparing Low Fat Mayonnaise Products

1. Prepare mayonnaise with little or no cholesterol, that has as good an appearance, taste, and texture as regular mayonnaise.

Activity 2: Binding Water in Meat Products

1. Prepare ground beef with varying levels of salt and rice in order to produce a product that is more nutritious than traditional lean/fat mixtures, but still tastes good.
Horticultural Science

A. Students shall examine the methods of plant propagation.
   1. Explain sexual reproduction and discuss the long term benefits and problems to the species with this type of reproduction.
   2. Conduct an experiment comparing the environments needed for germination of various seeds and develop appropriate criteria for three types of seeds.
   3. Compare and contrast the steps in germination of a monocot and a dicot.
   4. Describe the methods used to overcome seed dormancy and relate this problem to attempts to improve crop production in developing countries.
   5. Explain the damage done to a root system by improper transplanting techniques, and discuss the correct procedures when transplanting seedlings.
   6. Discuss several of the primary differences between monocots and dicots and explain how these differences influence plans for commercial plant propagation.
   7. Explain the methods of asexual propagation and identify which species and varieties are best suited to each method.
   8. Discuss the roles of vermiculite and perlite in the establishment of a good rooting medium.
   9. Describe the uses of synthetic rooting hormones and explain the varying need for such supplementation.
  10. Develop a schedule for plant propagation to meet seasonal production demands for plants such as poinsettias. Discuss such constraints as varieties, pot size, type of greenhouse, and overhead.

B. Students shall investigate factors in the environment affecting plant growth.
   1. Describe factors to be considered in selecting a greenhouse heating system.
   2. Explain how heat effects greenhouse crops and photosynthesis.
   3. Discuss the importance of a proper ventilation system to greenhouse crops.
   4. Explain how the gaseous components of air in the greenhouse effect plant growth.
   5. Examine the effects of agricultural chemicals on air and water pollution. Relate these to environmental concerns of the public.
   6. Explain the relationship between greenhouse humidity and plant health. Identify multiple systems for controlling humidity and relate each to specific plant needs.
7. Describe the best match of irrigation systems with type of plant and plant growing medium.

8. Explain the importance of light intensity and duration to plant growth. Cite several examples of plants with differing light needs.

9. Discuss the methods of light control and the effects that each has on plant growth.

10. Describe the effect of light intensity on photosynthesis in greenhouse plants.

11. Compare and contrast an open and a closed environmental system.

C. Students shall analyze growth media.

1. Describe the desired characteristics of an ideal growing medium.

2. Develop an argument both for and against the use of amended soil and unamended soil. Identify plants that do best in each type.

3. Discuss the methods of sterilizing soil media and explain the advantages and disadvantages of each method.

4. Describe the effects of proper versus improper watering of plants and relate these to the functions of water in plant growth.

5. Explain porosity of the growing medium and how container size affects root growth.

6. Evaluate different methods of watering greenhouse plants and determine the appropriate method for three specific plants.

7. Describe the advantages and disadvantages of including fertilizer and pesticides in the water supply. Explain how humans must balance environmental concerns with the need and desire for improved plants.

8. Explain the aspect of growth influenced by each of the essential elements needed for plant growth.

9. Describe the deficiency symptoms of three major plant nutrients.

10. Explain the techniques of soil sampling and relate this process to testing the growing medium and interpreting the results to recommend fertilizer applications and pH treatment.

11. Discuss the uses of chemicals to regulate plant growth. Describe the decision-making process related to the use of stimulants, retardants, and rooting hormones.

12. Describe the factors required by micro-organisms in the decomposition of organic matter and relate their actions to the idea of compost.

13. Prepare a persuasive argument to convince a customer to use mulch on newly transplanted Bradford pear trees.

D. Students shall examine the management practices of field and greenhouse production.

1. Explain the differences between field production and greenhouse production and the plants produced in each.
2. Describe the use and application of harvest-aid chemicals. Address environmental issues as well as profitability concerns.

3. Discuss the use of chemicals to control rodents and predators in the context of the need for environmental safety and in response to animal rights activists.

4. Generate a plan to water greenhouse and field plants according to selected scheduled times and requirements.

5. Plan a project for growing poinsettias for a money raising event. Determine the location, size, and organization for a greenhouse and select the appropriate plants, supplies, and accessories needed.

6. Identify parts of a greenhouse and describe interior layouts best suited for different plants.

7. Interpret blueprints of a greenhouse or other growing structure and match the proper design to desired use.

8. Prepare a speech for middle school students about safety information found on labels of pesticides and instructions of equipment. Cite examples of different classes of pesticides and appropriate safety measures.

E. Students shall analyze marketing and market management.

1. Describe the differences in the levels of marketing and the marketing options available to horticulture producers. Identify advantages and disadvantages of each for specific crop types.

2. Address the problem of packaging and shipping fruits, vegetables, and other horticultural products.

3. Compare three methods of packaging ornamental plants. Describe a specific plan for their marketing in the community.

4. Describe problems associated with warehousing fruits and vegetables. Address the public's concern that tomatoes are always hard and unappealing when picked green. Describe changes that could be made to improve fruit and vegetable quality to the consumer.

5. Explain the benefits of wholesale and retail marketing for a particular product. Describe how these ideas could be used in republics of the former Soviet Union to develop a better consumer food supply.

6. Compare and contrast packaging units commonly used in direct-to-consumer and wholesale markets. Identify specific examples of good and bad usage.

7. Describe the processes used to maintain plant quality during the marketing process.

8. Explain the basic and secondary considerations of market analysis and describe each relative to its importance.

9. Choose a horticultural product and design a market analysis plan specific to it.
F. Students shall investigate practices used to produce herbaceous, woody, and nursery stock.

1. Discuss the Indiana definition and the identifiable characteristics of plants known as nursery stock. Identify commonly sold items which are not classified as nursery stock and develop a rationale for this differentiation.

2. Compare the methods and procedures used to propagate nursery stock. Identify specific plants that use each method and describe advantages and disadvantages.

3. Describe the structures, equipment, and material used in the production of nursery stock from an environmentalist point of view. Justify the use of chemicals and other products.

4. Address the maintenance and overwintering storage of nursery stock for various climates.

5. Explain the procedures used to harvest and handle field grown nursery stock. Develop an argument for each method and cite examples of plants for which it is best suited.

G. Students shall analyze fruit, nut, and vegetable production practices.

1. Plan an orchard including the necessary steps involved in site selection, soil preparation, plant propagation, and planting.

2. Generate a plan to address common preparation, planting, cultivating, pest, and environmental control problems.

3. Describe unique characteristics of various cultivars that have been recommended for Indiana.

4. Discuss proper harvesting techniques needed for specific plant characteristics.

5. Design a strategy for implementing fruit or vegetable production on the family farm or school land laboratory. Address the timing of planting, planting systems, distance, environmental problems and diseases.

6. Describe the important factors involved with plant selection of fruit and edible nut varieties commonly grown in Indiana.

7. Compare accepted and new practices used in growing fruit, vegetable, and nut varieties. Cite reasons for the new practices and describe how aspects of former procedures have been improved.

8. Use a frost-free map and planting chart to determine planting dates for locally grown fruits, nuts, and vegetables. Develop a proposal to increase production based on the information.

9. Describe methods used to protect plants from freeze and frost damage. Cite examples of those needed in Indiana and southern states for specific crops.

10. Explain the importance of selecting cultivars which are adapted to growing in Indiana and have a high level of consumer demand. Relate this to a market analysis for a specific product.

11. Explain hydroponics and describe the specific difficulties that must be overcome for successful yields.
12. Prepare a plan for a science fair project on hydroponics. Include aspects of pH variance and nutrient level changes.

13. Explain proper pruning techniques that insure healthy, productive fruiting wood and encourage good annual yield of quality fruit. Address the purposes of pruning and tools needed as well as specific practices for each major type of fruit and nut tree.

14. Develop guidelines for effective pest management using the IPM system and philosophy.

15. Describe management practices within the orchard to produce the optimum growth, yield, and maintenance of the orchard site. Include aspects of soil pH and nutrients, fertilization practices, soil texture, and weed control.

16. Describe procedures for picking and storing orchard products to insure a long storage life. Address how these procedures effect the five quality components of fresh produce.

17. Explain insurance requirements for the various types of horticultural businesses.

18. Generate a budget to establish price and profit in fruit and vegetable production.

H. Students shall explore an environmentally sound pest management system.

1. Discuss the common pests of horticultural plants and describe the damage inflicted to the plants.

2. Explain the different categories of plant diseases for flowers, vegetables, lawns, trees and shrubs, citing examples for each.

3. Examine the methods used to control plant pests and identify the advantages and disadvantages of each.

4. Prepare a training film for people using pesticides and herbicides to demonstrate the safety procedures and handling requirements. Include the different formulations and label instructions of pesticides as well as dilution ratios for chemicals.

5. Explain how humans become poisoned by pesticides. Describe what systems are affected and the proper first aid procedures for pesticide poisoning.

6. Using non-toxic solutions, design and perform an experiment to calibrate chemical application equipment.

7. Describe the insects known to harm crops in Indiana and discuss insecticide responses to the problem based upon the insect's type of metamorphosis.

8. Discuss the physiological principles of herbicides and relate the action to aspects of plant growth.

9. Describe several harmful insects and how they cause damage to crops. Cite examples of leg, wing, antenna and mouthparts of the most destructive insects.

10. Explain the classification of herbicides and discuss the appropriate uses for each type, citing specific examples.

11. Interpret the impact of current state and federal regulations on pest control measures. Describe how governmental regulations have influenced the quality of fruit and vegetable products in the U.S.
12. Prepare a speech to be given before a student group justifying the need for the Environmental Protection Agency. Address what functions are performed by the EPA and what impact the EPA has had on the life of the average person in the U.S.

I. Students shall examine career opportunities in horticultural science.

1. Discuss the variety of careers in horticultural science including growers, workers, and managers and their relative contributions to the industry.

2. Describe the economic importance of the horticultural science industry. Relate current trends to future need for horticultural workers.

3. Choose a specific job in the horticultural field. Determine the educational goals needed to gain employment in that area and requirements for continued employment and advancement.
Landscape Management

A-1. Students shall identify the fundamentals of insect development, the various insect pests responsible for causing damage in the landscape and determine the proper treatments.

1. Given pictures, identify various common pests found in the landscape.
2. Identify the characteristic evidence of insect pest feeding on trees and shrubs by actual signs and symptoms.
3. Determine the method of feeding for various insect pests.
4. Determine the proper control for each of the insect pests.
5. Identify the insects which are considered to be beneficial to man and explain how they are beneficial.
6. Identify and locate the basic parts of an insect.
7. Identify and differentiate between the various mouth parts found on insects.
8. Explain the growth and metamorphosis of insects.
9. Identify the various methods of control for insect pests and explain the principles of each method.

A-2. Students shall recognize the principles of disease, identify the various diseases responsible for causing damage in the landscape and determine the proper treatment.

1. Identify the biological causes of diseases and the definition of plant disease.
2. Identify the pathogens that cause plant diseases and explain their development.
3. Explain the "disease triangle" and the components of a disease.
4. Identify the various methods which can be used to control plant diseases in an integrated pest management system.
5. Evaluate the principles of diagnosing plant disease.
6. Identify the common diseases found in the landscape and the symptoms and signs which indicate their presence.
7. Evaluate the accepted recommended controls for the various landscape plant diseases.
8. Recognize the landscape problems which are classified as "people pressure diseases", determine their causes, and identify prevention methods.

A-3. Students shall identify the basic fundamentals of weed science, the various weeds found in the lawn and landscape and determine the proper methods of treatment.

1. Identify how weeds become pests and the problems that they cause in the landscape.
2. Identify the developmental stages and the life cycles.
3. Explain the procedure of classification and identify the various types of pest plants that are weeds.

4. Develop a weed control strategy and explain the procedures involved in the effective control of pest plants.

5. Compare and contrast the various methods of and the procedures involved in maintaining biological, cultural and/or chemical control.

6. Identify the various types of herbicides available and explain their methods of control.

7. Explain herbicide selectivity and identify the points of selectivity on a plant.

8. Given pictures, identify the common weeds which are problems in the landscape.

9. Determine the life cycle of common weeds and identify the recommended method of chemical control.

10. Explain the procedures involved in eliminating and maintaining a weed-free landscape.

A-4. Students shall analyze the client's site, using the proper diagnostic techniques, determine the problem, isolate the causes, and prescribe the proper treatment for the problem area.

1. Identify the techniques and procedures involved in conducting a proper diagnosis of a landscape site.

2. Evaluate the major steps to take in order to properly make a diagnosis.

3. Recognize the groups of agents that cause plant problems.

4. Recognize the importance of reference sources for determining plant problems.

5. Analyze a landscape site for potential pest problems and determine the possible causes utilizing the diagnosis procedures and the "Diagnostic Chart for Plant Problems".

6. Prepare a plant sample for submission to a diagnostic lab.

A-5. Students shall identify and explain the safety procedures used in the handling and application of horticultural chemicals.

1. Identify the different methods by which pesticides can enter the human body.

2. Identify the methods of accidental poisoning which can occur due to exposure to pesticides.

3. Identify the major ways in which humans can be exposed to pesticides.

4. Identify the proper protective clothing which a pesticide applicator should wear during application procedures.

5. Identify and explain the uses for the various protective equipment which pesticide applicators wear as safety devices.
6. Explain the "Protective Clothing and Equipment Guide" and identify precautionary actions to be taken prior to pesticide application.

7. Identify and explain the procedures for handling, storage, transportation, mixing and loading, and personal clean-up of pesticides.

8. Recognize the safety guidelines for the various application equipment.

9. Identify the basic safety guidelines for the application and cleaning of pesticide equipment.

10. Recognize the proper procedures for the disposal of pesticides.

11. Identify the basic first-aid procedures for pesticide poisoning and recognize the signs of accidental pesticide poisoning.

12. Identify the parts of a pesticide label and interpret the information found there.

A-6. Students shall analyze environmental quality as it relates to proper lawn and landscape maintenance.

1. Identify the impact that pesticides have on our environment and the effects on our natural resources.

2. Recognize the potential hazards and benefits that pesticides present in their use.

3. Recognize the effect of pesticides on our groundwater and the types of pesticides that contribute to its contamination.

4. Outline various ways to avoid groundwater contamination and help the environment when using pesticides.

5. Explain the procedures for reporting to environmental agencies.

B-1. Students shall investigate the different styles of landscape design.

1. Identify the types of design schemes used in landscape design (radial, arc tangent, rectilinear 90o, rectilinear 45o and curvilinear).

2. Compare and contrast the differences in each of the design themes.

3. Identify, from examples, the different styles and themes used in landscape design.

4. Identify and explain the concepts of symmetrical and asymmetrical balance.

B-2. Students shall investigate the importance of the landscape principles and the steps involved in the design process.

1. List the characteristics of a good landscape design.

2. Identify and explain the principles of landscape design.

3. List and discuss the steps involved in the design process.
4. Identify from graphic examples and define the following:

a. Order
b. Unity
c. Dominance
d. Repetition
e. Scale
f. Balance

5. Determine how each of the landscape principles are relative to and how each strongly influences the other principles in the landscape design.

B-3. Students shall survey and analyze the client's needs, in the landscape design process, utilizing the proper design question and discussion topics.

1. Identify and outline the client's needs prior to the development of a site design.
2. Determine what information needs to be obtained from the client during an initial site contact.
3. Apply the "Client Needs Checklist" to a residential design situation.
4. Determine how the client's needs will influence the landscape design.

B-4. Students shall generate a scale drawing of the client's property, which includes all existing fixed features and elements, using standard symbols and terms.

1. Utilize the engineer's scale in measuring and calculating dimensions on a drawing or design.
2. Demonstrate how the scale is used to calculate distances and measurements from the drawing to the site.
3. Organize all the collected data and produce a sketch of the landscape site which applies the proper scale to the drawing.
4. Recognize and construct the symbols used in landscape drawings for utilities, easements, and plant materials.
5. Identify and locate all existing plant material and fixed elements on the site, using the correct symbols.
6. Demonstrate the procedures involved in measuring a residential site and how to locate all of the existing features on the site.

B-5. Students shall develop a complete site analysis using standard symbols and features.

1. Explain the importance of a site analysis and the function that it serves in the development of the landscape.
2. List the important environmental and site features to consider when conducting a site analysis.

3. Examine a residential landscape and perform a site analysis. Be sure to perform the following functions:
   a. Prepare a site inventory/survey.
   b. Evaluate on-site and off-site conditions relative to the landscape site.
   c. Determine the climatic influences on the site.
   d. Determine the location of all utilities and easements.
   e. Evaluate and record all existing vegetation.
   f. Locate house orientation in relation to North.
   g. Consider views both on and off the site and the location of the site.

4. Record the conditions of the landscape site and prepare an analysis based on the list of considerations for a site analysis.

5. Recognize and reproduce the standard symbols used in the development of a site analysis.

6. Develop a graphic representation of the site analysis of a residential site.

B-6. Students shall provide a functional diagram of the client's site, locating the various activity areas on the site including the location, identification and explanation of the public, living and service areas.

1. Locate the public, living, and service areas on a residential site.

2. Identify the design fundamentals of landscaping the public area.

3. Outline the four landscape units considered in the public area and explain their principles involved in design.

4. Identify the design fundamentals for landscaping the living area.

5. Determine the important considerations in the development of the living area.

6. Identify the different units of the living area and how they affect the design.

7. Explain the importance of on-site and off-site view into the public and living areas.

8. Explain the relationship of the living area and the functional landscape.

9. Explain the purpose of the service area.

10. Explain how planning considerations will differ for the public, living, and service areas and determine the specific design considerations of each.

11. Apply all of the design information for the activity areas to a specific design problem.

B-7. Students shall draft, to scale, a landscape plan of the client's site including the proper planting symbols and labels on all of the proposed and existing features.

1. Apply all design techniques and site information to a master plan drawing of a residential site.
2. Identify and explain the uses of the basic equipment that a landscape designer uses in the drafting process.

3. Describe what a line drawing consists of and explain line weights, contrast, and quality.

4. Demonstrate the basic skills in the completion of a line drawing.

5. Define the various surfaces used for the production of line drawings.

6. Explain what a scale is and how it is used by the landscape designer.

7. Demonstrate the proper uses of a lettering guide.

8. List and explain the steps involved in the drawing sequence.

9. Explain the blueprint process.

10. Describe a plan drawing, the purpose of its use, and what is typically found on it.

11. Outline the steps involved in the construction of a landscape plan drawing and explain the process of each step.

B-8. Students shall develop a planting schedule for the implementation of the landscape design and identify plant materials listing quantity, interest, function and size.

1. Determine the effects of budget and maintenance on landscape installation.

2. Explain "phasing" and how it relates to the landscape design.

3. Determine the installation sequence of landscape materials and plants from the design.

4. Outline the order of implementation of the proposed elements on a landscape design.

5. Compose a plant list that describes the quantity, size, function, and landscape interest of the proposed plant materials.

6. Prepare a planting schedule from the plant list.

7. Explain the relationship between budget and design implementation.

C-1. Students shall identify woody trees, shrubs and ground covers of importance in Indiana.

1. Develop the ability to identify approximately 50 landscape plants of importance in Indiana by slides and physical characteristics, such as leaves and twigs.

2. Develop the ability to spell and pronounce, correctly, both common and botanical names of the plants.

3. Develop the knowledge of the outstanding landscape characteristics of trees, shrubs, and ground covers.

4. Develop a basic knowledge of the environmental requirements of these plants.

5. Develop a knowledge of the mature size of the plants.
C-2. Students shall identify herbaceous annual, perennial, and biennial plants by characteristics: size, interest and growth requirements.

1. Develop the ability to identify herbaceous annual, perennial, and biennial plants of importance in Indiana by slides, pictures, and live samples.

2. Develop the ability to spell and pronounce, correctly, both common and botanical names of the plants.

3. Develop the knowledge of the outstanding landscape characteristics of these selected plants, including the blooming period.

4. Develop a basic knowledge of the environmental requirements of these plants.

5. Develop a knowledge of the mature size of the plants.

6. Determine the life cycle of each plant as annual, perennial, or biennial.

7. Identify and demonstrate the handling and planting procedures for annual, perennial, and biennial plants, recognizing the differences in procedures of each.

C-3. Students shall select plants and materials for the landscape which satisfy the functional and aesthetic requirements of the site and the client.

1. Recognize the basic considerations in selecting landscape plants for the site.

2. Identify the environmental aspects of the site when choosing plants for it.

3. Identify the environmental influences on-site that affect plant selection:
   a. Air circulation
   b. Soil type
   c. Temperature
   d. Sunlight

4. Identify the term "microclimate" and explain its considerations on the site.

5. Recognize man's influence on the site and how man affects the conditions of the site.

6. Identify the criteria for selecting plants according to growth, visible characteristics, mature size, and life span.

7. Explain "overplanting" and outline ways to avoid such landscape plantings.

8. Recognize the functional and aesthetic uses of plants and landscape plantings.

9. Identify and explain how plants can form "outdoor rooms" in the landscape.

10. Recognize where to find sources of information concerning plants, their characteristics, and where to locate quality plant materials.
C-4. Identify and demonstrate the procedures used in soil preparation for landscape plants.

1. Recognize the three major classifications of soils.

2. Identify the major materials that make up the composition of our soils.

3. Recognize the importance of humus and the function that it serves in the soil.

4. Explain the function of air and water in the soil and the proper ratio of organic matter, minerals, water, and air.

5. Explain the procedures involved in "conditioning" the soil.

6. Identify the importance of a soil test and the basic procedures involved in taking a soil sample.

7. Identify the functions of fertilizer and the various types available for landscape plants.

8. Explain "pH" and its affect on soils and landscape plants.

9. Recognize the importance of proper drainage in soils and the affects upon landscape plants.

10. Identify the measures necessary to correct poorly drained soils.

11. Identify the function of the soil probe and demonstrate its use.

C-5. Students shall identify and demonstrate the procedures used in the installation of landscape plant material.

1. Identify and differentiate between the types of landscape plant stock: container, balled and burlapped, and bare-root material.

2. Indicate the best times to plant landscape plant materials and the importance of timing the planting procedures.

3. Recognize and explain the pre-plant operations involved in the installation process of plants.

4. Explain the plant care necessary for the types of materials prior to planting.

5. Describe the soil preparation process for landscape plants.

6. Explain the planting procedures for bare-root plants, balled and burlapped plants, and containerized plants.

7. Identify the guidelines for planting in specific soils.

8. Explain the procedures for planting in poorly drained soils.

9. Identify the post-planting procedures for landscape materials.

10. Explain the aspects of pruning newly planted landscape materials.

11. Explain the staking and guying process for newly planted trees.
12. Explain the importance of wrapping newly planted trees.
13. Identify the important aspects of watering newly installed landscape plants.
14. Explain "transplanting" and the process involved.
15. Explain the two-year process for transplanting.
16. Outline and demonstrate the techniques involved in the planting of a tree and/or shrub, including the pre-plant and post-planting care procedures.

C-6. Students shall identify the various structures used in the landscape and explain the principles involved in their use.

1. List the common structures used in the landscape and explain their purpose.
2. Identify the uses and types of grass pavers.
3. Identify the uses of railroad ties in the landscape and explain the treatment of ties.
4. Explain the basic techniques for the installation of railroad ties.
5. Discuss the function and location of patios in the landscape including the effects of size, shape, and materials.
6. Identify the functions of walkways in the residential site and explain the principles of location, shape, and material involved in their uses.
7. List the different functions of using a fence in the landscape and the treatment of such a structure.
8. Explain the use of landscape edging and the proper installation techniques involved.

D-1. Students shall examine and differentiate between the methods for the care of horticultural plants, materials and structures utilized in the landscape.

1. Explain and demonstrate the proper procedures for watering landscape plants.
2. Discuss and follow the proper procedures for staking, guying, and wrapping trees.
3. Explain the functions and characteristics of landscape mulches and employ the application procedures in the landscape.
4. Describe the functions and characteristics of fertilizing woody trees and shrubs and demonstrate the proper application of fertilizers in the landscape.
5. Outline the functions and demonstrate the proper procedures for pruning woody ornamental plants.

D-2. Students shall interpret how environmental influences affect plants and maintenance considerations, including hardiness zone, growth requirements and mature size.
1. Compare the various climatic factors that influence the landscape and the plant materials.

2. Explain the concept of "hardiness" and recognize the USDA Hardiness Zone map and evaluate its significance.

3. Compare and contrast the atmospheric factors that affect the landscape.

4. Analyze the root zone environment and its affect on plants.

5. Explain the concepts of mature plant size and spacing of plant materials.

6. Identify the maintenance considerations of landscape structures.

7. Recognize the basic techniques of design to achieve minimum maintenance.

D-3. Student shall complete the steps necessary to develop a landscape maintenance plan.

1. Practice the procedures and evaluate the criteria necessary to develop a landscape maintenance schedule for a residential site.

2. Utilize the tools needed to properly maintain a landscape site.

3. Explain the role that plants and materials take in developing the landscape maintenance plan and outline the procedure of organizing the materials.

4. Determine the levels of maintenance for residential sites and assess how the proper level of maintenance is determined for the site.

D-4. Students shall plan a year-round maintenance schedule for a landscape site.

1. Organize data and information collected from a residential landscape site to develop a year-round maintenance schedule.

2. Calculate the approximate time required to perform the maintenance tasks.

3. Organize landscape plants found on the landscape site into their respective categories and groups.

D-5. Students shall follow safety and maintenance procedures necessary for the operation of basic power equipment used in landscape maintenance operations.

1. Demonstrate the correct use of basic power equipment used in small maintenance operations.

2. Differentiate between the types of small engines used and analyze the principles of operation and use of the power equipment.

3. Discuss the proper maintenance and servicing procedures involved in the basic power equipment.
4. Utilize proper safety practices when using small power equipment in landscape operations.

E-1. Students shall examine career opportunities in and the importance of the landscape industry to ornamental horticulture.

1. Compare the various occupational options available in the field of landscape management and contrast their basic functions.

2. Examine the need for professionals in the landscape industry and their influence on the environment.

3. Investigate the job requirements, educational requirements and the public attitudes toward people in the landscape industry.

4. Demonstrate the use of the tools used by professionals in the landscape design industry.

E-2. Students shall put in action the equipment and materials needed to start a business in the landscape maintenance business.

1. Explain the definition of "landscape maintenance" and examine the various jobs required of the individual involved in maintaining the landscape.

2. Prioritize the personal requirements for beginning in the landscape maintenance business and evaluate the employment possibilities available.

3. Identify and explain the uses of the various "tools of the trade" used in maintaining the landscape.

4. Distinguish the relationship between landscape design and landscape maintenance.

E-3. Students shall apply personal communication skills and recommend appropriate employee/customer relations.

1. Support the need for effective communication skills in the horticulture industry.

2. Demonstrate the standards for handling customers in the retail business.

3. Demonstrate the standards for handling customer complaints.

4. Employ the methods and procedures for maintaining customer satisfaction.

E-4. Students shall make use of correct telephone procedures used in the horticulture industry.

1. Outline the basic points for dealing with people on the telephone.

2. Evaluate the influence of their speech habits on telephone voice tones.

3. Compare and contrast the professional phrasing used on the telephone to insure effectiveness and efficiency.

4. Examine the importance of good telephone etiquette and its importance in good business.
E-5. Students shall demonstrate the procedures of selling landscape planning to a potential client.

1. Put in action the proper procedures for presenting a landscape design to a potential client.
2. Outline the strategies for making a successful sale.
3. Summarize the methods for presenting a landscape design to a potential customer.

E-6. Students shall calculate materials, labor, and equipment needed for a landscape project in order to prepare a written estimate for a customer.

1. Make use of the features of a cost estimate for proposed landscape designs and landscape maintenance.
2. Utilize the correct procedures for calculating the necessary items in a cost estimate.
3. Prepare a cost estimate for a proposed landscape design and for a complete landscape maintenance project.

E-7. Students shall compose a project estimate to include labor, equipment and material needs for a completed landscape design.

1. Outline the procedures and sequences leading to the preparation of a landscape estimate and bid.
2. Justify the items that are included in a bid and the order in which they are listed.
3. Organize estimate materials into a written landscape bid.
4. Prepare a complete bid, proposal and contract for a landscape client from a landscape design and site information.
A. Students shall investigate the opportunities and requirements for employment in natural resources management and related industries.

1. Examine specific job titles and briefly explain their job responsibilities and duties.

2. Identify post-high school educational institutions offering natural resource courses.

B. Students shall analyze the historical and regional perspective of the forest industry and forest policy in Indiana and the United States.

1. Identify major forest areas in the United States and list a major marketable species in each area.

2. Identify major marketable timber species in Indiana, and the primary and secondary wood products.

3. Organize historic trends of land use and forest changes in Indiana leading to current forested acreage.

4. Evaluate the economic impact and cultural practices used in the production of Christmas trees, maple syrup, orchards and landscape nurseries.

5. Identify Indiana hardwoods that are highly valued firewood.

C. Students shall evaluate how forest plants provide watershed protection, recreational opportunities, domestic needs, and food and cover for wildlife.

1. Define forest components as related to the needs of wildlife.

2. Cite recreational uses of the forest and forest plants.

3. Analyze the relationship between forest conditions and water quality.

4. Examine products that originate from Indiana forests.

5. Define the term urban forestry and explain the significance of urban trees to human communities.
D. Students shall differentiate the factors which influence the growth, vigor, and occurrence of forest species and the methods of classifying trees.

1. Differentiate between biotic and abiotic site factors and relate how annual precipitation, seasonal temperature fluctuation and soil site index influence plant growth.

2. Compare and contrast dominant and suppressed trees and identify suppressed trees that have release potential.

3. Predict simple successional changes on a given site.

4. List the major forest types in Indiana.

5. Define silvicultural and dendrology.

6. Demonstrate correct tree planting techniques.

7. List external and internal parts of a tree and describe the function of each.

8. Demonstrate proficiency in using a dichotomous key to identify trees and shrubs.

9. Differentiate between angiosperms and gymnosperms.

10. Identify on sight common trees native to Indiana.

11. Identify on sight common forest insect pests and common diseases, the damage they cause and methods of prevention and treatment.

12. Compare the historical impact of major insect or disease occurrences in Indiana and the eastern U.S. (e.g., Dutch Elm Disease, Chestnut Blight, Gypsy Moth, etc.)

13. Discuss current genetic research to improve tree growth rate and resistance to insects and disease.

E. Students shall integrate the methods used in timber stand improvement, timber harvesting and forest management for multiple use.

1. Define the terms timber stand improvement, sustained yield and multiple use forest management, and list components considered in multiple use/multiple benefit land management.

2. Describe silvicultural practices used to manage and harvest the forest and demonstrate proper selection, marking and measurement of trees for harvest.

3. Determine the volume of a log using the appropriate volume table and log scale stick.

4. Evaluate features that are important in the identification of lumber, and examine defects of wood which affect lumber quality.

F. Students shall identify forest tools and demonstrate safely their proper use and maintenance.

1. Identify and explain the use of major forestry hand and power tools, including all safety precautions and equipment.
2. Perform maintenance operations on each of these tools including sharpening and handle replacement.

3. Identify the parts of a chain saw, calculate proper oil/fuel mixture and demonstrate safe maintenance procedures.

4. Operate a chain saw safely while correctly felling, limbing, bucking, and brushing.

G. Students shall develop and exhibit communication skills which are important for natural resource managers.

1. Examine the need for communication skills in the natural resources professions.

2. Describe the important features of a descriptive, interpretive and persuasive presentation.

3. Exhibit proper introduction techniques.

4. Make an oral presentation appropriate to a given situation.

5. Write a presentation on a natural resource topic.

H. Students shall integrate interrelated aspects of the environment in proposing resource management practices.

1. Define ecology.

2. Define and provide examples of environmental conservation, preservation, exploitation and stewardship.

3. Propose an example of biotic succession.

4. Analyze a basic food chain, including the transfer of energy through the chain.

5. Evaluate an instance where people have altered the local and/or global balance of nature and give positive and negative results.

6. Give an example of how an ecological succession can be altered so it will remain at a secondary stage rather than advancing to the climax stage, and how this action affects production.

7. Identify agencies at the county, state and federal levels with environmental management responsibilities.

I. Students shall evaluate problems confronting human life as the finite amounts of non-renewable natural resources are depleted and the area for production of renewable natural resources becomes limited.

1. Define the terms renewable and non-renewable resources and provide examples of each.

2. Evaluate the effects of population growth on the environment.
3. Examine problems relating to resource management resulting from local population
shifts from rural to urban and vice versa.

4. Hypothesize future needs and uses of energy related to business, industry, and
population, and how energy conservation practices could be implemented locally, regionally and
statewide.

5. Discuss positive and negative features of nuclear, solar, water, wind, geothermal,
animal waste, wood, and fossil fuel powered energy and consider how these features affect
policy making as it is related to these natural resources.

J. Students shall analyze soil conservation practices.

1. Define soil erosion.

2. Describe major factors causing soil erosion and the consequences of uncontrolled
erosion.

3. Analyze characteristics of plants commonly used in resource conservation, their
applications and identify local sources for purchase.

K. Students shall identify air pollutants, describe their effects on the environment and
evaluate methods of control.

1. Prepare list of air pollutants and their characteristics, identify local sources
of air pollutants and perform air monitoring techniques.

2. Evaluate several air pollution control methods, and identify the laws and
regulations enacted to control air pollution.

L. Students shall evaluate the importance of water, its major uses, and management
practices related to water resources.

1. Describe the hydrologic cycle and define the terms aquifer, evaporation, surface
water, ground water, flood plain, water table, and watershed.

2. Investigate the distribution of the world's water supply and what percentage is
usable.

3. Identify the major uses of water in Indiana including the amounts used for
industry, agriculture, and private consumption and compare these uses with other parts of the
country.

4. Determine the major watersheds of Indiana.

5. Analyze the properties of surface water and ground water and how contaminants move
and react in water.

6. Compare the differences between point and non-point source pollution, and
demonstrate techniques used to determine water quality.

7. Identify types of waste water and discuss techniques used to reclaim waste water.

8. Examine the management of wastewater in an agricultural setting, including
disposal of waste water from livestock operations and how a septic system works.
M. Students shall examine the identity, handling, storing, disposal, and safety of hazardous materials.

1. Identify hazardous materials and discuss safe handling, storage and disposal procedures for these materials.

2. Assess governmental regulations concerning the safe handling, storage and disposal of hazardous materials.

N. Students shall identify common species of fur-bearing wildlife of Indiana and recommend wildlife management practices.

1. Identify on sight fur-bearing animals indigenous to Indiana and describe their life cycles.

2. Define wildlife management, habitat, native wildlife, exotic species, and migration.

3. Examine the impact of agriculture on wildlife populations, recommend methods to improve wildlife habitat and recognize the concepts of "edge", "biodiversity", "habitat", "food chain", and "niche".

4. Define the term population curve and demonstrate how reproduction and morality affect the curve.

5. Evaluate hunting and fishing regulations including the scientific basis for such restrictions.

O. Students shall assess the importance of predators and endangered species, and the roles each plays in the natural community.

1. Define endangered species, predators and threatened species and list examples of each.

2. Examine possible causes of extinction.

3. Analyze management strategies that have repopulated endangered and threatened species.

P. Students shall analyze the characteristics and management of waterfowl.

1. Define drake, duck, hen, gander, goose, gosling, dabbling (puddle) duck, and diving duck.

2. Describe the characteristics of waterfowl, including family name, habitat, characteristics of the young and life cycle.

3. Diagnose the purposes of waterfowl management and evaluate techniques used in such management.

4. Define waterfowl migration and list the major flyways in North America.
5. Be able to identify on sight species of waterfowl that migrate through Indiana and species that winter in Indiana.

Q. Students shall analyze the characteristics and management of Indiana fish.

1. Classify fish according to their place in the food chain, including plant eaters, plankton feeders, insect eaters, omnivores and predators.

2. Illustrate the physical characteristics used to identify fish species.

3. Explain the proper role of stocking in managing fishery resources and identify fish species propagated in Indiana hatcheries.

4. Identify the habitat requirements and life cycles of representative warmwater and coldwater fishes, and hypothesize how fish habitat may be altered.

5. Evaluate the economic and recreational values of Indiana's fishery resources.

6. Illustrate the management practices used to raise fish in ponds or hatcheries.

R. Students shall demonstrate ability to use and care for surveying equipment, and be proficient in the use of maps.

1. List applications of surveying in natural resource management.

2. Set up and maintain a complete field notebook.

3. Set up and adjust a level, take a reading on a rod and use a theodolite to determine angles and distances.

4. Calculate and determine within third order precision the difference in elevation between two points using single wire leveling.

5. Orient a map with a compass, find a given field location by using a map and a compass and perform basic land measurements including pacing and chaining.

6. Compare the relationship between azimuth and bearings, and locate a given point on a map with azimuths and distances.

7. Describe the location of a parcel of land in terms of the Federal System of Rectangular Surveys, including the legal description based on section, township, and range.

8. Interpret a topographic map key and convert map distance to ground distance.

9. Explain the difference between astronomic north and magnetic north.

10. Explain how Indiana state boundaries and section boundaries were established.

S. Students shall examine general aspects of recreational area management and associated employment opportunities.

1. Identify the positive features of a recreational area in terms of safety and use.
2. Describe differences between the four recreational area types (neighborhood, community, regional and state) and uses which are encouraged and discouraged at each.

3. Evaluate career opportunities in the national and state park systems, including basic duties, requirements, and educational prerequisites.

4. Identify recreational situations requiring written rules, discuss problems of user controls and law enforcement in recreational areas, and discuss solutions to these problems.

5. Identify and discuss negative environmental consequences which may result from inappropriate use of off-road recreation vehicles.

6. Demonstrate knowledge of the "Rules of the Waterway", identifying navigational markers and demonstrating a knowledge of their meanings.

7. Describe the practical and educational prerequisites for occupations related to water recreation management.

T. Students shall exhibit safety procedures and be prepared to handle minor emergency situations that may arise in an outdoor location.

1. List and explain general safety procedures to be followed when dealing with people in groups.

2. Exhibit the ability to build a fire, extinguish a fire, and eliminate all traces of the fire.

3. Describe the procedure to be taken when attempting a water rescue.

4. Explain and demonstrate how to avoid and give emergency care for shock, venomous bites or stings, broken bones, hypothermia, and hyperthermia.

5. Describe the value of layering when dressing for cold weather, and the proper clothing needed and appropriate behavior for protection from rain, snow and extreme heat and cold.

6. Select the safest and most comfortable camping site protected from the elements.

U. Students shall examine the basic components of weather systems and their effects on resource management and rural recreation.

1. Distinguish between weather and climate.

2. Demonstrate how to read a barometer, anonometer, maximum/minimum thermometer, rain gauge and hygrometer.

3. Define relative humidity and explain its importance in resource management.

4. Analyze the role the jet stream plays in determining the weather pattern.

5. Examine the effect that low pressure, high pressure, warm fronts and cold fronts have on weather conditions.
Plant and Soil Science

A. Students shall examine career opportunities in and the importance of plant and soil science.

1. Describe the interrelationship of careers in plant and soil science and the environment as a whole.

2. Explain the economic importance of plant and soil science in local, state, regional (corn belt), national and global communities.

3. Refine previously developed mental models about career opportunities, educational and job requirements, and career trends i.e., biotechnology, based upon newly acquired information.

B-1. Students shall use the basic principles of the taxonomic key.

1. Analyze the "system of classification" developed by Carolus Linnaeus for clarity and specificity.

2. Explain the taxonomy and describe its use in the study of plants.

3. Order the following terms of plant classification: kingdom, division, class, order, family, genus, species and variety, and generate a different (unique) classification system for plants.

4. Contrast botanical varieties with cultivars and give six examples of each from both decorative and agricultural plants.

5. Propose reasons for the current use of the modern system of plant classification.

6. Explain the origin of a scientific plant name and describe the significance of the first and second word of the name.

B-2. Students shall use plant characteristics in a taxonomic key.

1. Describe criteria for distinguishing characteristics of the plant kingdom from the animal, fungi, protist and monera kingdoms.

2. Justify the three bases on which agriculture plants can be classified using newly developed criteria.

3. Classify plants according to their five major parts.

4. Sketch, name, and provide three examples of each of the four types of leaf arrangements on a stem.

5. Describe the implications for cultivating plants based upon their classification by growth habits.

6. Contrast the structures and germination process of monocotyledons and dicotyledons and explain the leaf and flower structures of each as they grow.

7. Identify by visual inspection and assign scientific names to the common crop and weed plants and seeds.
8. Distinguish between noxious and semi-noxious weeds and explain the cultural ramifications of each.

9. Develop a plan for improving plant species based on their characteristics (e.g. leaves, seeds, roots).

C-1. Students shall explore plant cell parts and functions.

1. Sketch a plant cell, identify its parts (e.g., cytoplasm, vacuole, chloroplast, mitochondria, nucleus and cell wall), and explain the function of each.

2. Compare the processes of mitosis and meiosis in plants, describe the purpose and products, and give examples of where each occurs.

3. Sketch a plant and animal cell, comparing and contrasting the two. Then develop a rationale for the purposes of the primary differences.

4. Identify and contrast the sequence of events in the mitosis of plant and animal cells.

5. Relate meiosis to: a) the prediction of variation of characteristics in offspring, and b) Mendel's laws of segregation and independent assortment.

C-2. Students shall explore plant parts and their functions.

1. Compare the four primary plant structures, indicating the functions and food value of each. Discuss how planting decisions in underdeveloped countries could be based on this information.

2. Explain the importance of meristematic tissue in growth and physiology, and in relationship to plant reproduction.

3. Compare and contrast specialized roots, stems, and leaves (e.g., stolons, rhizomes, bulbs, tubers). Sketch and label appropriate examples of each type.

4. Predict the adaptations that may be initiated in various plants that survive a changing environment.

5. Describe how these structures contribute to the well being of the total plant: a) roots--corn plant, b) transport--woody plant, c) xylem--roots, stems, leaves.

6. Discuss how an individual could use knowledge of plant structures to grow a bountiful harvest of vegetables in a given location.
D. Students shall investigate material movements in plants.

1. Diagram the transpirational and translocational systems of a plant and describe the functions of each (e.g., cambium, xylem, phloem).

2. Explain why knowledge of the translocational system of plants is necessary for successful grafting.

3. Compare transpiration through the stomata and the pores of human skin and explain the role of water in each.

4. Discuss how the four environmental factors of wind, humidity, temperature, and insolation affect transpiration rates of plants.

5. Describe the process of transportation to and the resulting change in target structures for two plant hormones.

6. Relate translocation of water and plant nutrients to the process of photosynthesis.

E. Students shall explore the environmental factors affecting plant growth.

1. Analyze growth of a plant from a seed or cutting to marketable or harvestable size and examine the effects of plant maintenance on the plant.

2. Discuss the environmental factors affecting plant growth and formulate a plan to best use a plot of ground for a personal vegetable garden.

3. Discuss the effects of photoperiodism in plant growth and the possible economic uses of this scientific knowledge to benefit society.

4. Given data from suitable observations of plant growth at various temperatures, plot the data and generalize from its analysis the optimum temperature range for the growth of that plant.

5. Develop an experiment that will show how a plant may adapt to environmental changes such as change in direction of light source, change in position, or gravity.

F. Students shall analyze the germination of plants.

1. Discuss the requirements necessary for seed germination and analyze factors that might decrease germination rates.

2. Compare the life-cycle of a dicotyledonous plant and a monocotyledonous plant from seed to seed production. Address how their differences require varied approaches to planting and cultivation techniques.

3. Discuss the impact upon society of at least five major products which are seed by-products.

4. Based upon knowledge of seed germination factors, develop a plan to increase wheat crop production in the former Soviet Union in light of their past environmental history.

G-1. Students shall investigate plant reproduction.
1. Describe the various processes by which asexual reproduction may occur and cite examples to illustrate: a) fission, b) budding, c) regeneration, d) layering, e) fragmentation, f) sporulation.

2. Develop a set of criteria and determine the most advantageous of the four methods by which pollen is distributed.

3. Analyze the major events that take place in plant reproduction including pollination, fertilization and seed production.

4. Compare and contrast advantages and disadvantages of seed production (sexual) with vegetative propagation (asexual).

5. Devise and conduct an experiment with garden peas similar to that of Gregor Mendel. Predict and verify results.

6. Construct a model to demonstrate four environmental factors that affect the rooting of a stem cutting.

7. Cite examples of plants that propagate by each of the ten asexual methods and describe the agricultural impact of each in terms of cost, space needed, and ease of generation.

8. Explain how heredity and environment affect offspring in plants.

G-2. Students shall explore energy synthesis and use in plants.

1. Compare and contrast the processes of photosynthesis and respiration using both word and chemical equation format.

2. Discuss how energy is acquired and released in the photosynthetic process.

3. Describe the carbon-oxygen-hydrogen cycle as it occurs in the biosphere by relating the role of the various component materials and processes such as: a) the series of events in photosynthesis which lead to capturing energy, b) green plants, c) animals, d) the series of events in respiration that release energy from food, and e) conservation of energy in the cycle.

4. Analyze the process by which simple sugars are transformed into complex organic compounds (starch, fats, etc.) Compare this with the opposite process in animals.

5. Explain the role of the chlorophyll molecule in photosynthesis.

6. Discuss the external environmental factors which influence photosynthesis. How does environmental pollution effect our future survival with regard to plant (crop) production?

7. Describe the role of enzymes in the total process of photosynthesis.

H. Students shall analyze the impact of other life forms on crop plants.

1. Describe how "pests" play a role in crop quality.

2. Cite common plant diseases in your area and discuss possible ways they are transmitted and eradicated.
3. Analyze the relationship of proper plant nutrition with improved plant health in the areas of development, growth, and production of plants.

4. Discuss "integrated pest management" and describe ways to implement this into a management program. Predict difficulties which might be encountered during implementation with respect to current environmental protection regulations.

5. Prepare a sample pest management plan using mechanical, biological, and chemical control of plant pests for a school garden. Cite advantages and disadvantages of both.

6. Describe a biome in which plants and both beneficial and harmful insects exist. Analyze why some insects are helpful and detail the harm done by others.

7. Discuss the life cycles of the grasshopper and mite and explain why insects which go through a complete metamorphosis are the most damaging to plants.

8. Describe the differences in agricultural techniques worldwide as a result of the variety of nematodes and their specific damage patterns.

9. Discuss the ways that weeds cause damage and production loss.

10. For the weeds common to your area, identify means of weed control other than chemicals.

11. Analyze the uses for both a contact and systemic pesticide and predict the types and quality of foods available if a pesticide free society is declared.

12. Compare the effects of selective and nonselective herbicide and how they might be used for sterilization, clean-up, and weed control.

13. Discuss the three plant growth periods when herbicides can be applied and advantages of each.

14. Discuss the four categories of pesticides and evaluate a proposal to ban highly toxic pesticides in terms of the quality of life that would be produced.
I. Students shall explore the processes involved in biotechnology in plant science.

1. Discuss how biotechnology will influence agriculture in the future.

2. Relate the scientific method to the basic processes of biotechnology research.

3. Determine the scientific and technological knowledge and skills needed for career opportunities in biotechnology.

4. Describe at least three developments or applications resulting from biotechnology research in plant and soil science specifically related to disease resistance, product quality and photosynthesis.

5. Predict future impacts of microorganism research.

6. Relate how genetic engineering can affect one's future health and well-being.

7. Debate the positive and negative effects of one type of biotechnical research; address environmental and ethical concerns, concerns over control of the research, and concerns over conflict of interest.

J. Students shall investigate the various methods of land location and measurement using all appropriate technologies.

1. Generate an accurate sketch of all townships in their school district using section numbers, map symbols, and appropriate hard copy and computer technologies.

2. Appraise and utilize the index to owners to find a specific farm or land parcel. Describe how computer technology could be used to streamline land record keeping.

3. From the table of land measurements, calculate acreage from each type of measurement.

4. Identify and measure farms and fields from aerial photographs, taking into consideration topographic crests, the elevation of flight and lens angle.

5. Compose an accurate land description of a land parcel and measure the parcel to the nearest 1/100th acre.

6. Identify and sketch a land parcel from its description.

K. Students shall investigate the physical properties of the soil.

1. Considering the major factors in the formation of soils, describe the probable past of the soil found on the school grounds.

2. Construct a model to explain why soil of different ages is exposed in Indiana and surrounding states.

3. Give examples of how humans are dependent upon soil, directly or indirectly, for their food, clothing and shelter.

4. Evaluate the quality of a parcel of land based upon the horizons in a soil profile.

5. Describe how the basic components of a soil influence its possible uses.
6. Using information about the soil textural classes, describe how the soil provides for the growing of plants.

7. Describe the perfect physical traits of soil for a garden in terms of color and texture.

8. From observations of simple experiments, identify and briefly explain mechanisms by which minerals are changed in the formation of soil.

9. Explain the action of rivers, wind, and glaciers in the deposition of parent material in Indiana soils.

L. Students shall investigate the tillage practices necessary to keep soil productive.

1. Relate the several factors that contribute to soil compaction and the destruction of soil tilth to a discussion of the advantages and disadvantages of cultivation.

2. Describe the visible effects of soil compaction on plants and the effects it has on soil.

3. Evaluate the various methods of land preparation and seeding based on soil and plant characteristics.

4. Use the TESTOP computer program to determine the optimum tillage system for a specific 160 acre farm.

5. Explain the effect of depth of planting on seed emergence and relate plant germination characteristics to soil properties.

6. Discuss the advantages and disadvantages of incorporating crop residues or green manures into the soil.

M. Students shall explore the management strategies required to keep soil productive.

1. Relate the nitrogen cycle to the question of fertilizer choice.

2. Discuss the benefits of earthworms and micro-organisms in the soil

3. Describe types of organic matter in the soil and analyze ways to benefit the soil.

4. Distinguish among an acid, alkaline, and saline soil condition and describe their effects on plant growth.

5. Analyze soil environmental factors affecting plant nutrient availability and suggest ways to improve the effect of each.

6. Cite examples of how humans have affected nature and predict some consequence if they continues on their present course.

7. Analyze the effect of cation exchange capacity on soil pH and fertility.

8. Calculate the content of N-P-K in a fertilizer container from information on the package and calculate the amount of nitrogen needed for an acre of a crop using a selected nitrogen source.
9. Given a group of unhealthy plants, identify symptom and plant nutrient deficiencies when the following minerals are inadequate: N, P, K, Fe, S, Mg. Devise and conduct an experiment to use noncommercial remedies for the problem.

10. Compare advantages and disadvantages of organic and inorganic fertilizer in a world becoming more conscience of environmental pollution.

11. Describe general methods for testing soil deficiency. Identify a source for each of the three primary elements.

12. Perform a soil test and complete a report on the test. Compare this to a commercial soil test report and determine the proper amounts of N, P and K to put on a field.

13. Discuss the affect of high and low soil pH on the availability of plant nutrients and describe ways to increase or lower pH using soil amendments.

N. Students shall examine soil and water relationships.

1. Differentiate between infiltration and percolation and describe their effect on water availability.

2. Discuss how water in soil can move upward against gravitational pull and cite examples of this action in various soil types.

3. Discuss hydroponics and explain why it might be the wave of the future.

4. Given a specific land description, formulate a plan to modify soil to improve moisture relationships. Consider cost, feasibility, and environmental impact.

5. Discuss how the normal hydrologic cycle of the earth has been disrupted by volcanic eruption, the ozone layer demise and other negative environmental effects.

6. Evaluate the different types of irrigation systems based upon various crop and soil conditions.

7. Given the appropriate information, calculate the approximate amount of water needed and the cost for that water for a single complete production cycle for a major local crop.

8. Construct a demonstration showing possible methods that would help to control the runoff of a give watershed.

9. Address the problem of chemical impurities in agricultural waste water run-off in the form of a speech to a civic organization.

10. Describe the effects of soil texture on depth of water penetration and water and nutrient holding capacity.

O. Students shall investigate the soil conservation practices necessary to keep soil productive.

1. Propose management practices and cropping systems when given features and land capabilities that would help improve the usefulness of the land.

2. Describe how the types of information found within a soil survey assist in soil conservation.
3. Read and interpret a soil classification map using the USDA Land Use Capability Classification system as if interested in purchasing farm land.

4. Discuss the advantages/disadvantages of organic and inorganic soil amendments. Cite situations where both types would be useful in improving the soil.

5. Explain how roots interact with soil and relate this to the process of nitrogen fixation.

6. Relate the factors that influence soil water erosion to the detrimental effects that can be minimized with specific conservation practices.

7. Analyze affects of wind erosion and evaluate several management procedures such as windbreaks.

8. Explain how the programs and services provided by the soil conservation service contribute to successful soil management in Indiana.

9. Calculate soil loss using the universal soil loss equation.

10. Measure slope and explain the relationship between steepness of slope and erosion.

P. Students shall analyze the impact of several factors on the selection of a cropping system and cultural practices.

1. Explain why the most profitable crops aren't grown on all available land.

2. Describe the factors that must be considered when selecting a crop.

3. Develop an argument both for and against crop rotation.

4. Describe the relationship between cropping intensity and income.

5. Analyze how conservation is affected by cropping systems and cultural practices. Identify and evaluate two specific cropping systems used in Indiana.

Q. Students shall investigate the harvesting of crops in Indiana.

1. Relate the history of the development of three specialized types of harvesting equipment used in Indiana to the crop each is used to harvest.

2. Discuss the relationship of planting technique with harvesting loss in corn. Determine the optimum economic procedure.

3. Explain characteristics that determine harvest maturity for corn and soybeans.

4. Discuss the economic impact of delayed harvesting of crops in the fall.

5. Describe problems involved with the storage and transportation of major Indiana crops. Address how these relate to the placement of towns, rivers, and railroads historically.
Supervised Agricultural Experience (SAE)

A. Students shall be able to describe the importance of an SAE program and the benefits that can be obtained from a successful SAE program.

1. Define SAE.

2. Summarize the reasons for having an SAE program.

3. Outline the benefits of a good SAE program.

4. Specify the criteria which must be met to qualify as an SAE program.

5. Evaluate the characteristics of a good SAE program.

6. Explain the relationship of SAE programs to the total agricultural program.

B. Students shall be able to identify the opportunities for SAE projects in the community.

1. List the six major types of SAE programs.

2. Evaluate the characteristics of the SAE program areas.

3. Identify examples of projects in each program area.

4. Identify the resources/opportunities for SAE projects within the school, community, and home.

5. Describe local guidelines for the scope and nature of SAE programs.

C. Students shall be able to select goals for an SAE program.

1. Explain the importance of setting goals for an SAE program.

2. List the types of goals which could be set for an SAE program.

3. Explain how goals should be set for the SAE program.

D. Students shall outline the steps that are needed to begin an SAE program.

1. Evaluate personal interests for each SAE program area.

2. Outline how to obtain help in determining what will be needed for the SAE program.

3. Offer possible ways of financing the SAE program.

4. Describe the responsibilities involved in planning and conducting an SAE program.

5. Write a personal annual and long range SAE program plan.

6. Discuss the potential value of the selected SAE program for personal and career development.
7. Activate SAE program plans.

E. Students shall be able to keep the following records for their SAE programs: budgets, inventories, financial statements, receipts and expenditures.

1. Explain the importance of keeping records.
2. Identify the necessary forms to keep in the record book.
3. Explain what information is included in Ownership Business Agreements and Placement Training Agreements.
4. Explain what a budget is and where it is used.
5. Identify the information necessary to budgeting.
6. Explain how to complete a budget for an SAe program.
7. Compare and contrast a budget and a cash flow summary.
8. Explain the importance of keeping an accurate inventory and demonstrate how to complete a beginning inventory.
9. Explain the beginning financial statement and demonstrate how to construct it.
10. Explain the methods used to record receipts and expenditures.
11. Demonstrate how to total receipt and expenditure pages at the end of the month.
12. Identify any additional records which should be kept each month and explain their purpose.

F. Students shall be able to complete the forms needed to summarize, analyze, and evaluate the SAE program.

1. Identify the forms needed to summarize the year's records.
2. Explain how the cash flow summary is used.
3. Explain depreciation and how it is recorded.
4. Explain the importance of completing an ending inventory.
5. Identify the purposes of having a profit or loss statement and the information needed to complete it.
6. Explain how enterprises are analyzed in an SAE program.
7. Identify where to find the information necessary to complete an SAE program summary.
8. Identify the forms which are used to evaluate and improve an SAE program.
9. Explain net worth and how does it reveal the progress of an SAE program.
10. Identify some points to evaluate on the financial statement.
11. Identify some ways to increase returns from an SAE program.

12. Identify the "problems" or weaknesses in the SAE program and select possible short and long range solutions.

13. Evaluate the overall quality and value of the SAE program.

14. Revise the long range plan for the SAE program, as necessary.

15. Make appropriate decisions about expanding and/or diversifying the SAE program.

G. Students shall identify the awards that are available based on an SAE program.

1. Identify the awards which may be received from an SAE program.

2. Identify the information needed to complete award applications.

3. Identify the minimum SAE program requirements for FFA degrees.

H. Students shall develop a knowledge of job search techniques and resources available to the job seeker.

1. Prepare a list of contacts for employment based on personal aptitudes, traits, abilities, and interests in relation to career choices.

2. Identify the factors to consider when selecting resources to locate a job.

3. Understand how to interpret want ads and posted job vacancy announcements.

4. Compare and contrast public and private employment agencies.

5. Discuss the services provided by employment agencies.

6. Explain how to use placement services for a personal job search.

I. Students shall understand the importance of the first contact in the job search.

1. Identify and describe six items to be included in a resume.

2. List the important factors to consider when using the telephone for a job search.

3. Describe the important components of a resume.

4. Explain the use of a resume in a job search.

5. List the important components of a cover letter and be able to write one.


J. Students shall understand the fundamental requirements for keeping a job.
1. Discuss the importance of interpersonal communication, appropriate dress, and self-evaluation procedures.

2. Discuss the concept of professional ethics.

3. Understand how being able to follow directions effectively relates to job survival.

4. Gain an understanding of the major reasons why workers are fired from their jobs.

K. Students who are juniors or seniors in Agricultural Science and Business shall have the opportunity to be placed in an Agricultural Cooperative Program related to their individual SAE's.

1. Gain employment on a farm, ranch or in an agribusiness which is not owned by the student's parents or guardians.

2. A minimum of 15 hours per week will be required, 10 of the 15 required hours must be during the school week.

3. Demonstrate management skills by keeping satisfactory records.