OFFICE OF CHIEF ACADEMIC OFFICER
Summary of State Board of Education Agenda Items
Consent Agenda
January 21, 2016

OFFICE OF CAREER AND TECHNICAL EDUCATION

C. Begin the Administrative Procedures Act process: To establish the Mississippi Secondary Curriculum Framework in Career and Technical Education for Heavy Equipment Operation

Executive Summary

Heavy Machinery Operation is an instructional program that prepares students for employment or continued education in the occupations of the Heavy Machinery Operation field. The curriculum framework for this program was developed in partnership with the Mississippi Construction Education Foundation (MCEF). MCEF is the accredited sponsor for the National Center for Construction Education and Research (NCCER). Approved secondary curriculum will be disseminated for implementation in the fall 2016.

All curricula frameworks are designed to provide local programs with an instructional foundation that can be used to develop localized instructional management plans and course syllabi. Additionally, the frameworks include the following elements for each revised secondary curricula:

- Program
- Description
- Classification of Instructional Program (CIP) Code and CIP Name
- Course Outline and Codes
  - Curriculum
  - Student Competencies
  - Suggested Student Objectives

NOTE: The Office of Career and Technical Education has provided an executive summary of the curriculum framework. The detailed document is available upon request.

Recommendation: Approval

Back-up material attached

2016 Heavy Equipment Operation

Program CIP: 49.0202 Construction/Heavy Equipment/Earthmoving Equipment Operation

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The Research and Curriculum Unit (RCU), located in Starkville, MS, as part of Mississippi State University, was established to foster educational enhancements and innovations. In keeping with the land grant mission of Mississippi State University, the RCU is dedicated to improving the quality of life for Mississippians. The RCU enhances intellectual and professional development of Mississippi students and educators while applying knowledge and educational research to the lives of the people of the state. The RCU works within the contexts of curriculum development and revision, research, assessment, professional development, and industrial training.

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Acknowledgments

The Heavy Machinery Operation curriculum was presented to the Mississippi Board of Education on November 19, 2015. The following persons were serving on the state board at the time:

Dr. Carey M. Wright, State Superintendent of Education
Dr. John R. Kelly, Chair
Mr. Richard Morrison, Vice-Chair
Dr. O. Wayne Gann
Mrs. Kami Bumgarner
Mr. William Harold Jones
Mr. Charles McClelland
Mrs. Rosemary G. Aultman
Mr. Johnny Franklin
Dr. Karen Elam

Jean Massey, Associate Superintendent of Education for the Office of Career and Technical Education at the Mississippi Department of Education, assembled a taskforce committee to provide input throughout the development of the Heavy Machinery Operation Curriculum Framework and Supporting Materials.

Lemond Irvin, Instructional Design Specialist for the Research and Curriculum Unit at Mississippi State University researched and authored this framework.
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Also, special thanks are extended to the teachers who contributed teaching and assessment materials that are included in the framework and supporting materials:

Corey Stevens, Wayne County School District, Career and Technical Center, Waynesboro, MS

Appreciation is expressed to the following professionals, who provided guidance and insight throughout the development process:

Mike Barkett, Program Coordinator, Mississippi Construction Education Foundation President, mike@mcef.net

Betsey Smith, Associate Director for the Research and Curriculum Unit at Mississippi State University

Scott Kolle, Project Manager for the Research and Curriculum Unit at Mississippi State University

Jolanda Young, Educational Technologist for the Research and Curriculum Unit at Mississippi State University

Standards

Standards are superscripted in each unit and are referenced in the appendices. Standards in the Heavy Machinery Operation Curriculum Framework and Supporting Materials are based on the following:

NCCER Learning Series
NCCER Learning Series from the National Center for Construction Education and Research
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College and Career-Ready Standards
The College and Career-Ready Standards emphasize critical thinking, teamwork and problem-solving skills. Students will learn the skills and abilities demanded by the workforce of today and the future. Mississippi adopted Mississippi College- and Career-Ready Standards (MCCRS) because they provide a consistent, clear understanding of what students are expected to learn so that teachers and parents know what they need to do to help them. Reprinted from http://www.mde.k12.ms.us/MCCRS

International Society for Technology in Education Standards (ISTE)
Reprinted with permission from *National Educational Technology Standards for Students: Connecting Curriculum and Technology*, Copyright 2007, International Society for Technology in Education (ISTE), 800.336.5191 (U.S. and Canada) or 541.302.3777 (International), iste@iste.org, www.iste.org. All rights reserved. Permission does not constitute an endorsement by ISTE.

21st Century Skills and Information and Communication Technologies Literacy Standards
In defining 21st-century learning, the Partnership for 21st Century Skills has embraced five content and skill areas that represent the essential knowledge for the 21st century: global awareness; civic engagement; financial, economic, and business literacy; learning skills that encompass problem-solving, critical-thinking, and self-directional skills; and information and communication technology (ICT) literacy.

Preface

Secondary career and technical education programs in Mississippi face many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, *Mississippi Code of 1972*, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, Ch. 487, §14; Laws, 1991, Ch. 423, §1; Laws, 1992, Ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act IV, 2007; and No Child Left Behind Act of 2001).

Mississippi Teacher Professional Resources

The following are resources for Mississippi teachers:

Curriculum, Assessment, Professional Learning, and other program resources can be found at The Research and Curriculum Unit's website: http://www.rcu.msstate.edu

Learning Management System: An online resource

Learning Management System information can be found at the RCU's website, under Professional Learning.

Should you need additional instructions, please call the RCU at 662.325.2510.

Executive Summary

Pathway Description
Heavy Machinery Operation is an instructional program that prepares students for employment or continued education in the occupations of the Heavy Machinery Operation field. The curriculum framework for this program was developed in partnership with the Mississippi Construction Education Foundation (MCEF). MCEF is the accredited sponsor for the National Center for Construction Education and Research (NCCER).

Industry Certification
The NCCER developed and published a set of industry standards that are taught nationwide by contractors, associations, construction users, and secondary and postsecondary schools called the NCCER Learning Series. When developing this set of standards, the NCCER assembled a team of subject matter experts that represented construction companies and schools across the nation. Each committee met several times and combined experts' knowledge and experience to finalize the set of national industry standards.
As a part of the accreditation process, all Mississippi Construction Technology instructors will be required to successfully complete the Instructor Certification Training Program. This program ensures that instructors possess a deep knowledge of content of the standards.
This state-of-the-art curriculum is modeled after the eight Mississippi NCCER Accredited Training and Education Facilities (ATEF). In order to become an NCCER ATEF program, school districts must meet a set of guidelines including the following:
Use the approved curriculum.

1. All instructors must be NCCER certified.
2. All completed Form 200s and release forms on all student completions are to be forwarded to MCEF for proper approval. MCEF will in turn forward to NCCER for processing.
3. Follow NCCER guidelines on test security and performance profiles.
4. Have an active advisory committee with at least two commercial contractors involved.
5. Follow safety practices and Occupational Safety and Health Administration (OSHA) standards used in the class and lab areas.
6. Involve commercial contractors in class presentations or field trips.
7. All construction programs must be included in the accreditation process.
8. Show active involvement in student leadership development (e.g., VICA and SkillsUSA).
9. Provide demonstrated placement into construction-related occupations, and provide timely reports to MCEF.

Districts will be required to complete a self-evaluation of all programs and host a site visit from industry to ensure proper lab, safety, and instructional procedures are in place.

Assessment
The latest assessment blueprint for the curriculum can be found at
http://www.rcu.msstate.edu/Curriculum/CurriculumDownload.aspx

Student Prerequisites
In order for students to be able to experience success in the program, the following student prerequisites are suggested:

1. C or higher in English (the previous year)
2. C or higher in Math (last course taken or the instructor can specify the math)
3. Instructor Approval and TABE Reading Score (eighth grade or higher)

or

1. TABE Reading Score (eighth grade or higher)
2. Instructor Approval

or

1. Instructor Approval

Teacher Licensure
The latest teacher licensure information can be found at
http://www.mde.k12.ms.us/educator-licensure

Professional Learning
If you have specific questions about the content of any of the training sessions provided, please contact the Research and Curriculum Unit at 662.325.2510.

Course Outlines

Option 1—Four One-Carnegie-Unit Courses

This curriculum consists of four one-credit courses, which should be completed in the following sequence:

1. **Fundamentals of Heavy Equipment Operation —Course Code: 997302**
2. **Application of Heavy Equipment Operation —Course Code: 997303**
3. **Theory of Heavy Equipment Operation —Course Code: 997304**
4. **Advanced Skills of Heavy Equipment Operation —Course Code: 997305**

Course Description: Fundamentals of Heavy Equipment Operation
Fundamentals of Heavy Equipment Operation focuses on the NCCER Learning Series Core. Students will leave the class with a basic knowledge in the areas of employability skills, safety, construction math, hand and power tools, construction drawings, materials handling and rigging and signaling knowledge.

Course Description: Application of Heavy Equipment Operation
Application of Heavy Equipment Operation provides an introduction to heavy machinery identification and operations, utility tractors, rough terrain forklifts, on-road dump trucks, skid steers, and loaders. This course gives students simulated and hands-on practice in these areas.

Course Description: Theory of Heavy Equipment Operation
Theory of Heavy Equipment Operation provides a continued emphasis on heavy equipment safety and basic operational techniques for compaction equipment, off-road dump trucks, back hoes, excavators, and motor graders. This course gives students simulated and hands-on practice in these areas.

Course Description: Advanced Skills of Heavy Equipment Operation
Advanced Skills of Heavy Equipment Operation includes an in-depth study of grades, excavation math, civil drawings, site work, soils, finish grading. Additionally, students learn about the fundamental requirements of a crew leader.

Fundamentals of Heavy Equipment Operation —Course Code: 997302

Unit	Unit Name	Hours
1	Introduction, Orientation, Employability and Communication Skills	20
2	Basic Safety	20
3	Introduction to Construction Math	20
4	Hand and Power Tools	20
5	Introduction to Construction Drawings	10
6	Introduction to Materials Handling	20
7	Rigging and Signaling	8
8	Orientation to Trade	10
9	Heavy Equipment Safety I	12
Total		140

Application of Heavy Equipment Operation —Course Code: 997303

Unit	Unit Name	Hours
10	Heavy Equipment Safety II	33
11	Identification of Heavy Equipment and Basic Operational Techniques I	67
12	Identification of Heavy Equipment and Basic Operational Techniques II	40
Total		140

Theory of Heavy Equipment Operation —Course Code: 997304

Unit	Unit Name	Hours
13	Orientation and Safety (Review and Reinforcement)	10
14	Identification of Heavy Equipment and Basic Operational Techniques III	85
15	Grades	15
16	Excavation Math	18
Total		128

Advanced Skills of Heavy Equipment Operation —Course Code: 997305

Unit	Unit Name	Hours
17	Interpreting Civil Drawings	20
18	Site Work	20
19	Soils	10
20	Finish Grading	20
21	Fundamentals of Crew Leader	20
Total		90

Option 2—Two Two-Carnegie-Unit Courses

This curriculum consists of two two-credit courses, which should be completed in the following sequence:

1. **Heavy Equipment Operation I—Course Code: 997300**

2. **Heavy Equipment Operation II—Course Code: 997301**

Course Description: Heavy Equipment Operation I
This course focuses on the NCCER Learning Series Core. Students will leave the class with a basic knowledge in the areas of employability skills, safety, construction math, hand and power tools, construction drawings, materials handling and rigging and signaling knowledge. It further provides for an introduction to heavy machinery identification and operations, utility tractors, rough terrain forklifts, on-road dump trucks, skid steers, and loaders. This course gives students simulated and hands-on practice in these areas.

Course Description: Heavy Equipment Operation II
This course provides a continued emphasis on heavy equipment safety and basic operational techniques for compaction equipment, off-road dump trucks, back hoes, excavators, and motor graders. Students will leave with simulated and hands-on practice in these areas. This course further provides an in-depth study of grades, excavation math, civil drawings, site work, soils, and finish grading. Additionally, students learn about the fundamental requirements of a crew leader.

Heavy Equipment Operation I —Course Code: 997300

Unit	Unit Name	Hours
1	Introduction, Orientation, Employability and Communication Skills	20
2	Basic Safety	20
3	Introduction to Construction Math	20
4	Hand and Power Tools	20
5	Introduction to Construction Drawings	10
6	Introduction to Materials Handling	20
7	Rigging and Signaling	8
8	Orientation to Trade	10
9	Heavy Equipment Safety I	12
10	Heavy Equipment Safety II	33
11	Identification of Heavy Equipment and Basic Operational Techniques I	67
12	Identification of Heavy Equipment and Basic Operational Techniques II	40
Total		280

Heavy Equipment Operation II —Course Code: 997301

Unit	Unit Name	Hours
13	Orientation and Safety (Review and Reinforcement)	10
14	Identification of Heavy Equipment and Basic Operational Techniques III	85
15	Grades	15

16	Excavation Math	18
17	Interpreting Civil Drawings	20
18	Site Work	20
19	Soils	10
20	Finish Grading	20
21	Fundamentals of Crew Leader	20
Total		218

Research Synopsis

Introduction
By implementing the National Center for Construction Education and Research in the construction skills standards to the Architecture and Construction Pathway, students who successfully master the curriculum should have the skills required to enter the workforce or pursue an advanced degree. These skills are based on industry-validated performance indicators. The pathway will include applied instruction designed to articulate with programs offered in Mississippi's community and junior colleges.

Needs of the Future Workforce
The U.S. Bureau of Labor Statistics reports that job prospects will be excellent for technicians in this field, particularly those who have received training at accredited technical schools. Data for this synopsis were compiled from the Mississippi Department of Employment Security (2014). Employment opportunities for each of the occupations are listed below.

Table 1.1: Current and Projected Occupation Report

Description	Jobs, 2010	Projected Jobs, 2020	Change (Number)	Change (Percent)	Average Hourly Earning
Agricultural Equipment Operators	280	300	20	7.1	$12.94
Logging Equipment Operators	1,320	1,360	40	3.0	$15.67
Paving, Surfacing, and Tamping Equipment Operators	430	440	10	2.3	$14.79
Operating Engineers and Other Construction Equipment Operators	3,150	3,320	170	5.4	$16.83
First-Line Supervisors of Transportation and Material-Moving Machine and Vehicle Operators	2,180	2,320	140	6.4%	$24.62
Conveyor Operators and Tenders	500	540	40	8.0%	$12.43
Crane and Tower Operators	840	890	50	6.0%	$19.44
Excavating and Loading Machine and Dragline Operators	770	810	40	5.2%	$17.39
Industrial Truck and Tractor Operators	5,960	6,240	280	4.7%	$13.99

Source: Mississippi Department of Employment Security; www.mdes.ms.gov (accessed August 5, 2014).

Perkins IV Requirements
The Heavy Equipment Operator curriculum meets Perkins IV requirements of high-skill, high-wage, and/or high-demand occupations by introducing students to and preparing students for occupations. It also offers students a program of study including secondary, postsecondary, and IHL courses that will prepare them for occupations in these fields. Additionally, the Heavy Equipment Operator curriculum is integrated with academic College and Career Readiness standards. Lastly, the Heavy Equipment Operator curriculum focuses on ongoing and meaningful professional development for teachers as well as relationships with industry.

Curriculum Content
Summary of Standards
The standards to be included in the Heavy Equipment Operator curriculum are the College and Career Readiness Standards for Mathematics and Science, 21st Century Skills, and the National Educational Technology Standards (NETS) for students. Combining these standards to create this document will result in highly skilled, well-rounded students who are prepared to enter a secondary academic or career and technical program of study. They will also be prepared to academically compete nationally as the College and Career Readiness Standards are designed to prepare students for success in community colleges, Institutions of Higher Learning, and careers.

Transition to Postsecondary Education
The latest articulation information for Secondary to Postsecondary can be found at the Mississippi Community College Board (MCCB) website http://www.mccb.edu/

Best Practices
Innovative Instructional Technologies
Recognizing that today's students are digital learners, the classroom should be equipped with tools that will teach them in the way they need to learn. The Heavy Equipment Operation teacher's goal should be to include teaching strategies that incorporate current technology. It is suggested that each classroom house a classroom set of desktop student computers and one teacher laptop. To make use of the latest online communication tools such as wikis, blogs, and podcasts, the classroom teacher is encouraged to use a learning management system, for example, the Heavy Equipment Operation LMS Content Management System, that introduces students to education in an online environment and places the responsibility of learning on the student.

Differentiated Instruction
Students learn in a variety of ways. Some are visual learners, needing only to read information and study it to succeed. Others are auditory learners, thriving best when information is read aloud to them. Still others are tactile learners, needing to participate actively in their learning experiences. Add the student's background, emotional health, and circumstances, and a very unique learner emerges. Many activities are graded by rubrics that allow students to choose the type of product they will produce. By providing various teaching and assessment strategies, students with various learning styles can succeed.

Career and Technical Education Student Organizations
Teachers should investigate opportunities to sponsor a student organization. There are several opportunities here in Mississippi that will foster the types of learning expected from the Heavy

Equipment Operation curriculum. SkillsUSA is the student's organization for Heavy Equipment Operation. SkillsUSA provides students with growth opportunities and competitive events. It also opens the doors to the world of manufacturing, Heavy Equipment Operation and construction as well as scholarships opportunities.

Cooperative Learning

Cooperative learning can help students understand topics when independent learning cannot. Therefore, you will see several opportunities in the Heavy Equipment Operation curriculum for group work. To function in today's workforce, students need to be able to work collaboratively with others and solve problems without excessive conflict. The Heavy Equipment Operation curriculum provides opportunities for students to work together and help each other to complete complex tasks.

Conclusions

The Heavy Equipment Operation Curriculum is one of Mississippi's most comprehensive trade and industrial curriculums. Students that complete these programs are well-equipped for a variety of endeavors. Instructors are urged to encourage Heavy Equipment Operation students to pursue educational opportunities at community colleges and universities in Mississippi.

Professional Organizations

Mississippi ACTE. May be found at http://www.mississippiacte.com/

Mississippi Construction Education Foundation (MCEF).
290 Commerce Park Drive, Suite B
Ridgeland, MS 39157
Phone: 601.605.2989 or Toll-free: 800.358.3788
Fax: 601.605.2987
http://www.mcef.net/

National Center for Construction Education and Research (NCCER).
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