2008 Mississippi Curriculum Framework

Postsecondary Irrigation Management Technology
(Program CIP:01.0699 - Applied Horticulture/Horticultural Business Services, Other)

Acknowledgments

Standards in this document are based on information from the following organizations:

Certified Irrigation Auditor   Proposed standards for Irrigation Management Technology
                                            are based on the certification process for Certified
                                            Landscape Irrigation Auditor as granted by the Irrigation
                                            Association.

Related Academic Standards   CTB/McGraw-Hill LLC. (1994). *Tests of adult basic
                                            education, forms 7 and 8.* Monterey, CA: Author.
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                                            Hill LLC. Reproduction of this material is permitted for
                                            educational purposes only.

21st Century Skills   Reproduced with permission of the Partnership for 21st
                                            Century Skills. Further information may be found at
                                            www.21stcenturyskills.org.

Preface

Irrigation Management Technology Research Synopsis

Irrigation Management Technology was established in response to a request from the landscaping industry for trained technicians in the field of irrigation. The program is targeted toward training for the design, installation, operation, and maintenance of irrigation systems for lawn and turf areas such as golf courses, athletic fields, commercial enterprises, and homes.

Courses in the curriculum are based on the standards established by the Irrigation Association, a national organization representing irrigation manufacturers and their representatives, dealers, distributors, consultants, and contractors. Students completing the program will be qualified to sit for the association-sponsored exams for Certified Landscape Irrigation Auditor and Certified Golf Irrigation Auditor.

Articles, books, Web sites, and other materials listed at the end of each course were considered during the development process. *Irrigation and the Green Industry*, the Irrigation Association's journal, and *Lawn and Landscape Magazine*, a publication of the Melby Company, were especially useful in providing insight into trends and issues in the field. These references are suggested for use by instructors and students during the study of the topics outlined.

Industry advisory team members from Hinds Community College were involved in all stages of development of this curriculum, and they met periodically to review course content.

Curriculum
The following national standards were referenced in each course of the curriculum:
- CTB/McGraw-Hill LLC *Tests of Adult Basic Education, Forms 7 and 8* Academic Standards
- *21st Century Skills*
- *Certified Landscape Irrigation Manager, The Irrigation Association*

Assessment
Students will be assessed using the Mississippi CPAS Assessment for Irrigation Technology. Students will have the option of sitting for the Certified Landscape Irrigation Auditor examination and/or the Certified Golf Irrigation Auditor examination.

Professional Learning
It is suggested that instructors participate in professional learning related to the following concepts:
- How to use the program Blackboard® site
- Differentiated instruction – To learn more about differentiated instruction, please go to http://www.paec.org/teacher2teacher/additional_subjects.html, and select Differentiated Instruction. Work through this online course, and review the additional resources.

Articulation
No articulated credit will be offered upon implementation of this curriculum by the college.

Foreword

As the world economy continues to evolve, businesses and industries must adopt new practices and processes in order to survive. Quality and cost control, work teams and participatory management, and an infusion of technology are transforming the way people work and do business. Employees are now expected to read, write, and communicate effectively; think creatively, solve problems, and make decisions; and interact with each other and the technologies in the workplace. Vocational–technical programs must also adopt these practices in order to provide graduates who can enter and advance in the changing work world.

The curriculum framework in this document reflects these changes in the workplace and a number of other factors that impact local vocational–technical programs. Federal and state legislation calls for articulation between high school and community college programs, integration of academic and vocational skills, and the development of sequential courses of study that provide students with the optimum educational path for achieving successful employment. National skills standards, developed by industry groups and sponsored by the U.S. Department of Education and Labor, provide vocational educators with the expectations of employers across the United States. All of these factors are reflected in the framework found in this document.

Referenced throughout the courses of the curriculum are the 21st Century Skills, which were developed by the Partnership for 21st Century Skills, a group of business and education organizations concerned about the gap between the knowledge and skills learned in school and those needed in communities and the workplace. A portion of the 21st Century Skills addresses learning skills needed in the 21st century, including information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills. The need for these types of skills has been recognized for some time, and the 21st Century Skills are adapted in part from the 1991 report from the U.S. Secretary of Labor's Commission on Achieving Necessary Skills (SCANS). Another important aspect of learning and working in the 21st century involves technology skills, and the International Society for Technology in Education, developers of the National Educational Technology Standards (NETS), were strategic partners in the Partnership for 21st Century Skills.

Each postsecondary program of instruction consists of a program description and a suggested sequence of courses that focus on the development of occupational competencies. Each vocational–technical course in this sequence has been written using a common format, which includes the following components:

- Course Name – A common name that will be used by all community/junior colleges in reporting students

- Course Abbreviation – A common abbreviation that will be used by all community/junior colleges in reporting students

- Classification – Courses may be classified as:
    - Vocational–technical core – A required vocational–technical course for all students

- o Area of concentration (AOC) core – A course required in an area of concentration of a cluster of programs
- o Vocational–technical elective – An elective vocational–technical course
- o Related academic course – An academic course that provides academic skills and knowledge directly related to the program area
- o Academic core – An academic course that is required as part of the requirements for an associate's degree

- Description – A short narrative that includes the major purpose(s) of the course and the recommended number of hours of lecture and laboratory activities to be conducted each week during a regular semester

- Prerequisites – A listing of any courses that must be taken prior to or on enrollment in the course

- Corequisites – A listing of courses that may be taken while enrolled in the course

- Competencies and Suggested Objectives – A listing of the competencies (major concepts and performances) and of the suggested student objectives that will enable students to demonstrate mastery of these competencies

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75 percent of the time allocated to each course. The remaining 25 percent of each course should be developed at the local district level and may reflect the following:
    - o Additional competencies and objectives within the course related to topics not found in the state framework, including activities related to specific needs of industries in the community college district
    - o Activities that develop a higher level of mastery on the existing competencies and suggested objectives
    - o Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed and revised
    - o Activities that implement components of the Mississippi Tech Prep initiative, including integration of academic and vocational–technical skills and coursework, school-to-work transition activities, and articulation of secondary and postsecondary vocational–technical programs
    - o Individualized learning activities, including worksite learning activities, to better prepare individuals in the courses for their chosen occupational area

- Sequencing of the course within a program is left to the discretion of the local district. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors.

- Programs that offer an Associate of Applied Science degree must include a minimum 15 semester credit hour academic core. Specific courses to be taken within this core are to be determined by the local district. Minimum academic core courses are as follows:
  - o 3 semester credit hours   Math/Science Elective
  - o 3 semester credit hours   Written Communications Elective
  - o 3 semester credit hours   Oral Communications Elective
  - o 3 semester credit hours   Humanities/Fine Arts Elective
  - o 3 semester credit hours   Social/Behavioral Science Elective

  It is recommended that courses in the academic core be spaced out over the entire length of the program, so that students complete some academic and vocational–technical courses each semester. Each community/junior college has the discretion to select the actual courses that are required to meet this academic core requirement.

- Technical elective courses have been included to allow community colleges and students to customize programs to meet the needs of industries and employers in their area.

In order to provide flexibility within the districts, individual courses within a framework may be customized by:
- adding new competencies and suggested objectives.
- revising or extending the suggested objectives for individual competencies.
- adjusting the semester credit hours of a course to be up one hour or down one hour (after informing the State Board for Community and Junior Colleges [SBCJC] of the change).

In addition, the curriculum framework as a whole may be customized by:
- resequencing courses within the suggested course sequence.
- developing and adding a new course that meets specific needs of industries and other clients in the community or junior college district (with SBCJC approval).
- utilizing the technical elective options in many of the curricula to customize programs.

Table of Contents

Program Description

Irrigation Management Technology is designed to provide students with skills that lead to employment in residential and commercial irrigation industries. The program includes training in the areas of irrigation system design and installation, system troubleshooting and repair, and irrigation business and shop management. Students enrolled in the program have the options of taking a one-year course of study and receiving a technical certificate or taking a two-year course of study and receiving an Associate of Applied Science degree. A minimum of 42 semester credit hours is required to earn the technical certificate. A minimum of 72 semester credit hours is required to earn the Associate of Applied Science degree. Students who complete the program will be qualified to sit for the Certified Landscape or Certified Golf Irrigation Auditor's examinations after earning one year of experience in the field. Students will be qualified to sit for the Certified Irrigation Contractor and Certified Irrigation Designer examination after earning two years of experience in the field. Students may sit for the first two steps of the Certified Irrigation Designer examination upon completion of the program. The remaining steps (3 and 4) may be completed after obtaining two years of field experience.

Required courses for a technical certificate in Irrigation Management Technology include the following:

2 sch   Introduction to Irrigation (IRM 1112)
3 sch   Residential Irrigation Design (IRM 1123)
4 sch   Irrigation Systems Installation I (IRM 1144)
3 sch   Irrigation Systems Installation II (IRM 1243)
3 sch   Irrigation Troubleshooting and Repair (IRM 1223)
3 sch   Irrigation Pumps, Controls, and Relays (IRM 2233)
4 sch   Botany/Botany Lab (BOT 1314)
4 sch   Survey of Microcomputer Applications (CPT 1324)
3 sch   Landscape Business Management (HLT 2313)
3 sch   Landscape Construction (HLT 2713)
3 sch   Spanish Conversation I (ATE 1213)
3 sch   Green Industry Cost Estimating (HLT 2123 or IRM 2123)
2 sch   Irrigation Auditing (IRM 2312)
3 sch   Supervised Work Experience in Irrigation Management Technology (IRM 2923)

Suggested Course Sequence*
Irrigation Management Technology
Associate of Applied Science Degree

FIRST YEAR

2 sch	Introduction to Irrigation (IRM 1112)
4 sch	Irrigation Systems Installation I (IRM 1144)
4 sch	Botany/Botany Lab (BIO 1314)
3 sch	Written Communications Elective
2 sch	Green Industry Seminar (HLT 1222)
1 sch	Leadership Management (HLT 1411)

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16 sch

3 sch	Irrigation Pumps, Controls, and Relays (IRM 2233)
3 sch	Irrigation Systems Installation II (IRM 1243)
3 sch	Fine Arts/Humanities Elective
3 sch	Social Behavioral Science Elective
3 sch	Approved Elective**
1 sch	Leadership Management II (HLT 1421)

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16 sch

SUMMER TERM

3 sch   Supervised Work Experience in Irrigation Management Technology (IRM 2923)

SECOND YEAR

3 sch	Approved Computer Elective
3 sch	Green Industry Cost Estimating (IRM 2123)
3 sch	Oral Communications Elective
3 sch	Approved Elective**
3 sch	Spanish Conversation I
3 sch	Humanities/Fine Arts Elective
1 sch	Leadership Management III (HLT 1431)

_____
19 sch

3 sch	Landscape Construction (HLT 2713)
3 sch	Landscape Business Management (HLT 2313)
3 sch	Irrigation Troubleshooting and Repair (IRM 1223)
3 sch	Residential Irrigation Design (IRM 1123)
1 sch	Leadership Management IV (HLT 1441)
2 sch	Irrigation Auditing (IRM 2312)
3 sch	Approved Elective**

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18 sch

*   Students who lack entry-level skills in math, English, science, and so forth will be provided related studies.

**APPROVED ELECTIVES

Any IRM, HLT, or TEM course may be selected as an approved elective with faculty approval.
Other approved electives include the following:

DDT 1413	Elementary Surveying
BOT 1433	Business Accounting or ACC 1213 Principles of Accounting
BOT 1313	Applied Business Math or BAD 1313 Business Mathematics
BAD 2413	Legal Environment of Business
PHY 1214	Survey of Physics

Irrigation Management Technology Courses

Course Name: Introduction to Irrigation

Course Abbreviation: IRM 1112

Classification: Vocational–Technical Core

Description: An introduction to irrigation practices and technologies. Includes instruction in the history of irrigation, regions of water management, and the basic components of agricultural, large turf, golf, commercial, and residential irrigation systems (2 sch: 2-hr lecture)

Prerequisites: None

Competencies and Suggested Objectives

1. Describe the history of irrigation in the United States.
    a. Identify early methods of irrigation.
    b. Identify key individuals in the development of irrigation systems.
    c. Discuss the development of key equipment and technological advances in irrigation.
    d. Establish a timeline showing the development of irrigation technologies.

2. Identify practices for water management in different regions of the United States.
    a. Examine reclamation acts dealing with water management and conservation.
    b. Discuss water rights issues associated with different regions in the U.S.

3. Describe and contrast components and practices associated with different types of irrigation systems.
    a. Describe methods and equipment for agricultural irrigation on large areas.
    b. Describe methods and equipment for irrigation large turf areas and golf courses.
    c. Describe methods and equipment for irrigation of commercial and residential systems.

STANDARDS

Certification Standards for the Irrigation Association's Certified Irrigation Auditor Exam

IR3   Apply irrigation terminology.
IR5   Apply principles of irrigation management.
IR9   Evaluate water use in an irrigation system and schedule.

Related Academic Standards

R1   Interpret Graphic Information (forms, maps, reference sources)
R2   Words in Context (same and opposite meaning)
R3   Recall Information (details, sequence)
R4   Construct Meaning (main idea, summary and paraphrase, compare and contrast, cause and effect)
R5   Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)

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L1   Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2   Sentence Formation (fragments, run-on, clarity)
L3   Paragraph Development (topic sentence, supporting sentence, sequence)
L4   Capitalization (proper noun, titles)
L5   Punctuation (comma, semicolon)
L6   Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1   Vowel (short, long)
S2   Consonant (variant spelling, silent letter)
S3   Structural Unit (root, suffix)

21st Century Skills

CS1   Global Awareness
CS2   Financial, Economic, and Business Literacy
CS4   Information and Communication Skills
CS5   Thinking and Problem-Solving Skills
CS6   Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Book

Morgan, R. M. (1993). *Water and the land, a history of American Irrigation*. Fairfax, VA: Irrigation Association.

Web Sites

Hunter Industries. (2006). Retrieved October 5, 2007, from www.hunterindustries.com

Irrigation Association. (2006). *Irrigation consumer handbook*. Retrieved October 5, 2007, from http://www.irrigation.org/Rsrcs/default.aspx?pg=consumer_info.htm&id=140

Irrigation Association Education Foundation. (2006). Retrieved October 5, 2007, from www.iaef.org

Rain Bird Corporation. (2006). Retrieved October 5, 2007, from www.rainbird.com

Course Name: Residential Irrigation Design

Course Abbreviation: IRM 1123

Classification: Vocational–Technical Elective

Description: A course designed to teach students the proper techniques for designing irrigation systems to achieve an effective and efficient irrigation system (3 sch: 2-hr lecture, 2-hr lab)

Prerequisites: IRM 1143 Residential Irrigation Installation or HLT 2824 Irrigation and Lighting Systems and Installation, and college math

Competencies and Suggested Objectives

1. Describe and apply techniques for designing effective and efficient irrigation systems.
    a.   Identify the symbols used on irrigation design blueprints.
    b.   Interpret blueprints and associated design specifications.
    c.   Record in-field information, determine different hydrozones, and create a base plan.
    d.   Determine design capacity for maximum flow rate.
    e.   Determine correct sprinkler placement.
    f.   Determine correct pipe layout and pipe sizing.
    g.   Determine precipitation rates using industry charts.
    h.   Apply principles of water conservation in irrigation system design.

2. Describe and apply principles of drip irrigation.
    a.   Describe the basic components of a drip system.
    b.   Collect site data for irrigation drip systems.
    c.   Apply the proper steps to design a drip system.
    d.   Describe methods of zoning and piping of drip systems.
    e.   Describe drip scheduling based on soil, plant, and water relations.

STANDARDS

Certification Standards for the Irrigation Association's Certified Irrigation Auditor Exam

IR1   Apply irrigation audit procedures and technology.
IR2   Develop base schedules and scheduling for irrigation.
IR3   Apply irrigation terminology.
IR4   Apply soil characteristics and properties to irrigation systems and scheduling.
IR5   Apply principles of irrigation management.
IR6   Apply weather and atmospheric conditions to irrigation systems and scheduling.
IR7   Apply plant anatomy and physiology to irrigation systems and scheduling.
IR8   Perform site selection procedures for irrigation audits.
IR9   Evaluate water use in an irrigation system and schedule.
IR10   Adjust/modify irrigation schedules.

Related Academic Standards

R1   Interpret Graphic Information (forms, maps, reference sources)
R2   Words in Context (same and opposite meaning)
R3   Recall Information (details, sequence)
R4   Construct Meaning (main idea, summary and paraphrase, compare and contrast, cause and effect)
R5   Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)
M1   Addition of Whole Numbers (no regrouping, regrouping)
M2   Subtraction of Whole Numbers (no regrouping, regrouping)
M3   Multiplication of Whole Numbers (no regrouping, regrouping)
M4   Division of Whole Numbers (no remainder, remainder)
M5   Decimals (addition, subtraction, multiplication, division)
M6   Fractions (addition, subtraction, multiplication, division)
M7   Integers (addition, subtraction, multiplication, division)
M8   Percents
M9   Algebraic Operations
A1   Numeration (ordering, place value, scientific notation)
A2   Number Theory (ratio, proportion)
A3   Data Interpretation (graph, table, chart, diagram)
A4   Pre-Algebra and Algebra (equations, inequality)
A5   Measurement (money, time, temperature, length, area, volume)
A6   Geometry (angles, Pythagorean theory)
A7   Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8   Estimation (rounding, estimation)
L1   Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2   Sentence Formation (fragments, run-on, clarity)
L3   Paragraph Development (topic sentence, supporting sentence, sequence)
L4   Capitalization (proper noun, titles)
L5   Punctuation (comma, semicolon)
L6   Writing Conventions (quotation marks, apostrophe, parts of a letter)

21st Century Skills

CS2   Financial, Economic, and Business Literacy
CS4   Information and Communication Skills
CS5   Thinking and Problem-Solving Skills
CS6   Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Books

Irrigation Association. (2000). *Advanced head layout*. Fairfax, VA: Author.

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Irrigation Association. (n.d.). *Drip design in irrigation.* Fairfax, VA: Author.

Irrigation Association. (2000). *Foundations of landscape irrigation design*. Fairfax, VA: Author.

Software

Software Republic. (1999). *RainCAD Suite*. Houston: Author.

Web Sites

Hunter Industries. (2006). Retrieved November 8, 2007, from www.hunterindustries.com

Irrigation Association Education Foundation. (2006). Retrieved November 8, 2007, from
    www.iaef.org

Rain Bird Corporation. (2006). Retrieved November 8, 2007, from www.rainbird.com

Course Name: Irrigation Systems Installation I

Course Abbreviation: IRM 1144

Classification: Vocational–Technical Elective

Description: An introductory course on the installation of irrigation systems. Includes instruction in basic components, site inspections, blueprint interpretation, methods and procedures for installation, and lighting system installation (4 sch: 2-hr lecture, 4-hr lab) (HLT 2824 may be taken in lieu of this course.)

Prerequisites: None

Competencies and Suggested Objectives

1. Describe the basic components of an irrigation system.
    a. Perform part identification of irrigation systems.
    b. Describe the basic components such as sprinkler heads, controllers, fittings, backflow preventers, manual valves, electrical valves, pipe and wire.

2. Perform site inspections.
    a. Collect information on-site.
    b. Perform pre-installation inspections.

3. Interpret blueprints of general designs of an irrigation system.
    a. Differentiate between commercial and residential irrigation systems.
    b. Determine the correct location of the sprinkler heads for even water distribution.
    c. Discuss nozzle sizing and precipitation rates.
    d. Differentiate between flow and pressure.
    e. Calculate the correct pipe sizes to reduce friction loss.
    f. Compare the efficiencies of spray, rotary, and impact drive heads.
    g. Explain static pressure, dynamic pressure, surge pressure, velocity, and friction loss on a simple irrigation system.
    h. Determine watering time needed per week depending on type of irrigation system and soil type.
    i. Discuss cross connection control.

4. Describe the methods and procedures to follow in the installation of an irrigation system.
    a. Discuss the layout of an irrigation system to include the use of necessary tools and equipment.
    b. Describe the installation process including pipe fitting, electrical components, starting and finishing points, system testing, and cleanup.

5. Describe the types and basic components of outdoor lighting.
    a. Discuss uses of landscape lighting.
    b. Identify and discuss basic components of an outdoor lighting system.
    c. Describe lighting techniques.
    d. Calculate voltage drop in a lighting system.

STANDARDS

Certification Standards for the Irrigation Association's Certified Irrigation Auditor Exam

IR2   Develop base schedules and scheduling for irrigation.
IR3   Apply irrigation terminology.
IR4   Apply soil characteristics and properties to irrigation systems and scheduling.
IR5   Apply principles of irrigation management.
IR6   Apply weather and atmospheric conditions to irrigation systems and scheduling.
IR7   Apply plant anatomy and physiology to irrigation systems and scheduling.
IR8   Perform site selection procedures for irrigation audits.
IR9   Evaluate water use in an irrigation system and schedule.
IR10 Adjust/modify irrigation schedules

Related Academic Standards

R1   Interpret Graphic Information (forms, maps, reference sources)
R2   Words in Context (same and opposite meaning)
R3   Recall Information (details, sequence)
R4   Construct Meaning (main idea, summary and paraphrase, compare and contrast, cause and effect)
R5   Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)
M1   Addition of Whole Numbers (no regrouping, regrouping)
M2   Subtraction of Whole Numbers (no regrouping, regrouping)
M3   Multiplication of Whole Numbers (no regrouping, regrouping)
M4   Division of Whole Numbers (no remainder, remainder)
M5   Decimals (addition, subtraction, multiplication, division)
M6   Fractions (addition, subtraction, multiplication, division)
M7   Integers (addition, subtraction, multiplication, division)
M8   Percents
M9   Algebraic Operations
A1   Numeration (ordering, place value, scientific notation)
A2   Number Theory (ratio, proportion)
A3   Data Interpretation (graph, table, chart, diagram)
A4   Pre-Algebra and Algebra (equations, inequality)
A5   Measurement (money, time, temperature, length, area, volume)
A6   Geometry (angles, Pythagorean theory)
A7   Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8   Estimation (rounding, estimation)
L1   Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2   Sentence Formation (fragments, run-on, clarity)
L3   Paragraph Development (topic sentence, supporting sentence, sequence)
L4   Capitalization (proper noun, titles)
L5   Punctuation (comma, semicolon)
L6   Writing Conventions (quotation marks, apostrophe, parts of a letter)

Postsecondary Irrigation Management Technology

21st Century Skills

CS2   Financial, Economic, and Business Literacy
CS4   Information and Communication Skills
CS5   Thinking and Problem-Solving Skills
CS6   Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Books

Melby, P. (1995). *Simplified irrigation system design* (2nd ed.). New York: Wiley.

Smith, S. (1996). *Landscape irrigation: Design and management*. New York: Wiley.

Course Name: Irrigation Troubleshooting and Repair

Course Abbreviation: IRM 1223

Classification: Vocational–Technical Elective

Description: A course designed to introduce students to basic fundamental and step processes to troubleshoot existing irrigation systems (3 sch: 1-hr lecture, 4-hr lab)

Prerequisites: None

Competencies and Suggested Objectives

1. Apply basic principles of maintenance and repair in irrigation systems.
   a. Discuss basic principles of electricity.
   b. Measure volts, amps, and resistance using a multimeter.
   c. Operate/program different industry irrigation controllers.
   d. Identify components of irrigation systems including controllers, valves, sprinklers, and backflow preventers.
   e. Pressure test irrigation sprinkler heads using a pitot tube and gauges.
   f. Demonstrate the use of various troubleshooting tools such as wire locators and fault locators.
   g. Perform site inspections of existing irrigation systems.

STANDARDS

Certification Standards for the Irrigation Association's Certified Irrigation Auditor Exam

IR2   Develop base schedules and scheduling for irrigation.
IR3   Apply irrigation terminology.
IR5   Apply principles of irrigation management.
IR6   Apply weather and atmospheric conditions to irrigation systems and scheduling.
IR8   Perform site selection procedures for irrigation audits.
IR9   Evaluate water use in an irrigation system and schedule.
IR10   Adjust/modify irrigation schedules

Related Academic Standards

R1   Interpret Graphic Information (forms, maps, reference sources)
R2   Words in Context (same and opposite meaning)
R3   Recall Information (details, sequence)
R4   Construct Meaning (main idea, summary and paraphrase, compare and contrast, cause and effect)
R5   Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)
M1   Addition of Whole Numbers (no regrouping, regrouping)
M2   Subtraction of Whole Numbers (no regrouping, regrouping)

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M3   Multiplication of Whole Numbers (no regrouping, regrouping)
M4   Division of Whole Numbers (no remainder, remainder)
M5   Decimals (addition, subtraction, multiplication, division)
M6   Fractions (addition, subtraction, multiplication, division)
M7   Integers (addition, subtraction, multiplication, division)
M8   Percents
M9   Algebraic Operations
A1   Numeration (ordering, place value, scientific notation)
A2   Number Theory (ratio, proportion)
A3   Data Interpretation (graph, table, chart, diagram)
A4   Pre-Algebra and Algebra (equations, inequality)
A5   Measurement (money, time, temperature, length, area, volume)
A6   Geometry (angles, Pythagorean theory)
A7   Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8   Estimation (rounding, estimation)
L1   Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2   Sentence Formation (fragments, run-on, clarity)
L3   Paragraph Development (topic sentence, supporting sentence, sequence)
L4   Capitalization (proper noun, titles)
L5   Punctuation (comma, semicolon)
L6   Writing Conventions (quotation marks, apostrophe, parts of a letter)

21st Century Skills

CS2   Financial, Economic, and Business Literacy
CS4   Information and Communication Skills
CS5   Thinking and Problem-Solving Skills
CS6   Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Book

Derryberry, B. (2000). *Troubleshooting irrigation control systems*. Fairfax, VA: Irrigation
    Association.

Journals and Magazines

GIE Media, Inc. (2006). *Lawn and landscape magazine.* Retrieved October 5, 2007, from
    http://www.lawnandlandscape.com

Irrigation Association. (2006). *Irrigation and green industry*. Retrieved October 5, 2007, from
    http://www.igin.com

Course Name: Irrigation Systems Installation II

Course Abbreviation: IRM 1243

Classification: Vocational–Technical Elective

Description: A continuation of IRM 1144 with emphasis on irrigation auditing and contracting procedures such as system installation, site inspection, uniform efficiency measures, and calculation of base watering schedules for a specific site (3 sch: 2-hr lecture, 2-hr lab)

Prerequisites: IRM 1144 Irrigation Systems Installation I or HLT 2824 Irrigation and Lighting Systems

Competencies and Suggested Objectives

1. Install an irrigation system.
    a. Lay out positions of lines, heads, and controllers.
    b. Operate equipment to dig trenches.
    c. Install lines, heads, and controllers.

2. Perform a site inspection.
    a. Operate an irrigation system.
    b. Inspect a system for damaged or faulty components.
    c. Repair or adjust components.

3. Measure uniformity and efficiency of an irrigation system.
    a. Collect data on uniformity and efficiency of the system.
    b. Identify wet and dry spots in the system.

4. Establish a base watering schedule.
    a. Determine precipitation rates for given areas.
    b. Identify water delivery rates and times for given plant demands.
    c. Adjust/program the system to the schedule.

STANDARDS

Certification Standards for the Irrigation Association's Certified Irrigation Auditor Exam

IR1   Apply irrigation audit procedures and technology.
IR2   Develop base schedules and scheduling for irrigation.
IR3   Apply irrigation terminology.
IR4   Apply soil characteristics and properties to irrigation systems and scheduling.
IR5   Apply principles of irrigation management.
IR6   Apply weather and atmospheric conditions to irrigation systems and scheduling.
IR7   Apply plant anatomy and physiology to irrigation systems and scheduling.
IR8   Perform site selection procedures for irrigation audits.
IR9   Evaluate water use in an irrigation system and schedule.
IR10   Adjust/modify irrigation schedules.

Related Academic Standards

R1   Interpret Graphic Information (forms, maps, reference sources)
R2   Words in Context (same and opposite meaning)
R3   Recall Information (details, sequence)
R4   Construct Meaning (main idea, summary and paraphrase, compare and contrast, cause and effect)
R5   Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)
M1   Addition of Whole Numbers (no regrouping, regrouping)
M2   Subtraction of Whole Numbers (no regrouping, regrouping)
M3   Multiplication of Whole Numbers (no regrouping, regrouping)
M4   Division of Whole Numbers (no remainder, remainder)
M5   Decimals (addition, subtraction, multiplication, division)
M6   Fractions (addition, subtraction, multiplication, division)
M7   Integers (addition, subtraction, multiplication, division)
M8   Percents
M9   Algebraic Operations
A1   Numeration (ordering, place value, scientific notation)
A2   Number Theory (ratio, proportion)
A3   Data Interpretation (graph, table, chart, diagram)
A4   Pre-Algebra and Algebra (equations, inequality)
A5   Measurement (money, time, temperature, length, area, volume)
A6   Geometry (angles, Pythagorean theory)
A7   Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8   Estimation (rounding, estimation)
L1   Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2   Sentence Formation (fragments, run-on, clarity)
L3   Paragraph Development (topic sentence, supporting sentence, sequence)
L4   Capitalization (proper noun, titles)
L5   Punctuation (comma, semicolon)
L6   Writing Conventions (quotation marks, apostrophe, parts of a letter)

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21st Century Skills

CS2   Financial, Economic, and Business Literacy
CS4   Information and Communication Skills
CS5   Thinking and Problem-Solving Skills
CS6   Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Books

Irrigation Association. (2004). *Certified irrigation contractor workbook.* Fairfax, VA: Author.

Postsecondary Irrigation Management Technology

Irrigation Association. (2004). *Certified landscape irrigation auditor*. Fairfax, VA: Author.

Journals and Magazines

GIE Media, Inc. (2006). *Lawn and landscape magazine.* Retrieved October 5, 2007, from
http://www.lawnandlandscape.com

Irrigation Association. (2006). *Irrigation and green industry*. Retrieved October 5, 2007, from
http://www.igin.com

Course Name: Green Industry Cost Estimating

Course Abbreviation: IRM 2123

Classification: Vocational–Technical Core

Description: A course designed to introduce budgeting and estimating fundamentals used in the landscape and irrigation industries (3 sch: 2-hr lecture, 2-hr lab) (Also taught as HLT 2123, Green Industry Cost Estimating)

Prerequisites: None

Competencies and Suggested Objectives

1. Describe business practices associated with estimating, bidding, and budgeting.
    a. Discuss trends in the budgeting and estimating processes of the landscape industry.
    b. Describe the three parts of a bid.
    c. Discuss different types of budgets used in business.
    d. Demonstrate the ability to make decisions based on a profit–loss statement.

2. Develop a bid proposal.
    a. Calculate field labor cost using industry standard ratios.
    b. Calculate average crew wages.
    c. Apply principles associated with general and administrative overhead costs.
    d. Calculate material labor cost using industry ratio formulae.
    e. Calculate net profit margins, gross profit margins, and break even point in an estimate.
    f. Calculate equipment cost for a budget.
    g. Prepare a formal bid proposal.

STANDARDS

Certification Standards for the Irrigation Association's Certified Irrigation Auditor Exam

IR3   Apply irrigation terminology.
IR5   Apply principles of irrigation management.
IR7   Apply plant anatomy and physiology to irrigation systems and scheduling.

Related Academic Standards

R1   Interpret Graphic Information (forms, maps, reference sources)
R2   Words in Context (same and opposite meaning)
R3   Recall Information (details, sequence)
R4   Construct Meaning (main idea, summary and paraphrase, compare and contrast, cause and effect)
R5   Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)
M1   Addition of Whole Numbers (no regrouping, regrouping)
M2   Subtraction of Whole Numbers (no regrouping, regrouping)

Postsecondary Irrigation Management Technology

M3   Multiplication of Whole Numbers (no regrouping, regrouping)
M4   Division of Whole Numbers (no remainder, remainder)
M5   Decimals (addition, subtraction, multiplication, division)
M6   Fractions (addition, subtraction, multiplication, division)
M7   Integers (addition, subtraction, multiplication, division)
M8   Percents
M9   Algebraic Operations
A1   Numeration (ordering, place value, scientific notation)
A2   Number Theory (ratio, proportion)
A3   Data Interpretation (graph, table, chart, diagram)
A4   Pre-Algebra and Algebra (equations, inequality)
A5   Measurement (money, time, temperature, length, area, volume)
A6   Geometry (angles, Pythagorean theory)
A7   Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8   Estimation (rounding, estimation)
L1   Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2   Sentence Formation (fragments, run-on, clarity)
L3   Paragraph Development (topic sentence, supporting sentence, sequence)
L4   Capitalization (proper noun, titles)
L5   Punctuation (comma, semicolon)
L6   Writing Conventions (quotation marks, apostrophe, parts of a letter)

21st Century Skills

CS2   Financial, Economic, and Business Literacy
CS4   Information and Communication Skills
CS5   Thinking and Problem-Solving Skills
CS6   Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Book

Huston, J. R. (2003). *How to price landscape and irrigation projects.* Englewood, CA: Author.

Computer Software

Huston, J. (2004). *How to price landscape and irrigation projects* [Computer software].
        Englewood, CA: Author.

Huston, J. (2004). *How to price landscape and irrigation projects tools* [Computer software].
        Englewood, CA: Author.

Course Name: Irrigation Pumps, Controls, and Relays

Course Abbreviation: IRM 2233

Classification: Vocational–Technical Core

Description: A study of the basic function, operation, and maintenance of water pumps for irrigation systems. Includes instruction in determining pump size and providing backflow protection (3 sch: 2-hr lecture, 2-hr lab)

Prerequisites: None

Competencies and Suggested Objectives
1. Apply basic principles of operation for pumps.
a. Identify the components of a basic pump, and describe their function or operation.
b. Identify the common types of pumps and their uses or applications.
c. Interpret pump curve charts.
2. Select a pump to meet specifications for a given job.
a. Calculate the required total dynamic head for a system pump.
b. Calculate horsepower needed.
c. Determine impeller size for a given job.
3. Apply principles for selecting backflow prevention devices for a specific site.
a. Describe the different types of backflow prevention devices and their applications, installation, and operation.
b. Select, install, and adjust a backflow device for a specific system.
4. Maintain pumps and backflow devices.
a. Demonstrate basic maintenance procedures.
b. Protect a pump and backflow device from freeze damage.

STANDARDS

Certification Standards for the Irrigation Association's Certified Irrigation Auditor Exam

IR3   Apply irrigation terminology.
IR5   Apply principles of irrigation management.
IR6   Apply weather and atmospheric conditions to irrigation systems and scheduling.
IR9   Evaluate water use in an irrigation system and schedule.

Related Academic Standards

R1   Interpret Graphic Information (forms, maps, reference sources)
R2   Words in Context (same and opposite meaning)
R3   Recall Information (details, sequence)
R4   Construct Meaning (main idea, summary and paraphrase, compare and contrast, cause and effect)

Postsecondary Irrigation Management Technology

R5 Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)

21st Century Skills

CS2 Financial, Economic, and Business Literacy
CS4 Information and Communication Skills
CS5 Thinking and Problem-Solving Skills
CS6 Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Books

Irrigation Association. (2004). *Certified irrigation contractor workbook.* Fairfax, VA: Author.

Irrigation Association. (2002). *Understanding pumps, controls and valves*. Fairfax, VA: Author.

Web Sites

Scherer, T. F. Irrigation water pumps. In *Educational materials from NDSU agriculture and university extensions*. Retrieved November 8, 2007, from http://www.ag.ndsu.edu/pubs/ageng/irrigate/ae1057w.htm

Stryker, J. (2006). Irrigation pumping systems. In *Irrigation tutorials*. Retrieved November 8, 2007, from http://www.irrigationtutorials.com/pump.htm

Course Name: Irrigation Auditing

Course Abbreviation: IRM 2312

Classification: Vocational–Technical Elective

Description: A course to prepare students to take the Irrigation Association's Certified Landscape Auditor examination. Includes instruction on site inspection, system inspection, and tune-up of irrigation systems, data collection, base water scheduling, and irrigation management practices. Students will perform an audit following approved practices. (2 sch: 1-hr lecture, 2-hr lab)

Pre/Corequisites: IRM 1144 Irrigation Systems Installation I, IRM 1123 Residential Irrigation Design, and IRM 1223 Irrigation Troubleshooting and Repair. (Two years of verified experience in the irrigation industry may substitute for these courses, per Irrigation Association requirements.)

Competencies and Suggested Objectives

1. Perform a site inspection.
   a. Review site plans.
   b. Locate irrigation equipment.

2. Perform a system inspection and tune-up.
   a. Operate and evaluate existing equipment.
   b. Perform basic repairs to an existing system.

3. Evaluate system performance.
   a. Gather and analyze data system flow and distribution.
   b. Identify problems in flow and distribution.
   c. Develop a solution to observed problems.

4. Implement a base watering schedule focusing on water conservation.

STANDARDS

Certification Standards for the Irrigation Association's Certified Irrigation Auditor Exam

IR1   Apply irrigation audit procedures and technology.
IR2   Develop base schedules and scheduling for irrigation.
IR3   Apply irrigation terminology.
IR4   Apply soil characteristics and properties to irrigation systems and scheduling.
IR5   Apply principles of irrigation management.
IR6   Apply weather and atmospheric conditions to irrigation systems and scheduling.
IR7   Apply plant anatomy and physiology to irrigation systems and scheduling.
IR8   Perform site selection procedures for irrigation audits.
IR9   Evaluate water use in an irrigation system and schedule.
IR10   Adjust/modify irrigation schedules.

Related Academic Standards

R1   Interpret Graphic Information (forms, maps, reference sources)
R2   Words in Context (same and opposite meaning)
R3   Recall Information (details, sequence)
R4   Construct Meaning (main idea, summary and paraphrase, compare and contrast, cause and effect)
R5   Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)
M1   Addition of Whole Numbers (no regrouping, regrouping)
M2   Subtraction of Whole Numbers (no regrouping, regrouping)
M3   Multiplication of Whole Numbers (no regrouping, regrouping)
M4   Division of Whole Numbers (no remainder, remainder)
M5   Decimals (addition, subtraction, multiplication, division)
M6   Fractions (addition, subtraction, multiplication, division)
M7   Integers (addition, subtraction, multiplication, division)
M8   Percents
M9   Algebraic Operations
A1   Numeration (ordering, place value, scientific notation)
A2   Number Theory (ratio, proportion)
A3   Data Interpretation (graph, table, chart, diagram)
A4   Pre-Algebra and Algebra (equations, inequality)
A5   Measurement (money, time, temperature, length, area, volume)
A6   Geometry (angles, Pythagorean theory)
A7   Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8   Estimation (rounding, estimation)
L1   Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2   Sentence Formation (fragments, run-on, clarity)
L3   Paragraph Development (topic sentence, supporting sentence, sequence)
L4   Capitalization (proper noun, titles)
L5   Punctuation (comma, semicolon)
L6   Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1   Vowel (short, long)
S2   Consonant (variant spelling, silent letter)
S3   Structural Unit (root, suffix)

21ˢᵗ Century Skills

CS2   Financial, Economic, and Business Literacy
CS4   Information and Communication Skills
CS5   Thinking and Problem-Solving Skills
CS6   Interpersonal and Self-Directional Skills

SUGGESTED REFERENCES

Book

Irrigation Association. (2004). *Certified landscape irrigation auditor*. Fairfax, VA: Author.

Course Name: Special Problem in Irrigation Management Technology

Course Abbreviation: IRM 291(1–3)

Classification: Vocational–Technical Elective

Description: A course to provide students with an opportunity to utilize skills and knowledge gained in other Irrigation Management Technology courses. The instructor and student work closely together to select a topic and establish criteria for completion of the project. (1–3 sch: 2- to 6-hr lab)

Prerequisites: Consent of Instructor

Competencies and Suggested Objectives

1. Develop a written plan that details the activities and projects to be completed.
   a. Use a written plan that details the activities and projects to be completed.
   b. Perform written occupational objectives in the special problem.

2. Assess accomplishment of objectives.
   a. Prepare daily written assessments of accomplishment of objectives.
   b. Present weekly written reports of activities performed and objectives accomplished to the instructor.

3. Use and follow a set of written guidelines for the special problem.   a. Develop and follow a set of written guidelines for the special problem.

STANDARDS

Specific standards for this course will depend upon the nature of the problem under investigation.

SUGGESTED REFERENCES

Specific references for use in this course will depend upon the nature of the problem under investigation.

Course Name: Supervised Work Experience in Irrigation Management Technology

Course Abbreviation: IRM 292(1–6)

Classification: Vocational–Technical Core

Description: A course that is a cooperative program between industry and education designed to integrate the student's technical studies with industrial experience. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hours. (1–6 sch: 3- to 18-hr externship)

Prerequisite: Consent of instructor and completion of at least one semester of advanced coursework in Irrigation Management Technology

Competencies and Suggested Objectives
1. Follow a set of instructor-written guidelines for the supervised work experience program.

2. Apply skills needed to be a viable member of the workforce.
    a. Prepare a description of skills to be developed in the supervised work experience program.
    b. Practice skills needed to be a viable member of the workforce.

3. Practice human relationship skills in the supervised work experience program.
4. Practice positive work habits, responsibilities, and ethics.
5. Develop written occupational objectives in the supervised work experience program.

6. Assess performance of occupational skills.
    a. Prepare daily written assessments of work performance as specified in the occupational objectives.
    b. Present weekly written reports of activities performed and objectives accomplished to the instructor.

STANDARDS

Specific standards for this course will depend upon the nature of the problem under investigation.

SUGGESTED REFERENCES

Specific references for use in this course will depend upon the nature of the problem under investigation.

Course Name: Work-Based Learning I, II, III, IV, V, and VI

Course Abbreviation: WBL 191(1–3), WBL 192(1–3), WBL 193(1–3), WBL 291(1–3), WBL 292(1–3), and WBL 293(1–3)

Classification: Free Elective

Description: A structured worksite learning experience in which the student, program area teacher, Work-Based Learning Coordinator, and worksite supervisor/mentor develop and implement an educational training agreement. Designed to integrate the student's academic and technical skills into a work environment. Includes regular meetings and seminars with school personnel for supplemental instruction and progress reviews (1–3 sch: 3- to 9-hr externship)

Prerequisites: Concurrent enrollment in vocational–technical program area courses

Competencies and Suggested Objectives

1. Apply technical skills and related academic knowledge needed to be a viable member of the workforce.
   a. Apply technical skills needed to be a viable member of the workforce.
   b. Apply skills developed in other related courses in a work-based setting.
   c. Perform tasks detailed in an educational training agreement at the work setting.

2. Apply general workplace skills to include positive work habits and responsibilities necessary for successful employment.
   a. Demonstrate proactive human relationship skills in the work setting to include conflict resolution, team participation, leadership, negotiation, and customer/client service.
   b. Demonstrate time, materials, and resource management skills.
   c. Demonstrate critical thinking skills such as problem solving, decision making, and reasoning.
   d. Demonstrate acquiring, evaluating, organizing, maintaining, interpreting, and communicating information.
   e. Demonstrate positive work habits and acceptance of responsibilities necessary for successful employment.

STANDARDS

Specific standards for this course will depend upon the nature of the problem under investigation.

SUGGESTED REFERENCES

Specific references for use in this course will depend upon the nature of the problem under investigation.

Postsecondary Irrigation Management Technology

Recommended Tools and Equipment

CAPITALIZED ITEMS

1. Fault locator
2. Line locator
3. Handheld controller
4. Walk behind trencher
5. Riding trencher
6. Irrigation auditor's kit (soil probe, pressure gauge, measuring tape, catch devices and stands) (1 per 4 students)
7. Irrigation pumps (variety)
8. Computer with Internet access and printer (1 per 2 students)
9. Design table with design tools

NON-CAPITALIZED ITEMS

1. Volt–ohm meter (10)
2. Flow meter (4)
3. Pressure gauges (10)
4. Pitot tubes (10)
5. Circular saw
6. Metal handsaw
7. Hacksaw
8. Reciprocating saw
9. Jigsaw
10. Air angle grinder with 35-ft hose
11. Power grinder
12. Shovel, sharpshooter (4)
13. Shovel, square (4)
14. Shovel, round (4)
15. Shovel, 3-in. trench (4)
16. Shovel, 4-in. trench (4)
17. Shovel, 6-in. trench (4)
18. Picks (4)
19. Student tool kit (1 per 4 students) [pipe wrenches, box-end wrenches, adjustable wrenches, spud wrenches, locking pliers, screwdrivers, ball-peen hammers, claw hammer, open-end wrenches, socket set with handles (3/8 in. and 1/2 in.), wire cutters, etc.]
20. Wire stripper and connector tool
21. Level/transit, laser
22. 100-ft tape (4)
23. 25-ft tape (4)
24. 4-ft masonry level (2)
25. 2-ft carpenter's level (2)
26. Handsaw

27. Pipe cutter
28. Irrigation fittings (controllers, heads, valves, etc.)
29. Ladder, 15-ft extension
30. Ladder, 12-ft extension
31. Ladder, 6-ft step

RECOMMENDED INSTRUCTIONAL AIDS

It is recommended that instructors have access to the following items:

1. Microcomputer integrated software package (word processing, spreadsheet, and database)
2. Irrigation System Design software
3. Scientific calculator
4. Digital scanner
5. Digital camera
6. Interactive display board
7. DVD player with monitor
8. LCD projector
9. Notebook computer

Assessment

This program is assessed using the MS-CPAS. The following blueprint summary contains the courses that are measured when assessing this program. Courses are grouped into *clusters*, and a weight is given to each cluster to determine the number of items needed from each cluster. The numbers of C1s and C2s (item difficulty levels) are also indicated on the blueprint. This blueprint becomes effective Spring 2010.

CLUSTER/COMPETENCY	Level 1 (C1) Number	Level 2 (C2) Number	Total	%

Cluster 1: Introduction and Management
        IRM 1112 Introduction to Irrigation
        IRM 2123 Green Industry Cost Estimating
	15	7	22	22%

Cluster 2: Auditing and Repair
        IRM 2312 Irrigation Auditing
        IRM 1223 Irrigation Troubleshooting and Repair
	16	6	22	22%

Cluster 3: Installation
        IRM 1144 Irrigation Systems Installation I
        IRM 1243 Irrigation Systems Installation II
	24	6	30	30%

Cluster 4: Design and Equipment
        IRM 1123 Residential Irrigation Design
        IRM 2233 Irrigation Pumps, Controls, and Relays
	20	6	26	26%

TOTAL QUESTIONS:	75	25	100	100%

Appendix A: Proposed Industry Standards for Certified Landscape Irrigation Auditor[1]

IR1   Apply irrigation audit procedures and technology.
IR2   Develop base schedules and scheduling for irrigation.
IR3   Apply irrigation terminology.
IR4   Apply soil characteristics and properties to irrigation systems and scheduling.
IR5   Apply principles of irrigation management.
IR6   Apply weather and atmospheric conditions to irrigation systems and scheduling.
IR7   Apply plant anatomy and physiology to irrigation systems and scheduling.
IR8   Perform site selection procedures for irrigation audits.
IR9   Evaluate water use in an irrigation system and schedule.
IR10   Adjust/modify irrigation schedules

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[1] Proposed standards for Irrigation Management Technology are based on the certification process for Certified Landscape Irrigation Auditor as granted by the Irrigation Association. More information on the association's certification process can be found at www.irrigation.org/certification.

Appendix B: Related Academic Standards[2]

Reading
R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary and paraphrase, compare and contrast, cause and effect)
R5 Evaluate and Extend Meaning (fact and opinion, predict outcomes, point of view)

Mathematics Computation
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations

Applied Mathematics
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)

Language
L1 Usage (pronoun, tense, subject–verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)

Spelling
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)

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[2] CTB/McGraw-Hill LLC. (1994). *Tests of adult basic education, forms 7 and 8.* Monterey, CA: Author.
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S3   Structural Unit (root, suffix)

Appendix C: 21st Century Skills[3]

CS1 **Global Awareness**
- Using 21st century skills to understand and address global issues
- Learning from and working collaboratively with individuals representing diverse cultures, religions, and lifestyles in a spirit of mutual respect and open dialogue in personal, work, and community contexts
- Promoting the study of non-English language as a tool for understanding other nations and cultures

CS2 **Financial, Economic, and Business Literacy**
- Knowing how to make appropriate personal economic choices
- Understanding the role of the economy and the role of business in the economy
- Applying appropriate 21st century skills to function as a productive contributor within an organizational setting
- Integrating oneself within and adapting continually to the nation's evolving economic and business environment

CS3 **Civic Literacy**
- Being an informed citizen to participate effectively in government
- Exercising the rights and obligations of citizenship at local, state, national, and global levels
- Understanding the local and global implications of civic decisions
- Applying 21st century skills to make intelligent choices as a citizen

CS4 **Information and Communication Skills**
- Information and media literacy skills: Analyzing, accessing, managing, integrating, evaluating, and creating information in a variety of forms and media; understanding the role of media in society
- Communication skills: Understanding, managing, and creating effective oral, written, and multimedia communication in a variety of forms and contexts

CS5 **Thinking and Problem-Solving Skills**
- Critical thinking and systems thinking: Exercising sound reasoning in understanding and making complex choices, understanding the interconnections among systems
- Problem identification, formulation, and solution: Ability to frame, analyze, and solve problems
- Creativity and intellectual curiosity: Developing, implementing, and communicating new ideas to others, staying open and responsive to new and diverse perspectives

CS6 **Interpersonal and Self-Directional Skills**
- Interpersonal and collaborative skills: Demonstrating teamwork and leadership, adapting to varied roles and responsibilities, working productively with others, exercising empathy, respecting diverse perspectives
- Self-direction: Monitoring one's own understanding and learning needs, locating appropriate resources, transferring learning from one domain to another
- Accountability and adaptability: Exercising personal responsibility and flexibility in personal, workplace, and community contexts; setting and meeting high standards and goals for oneself and others; tolerating ambiguity

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[3] *21st century skills.* (n.d.). Washington, DC: Partnership for 21st Century Skills.

- Social responsibility: Acting responsibly with the interests of the larger community in mind; demonstrating ethical behavior in personal, workplace, and community contexts