Chapter 127. Texas Essential Knowledge and Skills for Career Development and Career and Technical Education

Subchapter G. Education and Training

§127.316. Principles of Education and Training (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 9 and 10. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Education and Training Career Cluster focuses on planning, managing, and providing education and training services and related learning support services.

(3) Principles of Education and Training is designed to introduce learners to the various careers within the Education and Training Career Cluster. Students use self-knowledge as well as educational and career information to analyze various careers within the Education and Training Career Cluster. Students are introduced to societal influences of education and various school models. Additionally, students learn the role and responsibilities of a classroom educator. Students will develop a graduation plan that leads to a specific career choice in the student's interest area.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills required by the education profession and related occupations. The student is expected to:

(A) demonstrate written communication skills;

(B) perform job-appropriate numerical and arithmetic applications;

(C) practice various forms of communication such as verbal and non-verbal communication used in educational and career settings;

(D) exhibit teamwork skills;

(E) analyze the impact of current decision making on short- and long-term career plans;

(F) identify and implement problem-solving techniques;

(G) identify conflict-management skills;

(H) describe effective leadership skills;

(I) describe productive work habits such as being organized, managing time, and taking initiative;

(J) demonstrate professionalism, including appropriate attire expected of professionals in educational settings; and

(K) identify effective work ethic practices.

(2) The student identifies strategies that promote health and wellness to address the unique challenges of educators in balancing work and personal responsibilities. The student is expected to:

(A) explain common signs of stress and anxiety;

(B) describe appropriate boundaries for a healthy work-life balance;

(C) discuss the impacts of an education career on personal lifestyle such as impacts on time, earning potential, community presence and involvement, health and wellness, and family;

(D) describe appropriate boundaries for a healthy work-life balance; and

(E) discuss strategies to manage health and wellness.

(3) The student recognizes the impact of social media and web-based applications on the education process. The student is expected to

(A) demonstrate appropriate use of social media for educational purposes; and

(B) identify web-based resources that can be used in the education process.

(4) The student investigates the range of employment opportunities in the education and training field. The student is expected to:

(A) identify and investigate career opportunities in education and training;

(B) investigate additional occupations in education and training such as professional support services, administration, county extension agent, and corporate trainer;

(C) compare transferable skills among a variety of careers in education and; and

(D) analyze results from personal assessments such as how results from career interest and ability inventories relate to skills necessary for success in education and training occupations.

(5) The student explains societal impacts on the education and training field. The student is expected to:

(A) investigate trends or issues that have influenced the development of education across the United States such as historical, societal, cultural, and political trends and issues;

(B) explain pedagogy and andragogy theory;

(C) predict the education and training job market using information from sources such as labor market information, technology, and societal or economic trends; and

(D) summarize the role of family/caregiver in education.

(6) The student describes the characteristics of different educational and training environments. The student is expected to:

(A) summarize the various roles and responsibilities of professionals in teaching and training and early learning, including demonstrating ethical behavior in educational settings;

(B) describe different types of schools **in urban and rural areas and public and private schools** such as academies **, [~~and~~]** Montessori, **[~~public, private,~~]** charter, and magnet schools **[~~and schools in urban and rural areas~~]** ;

(C) compare teacher salary schedules among different school models such as public, private, and charter schools within rural and urban areas of the state;

(D) discuss factors, including stipends, state and school district initiatives, and level of education, that can impact earning potential; and

(E) identify various sources for information related to education careers such as requirements to become a teacher, curriculum standards, and the structures and roles of state and federal governing bodies in education.

(7) The student experiences authentic education and training opportunities. The student is expected to:

(A) observe educator duties and responsibilities through activities such as assisting, shadowing, or observing;

(B) develop and evaluate instructional materials such as visuals, teacher aids, manipulatives, lessons, and lesson plans;

(C) define lesson plan components, including objectives, direct instruction, guided practice, independent practice, and formative and summative assessments;

(D) identify and discuss methods to adapt lessons to meet student needs; and

(E) identify a personal set of beliefs related to education in preparation for developing a philosophy of education.

(8) The student identifies elements of an effective classroom environment. The student is expected to:

(A) use available classroom equipment and technology for effective instruction;

(B) analyze effective tools used in classroom management such as classroom expectations, seating charts, classroom set-up, procedures and routines, and teacher organization and preparation; and

(C) explain characteristics of an effective learning environment, including universally accessible classroom design.

(9) The student analyzes the education and training requirements for a career in an area of interest. The student is expected to:

(A) investigate degree plans or training alternatives for various occupations within teaching and training and early learning;

(B) develop a graduation plan that leads to a specific career choice in the area of interest;

(C) investigate and identify high school and dual enrollment opportunities related to education and training careers;

(D) investigate and identify scholarships, grants, and financial incentives related to interest areas in education and training;

(E) identify and compare technical and community college programs that align with interest areas in education and training; and

(F) identify and compare university programs and institutions that align with interest areas in education and training.

(10) The student documents technical knowledge and skills related to education and training. The student is expected to:

(A) assemble basic professional portfolio components such as basic resume, samples of work, service-learning logs, assessment results, and mock scholarship applications; and

(B) present a portfolio to interested stakeholders such as teachers, school administrators, career and technical education administrators, curriculum specialists, or human resources personnel.

(11) The student understands how classroom observations (video or in person) inform and improve instruction. The student is expected to:

(A) apply knowledge gained in the course to conduct targeted observations;

(B) record objective observations of student behavior and teacher interactions;

(C) explain how observations can influence philosophy of education and delivery of instruction; and

(D) identify qualities of an effective classroom through classroom observation.

§127.319. Child Development Associate Foundations (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in **Grades 10-12. [~~Grade 10 but open for students through Grade 12.~~]** Recommended prerequisites: Principles of Education and Training or Principles of Human Services. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Education and Training Career Cluster focuses on planning, managing, and providing education and training services and related learning support services.

(3) The Child Development Associate Foundations course is a laboratory course addressing the knowledge and skills related to applying Child Development Associate Competency Standards in early childhood environments and understanding how these competencies help young children move with success from one developmental stage to the next.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student identifies professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate effective written communication;

(B) practice various forms of communication such as verbal and non-verbal communication skills used in education and career settings;

(C) apply decision-making skills;

(D) identify and exhibit characteristics of professionalism; and

(E) develop effective work ethic practices.

(2) The student understands the need for establishing a safe, healthy learning environment for young children. The student is expected to:

(A) describe a safe physical setting for an indoor classroom environment;

(B) describe a safe physical setting for an outdoor play environment;

(C) compare and contrast the learning environments for childcare settings such as preschool, infant-toddler, family childcare, and home visitor environments;

(D) identify practices that promote health and prevent illness in an early childhood classroom; and

(E) identify components of a learning environment that promotes engagement, play, exploration, and learning of all children, including children with special needs.

(3) The student recognizes the importance of advancing each child's physical and intellectual competence in the early childhood classroom through a variety of developmentally appropriate equipment, learning experiences, and teaching strategies. The student is expected to:

(A) analyze the methods for promoting physical development in young children;

(B) investigate strategies for promoting cognitive development in young children;

(C) investigate techniques for promoting language and early literacy in young children, including dual-language learners; and

(D) investigate and explain reasons for promoting creative expression and creative abilities in young children.

(4) The student analyzes social and emotional development in young children. The student is expected to:

(A) summarize the value of developing a warm, positive, supportive, and responsive relationship with each child;

(B) explain the value of helping each child learn about and take pride in the child's individual and cultural identity; and

(C) research and explain the significance of helping each child function effectively in a group setting, express feelings, and acquire social skills.

(5) The student discusses the need for providing positive guidance in an early childhood classroom. The student is expected to:

(A) summarize the importance of a classroom management plan;

(B) explain the importance of positively addressing challenging behaviors; and

(C) compare various positive guidance techniques.

(6) The student describes the benefits of objective observations and assessments of young children in the early childhood classroom. The student is expected to:

(A) investigate and compare various observation tools and strategies;

(B) analyze how observations impact curriculum planning and individualized teaching; and

(C) describe how objective observations are used to build productive relationships with families.

(7) The student examines the importance of positive and productive relationships with families of young children. The student is expected to:

(A) investigate and describe different family structures;

(B) describe ways to establish partnerships with families; and

(C) describe methods for effectively communicating with families.

(8) The student analyzes the components of operating an effective, professional early childhood program. The student is expected to:

(A) discuss the importance of establishing and maintaining professional relationships within an early childhood program;

(B) research various techniques for navigating disagreements or conflicts between personnel of an early childhood program;

(C) investigate the qualities of teaching with intentionality; and

(D) explain the importance of advocating for early childhood education.

(9) The student documents technical knowledge and skills. The student is expected to:

(A) assemble professional portfolio components such as a resume, samples of learning experiences, service-learning log, and assessment results; and

(B) present the portfolio to interested stakeholders such as industry professionals, parents, community members, campus teachers and administrators, and peers.

§127.320. Practicum in Early Learning (Two Credits), Adopted 2021.

(a) General requirements. This course is recommended for students in Grade 12. Prerequisite: Child Guidance. Recommended prerequisites: Child Development or Child Development Associate Foundations. Students shall be awarded two credits for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Education and Training Career Cluster focuses on planning, managing, and providing education and training services and related learning support services.

(3) Practicum in Early Learning is a field-based course that provides students background knowledge of early childhood development principles as well as principles of effective teaching and training practices. Students in the course work under the joint direction and supervision of both a teacher facilitator and an exemplary industry professional. Students learn to plan and direct individualized instruction and group activities, prepare instructional materials, assist with record keeping, make physical arrangements, and complete other responsibilities of early learning teachers, trainers, paraprofessionals, or other educational personnel.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate advanced written communication skills;

(B) perform job-appropriate mathematical applications;

(C) demonstrate appropriate forms of communication such as verbal and non-verbal communication used in educational and career settings;

(D) promote and exhibit teamwork skills;

(E) analyze and apply decision-making skills;

(F) implement problem-solving techniques effectively;

(G) analyze and demonstrate conflict-management skills;

(H) assess personal leadership skills;

(I) describe and demonstrate professionalism, including time-management skills; and

(J) analyze and demonstrate effective work ethic practices.

(2) The student explores the early childhood education profession. The student is expected to:

(A) analyze current trends and issues that impact early childhood education such as political, societal, and economic trends and issues;

(B) analyze qualities of effective early childhood education professionals and programs;

(C) develop a written summary of professional beliefs and values about early childhood education, how young children learn, and the role of an early educator;

(D) explore the **educational and academic** **[~~educational/academic~~]** requirements and possible **degrees and certifications** **[~~degrees/certifications~~]** available in early childhood education.

(E) develop and refine a personal career plan in preparation for a career in the field of early childhood development or education;

(F) explore and identify early childhood development or education opportunities in non-traditional settings such as those in corporations, community outreach programs, nonprofits, and government entities; and

(G) explore educational high-needs and teacher-specialty areas such as special education and bilingual and English as a second language education programs.

(3) The student understands the learner and learning process. The student is expected to:

(A) apply **and reflect on the application of** principles and theories of human development appropriate to early learning situations **[~~and reflect on the application thereof~~]** ;

(B) apply **and reflect on the application of** principles and theories about the learning process to specific early learning situations **[~~and reflect on the application thereof~~]** ;

(C) analyze the dynamics of educator and student behaviors that facilitate the early learning process;

(D) analyze teaching skills that facilitate the early learning process and document field-learning experiences; and

(E) demonstrate and evaluate effective instructional practices to accommodate diversity such as learning differences, learner exceptionality, and special-needs considerations.

(4) The student plans and implements effective instruction. The student is expected to:

(A) demonstrate and evaluate techniques promoting early childhood growth and development skills such as language, literacy, numeracy, motor learning, and cross-disciplinary content areas;

(B) develop age-appropriate lesson plans and instructional materials that align to student learning goals;

(C) evaluate the effectiveness of lesson plans and instructional strategies; and

(D) explain how learner and professional feedback is used to guide selection and adjustment of instructional strategies.

(5) The student creates and maintains an effective learning environment. The student is expected to:

(A) create and maintain a safe and an effective learning environment;

(B) integrate teacher or trainer practices that promote an effective learning environment;

(C) apply classroom management techniques that promote an effective learning environment; and

(D) demonstrate specific conflict-management and mediation techniques supportive of an effective learning environment.

(6) The student assesses instruction and learning. The student is expected to:

(A) develop and apply formal and informal assessments to track and monitor student learning and progress; and

(B) analyze assessment data to inform and modify instruction.

(7) The student understands the relationship between school, families, and community in early learning. The student is expected to:

(A) select family services and school and community resources to promote student growth;

(B) promote learning and build support through positive school partnership activities with stakeholders such as families, schools, communities, and business/industry; and

(C) collaborate with professional early learning community members to meet the needs of students and families.

(8) The student develops technology skills **appropriate for effectively supporting students in the classroom**. The student is expected to:

(A) utilize **a variety of assistive technologies** **[~~current technology applications~~]** that are age-appropriate for specific student learning needs, including for early learners with special needs; and

(B) integrate **various educational technologies as tools** **[~~the skillful use of technology as a tool~~]** for instruction, evaluation, communication, and management.

(9) The student understands the professional, ethical, and legal responsibilities of early childhood professionals. The student is expected to:

(A) demonstrate and evaluate effective interaction skills with stakeholders such as students, educators, parents/guardians, community members, and other professionals;

(B) analyze professional and ethical standards that apply to early childhood professionals; and

(C) analyze situations requiring decisions based on professional, ethical, and legal considerations.

(10) The student explores the need and opportunities for continued professional development for early education professionals. The student is expected to:

(A) identify strategies and resources for the professional development of early education professionals such as research and assessment; and

(B) create a plan for professional career growth, including short-term and long-term goals.

(11) The student understands facility operations, including nutrition, program management, and safety guidelines. The student is expected to:

(A) explain the importance of accurate record maintenance such as personnel, student, incident, and facility documentation;

(B) create a meal plan that promotes good nutrition and wellness;

(C) explain the importance of allocation of facility resources and budget management; and

(D) explain the importance of safety procedures and regulations.

(12) The student continues to participate in field-based experiences in early childhood settings. The student is expected to:

(A) apply instructional strategies and concepts within a local educational or training facility; and

(B) document, assess, and reflect on instructional experiences.

(13) The student documents technical knowledge and skills. The student is expected to:

(A) gather artifacts and documentation that support attainment of technical skill competencies;

(B) update a professional portfolio to include components such as a resume, samples of work, service-learning log, recognitions, awards, scholarship essays, letters of recommendation, certifications, evaluations, and Child Development Associate (CDA) requirements; and

(C) present a portfolio to interested stakeholders.

§127.321. Extended Practicum in Early Learning (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grade 12. **Prerequisite** **[~~Required prerequisite~~]** : Child Guidance. Recommended prerequisites: Child Development or Child Development Associate Foundations. Corequisite: Practicum in Early Learning. This course must be taken concurrently with Practicum in Early Learning and may not be taken as a stand-alone course. Students shall be awarded one credit for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Education and Training Career Cluster focuses on planning, managing, and providing education and training services and related learning support services.

(3) Extended Practicum in Early Learning is a field-based internship that provides students background knowledge of early childhood development principles as well as principles of effective teaching and training practices. Students in the course work under the joint direction and supervision of both a teacher facilitator and an exemplary industry professional. Students learn to plan and direct individualized instruction and group activities, prepare instructional materials, assist with record keeping, make physical arrangements, and complete other responsibilities of early learning teachers, trainers, paraprofessionals, or other educational personnel.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) participate in a paid or unpaid, laboratory- or work-based application of previously studied knowledge and skills related to early childhood education professions;

(B) participate in training, education, or preparation for licensure, certification, or other relevant credentials to prepare for employment;

(C) demonstrate professional standards and personal qualities needed to be employable such as leadership, appreciation of diversity, conflict-management, work ethic, and adaptability with increased fluency;

(D) demonstrate technology applications skills such as effective use of social media, email, internet, publishing tools, presentation tools, spreadsheets, or databases with increased fluency to enhance work products; and

(E) employ planning and time-management skills and tools with increased fluency to enhance results and complete work tasks.

(2) The student applies professional communications strategies. The student is expected to:

(A) demonstrate verbal and non-verbal communication consistently in a clear, concise, and effective manner;

(B) present information formally and informally;

(C) analyze, interpret, and communicate information; and

(D) apply active listening skills to obtain and clarify information.

(3) The student implements advanced problem-solving methods. The student is expected to employ critical-thinking skills with increased fluency both independently and in groups to solve problems and make decisions.

(4) The student understands the professional, ethical, and legal responsibilities in early childhood education professions. The student is expected to:

(A) demonstrate a positive, productive work ethic by performing assigned tasks as directed;

(B) show integrity by choosing the ethical course of action when making decisions;

(C) demonstrate proper etiquette and knowledge of acceptable-use policies when using networks, especially resources on the internet and intranet; and

(D) comply with all applicable rules, laws, and regulations in a consistent manner.

(5) The student continues to participate in field-based experiences in early childhood education and education and training professions. The student is expected to:

(A) apply instructional strategies and concepts with increased fluency within a local educational or training facility;

(B) apply principles and theories that impact instructional planning;

(C) develop curriculum and related materials to support instruction that aligns with current child development industry standards;

(D) demonstrate competency in foundation and enrichment subject areas;

(E) create lesson plans that meet instructional goals;

(F) document, assess, and reflect on instructional experiences; and

(G) collect representative work samples.

§127.324. Communication and Technology in Education (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Principles of Education and Training. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Education and Training Career Cluster focuses on planning, managing, and providing education and training services and related learning support services.

(3) Communication and Technology in Education is an extended course of study designed to provide students with the fundamentals of planning, managing, and training services needed to provide learning support services in Kindergarten-Grade 12 classrooms. Students will develop knowledge and skills regarding the professional, ethical, and legal responsibilities in teaching related to educational technology; students will also understand laws and pedagogical justifications regarding classroom technology use. Students will develop knowledge of developmentally appropriate practice for age level when technology is used by learners. This course provides an

opportunity for students to participate in training related to standards set by the International Society for Technology in Education.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate written communication skills;

(B) perform job-appropriate numerical and arithmetic application;

(C) practice various forms of communication such as verbal and non-verbal communication skills used in educational and career settings;

(D) exhibit teamwork skills;

(E) apply decision-making skills;

(F) identify and implement problem-solving techniques;

(G) describe conflict-management skills;

(H) describe and demonstrate professionalism;

(I) describe effective work ethic practices;

(J) demonstrate appreciation for diversity;

(K) participate in training, education, or certification for employment;

(L) demonstrate skills related to seeking and applying for employment; and

(M) create a resume and cover letter to document information such as work experience, licenses, certifications, and work samples.

(2) The student understands the professional, ethical, and legal responsibilities when communicating in the educational field. The student is expected to:

(A) apply communication standards that promote professional, ethical, and legal conduct;

(B) identify times when communication between school and parents/community is necessary;

(C) distinguish between appropriate and inappropriate uses of social media and other communication platforms and methods; and

(D) cite sanctions and consequences for educator misconduct such as those stemming from inappropriate relationships.

(3) The student understands multiple forms of communication necessary for effective teaching. The student is expected to:

(A) demonstrate effective verbal communication skills with various stakeholders such as students, educators, parents/guardians, community members, and other professionals;

(B) demonstrate active listening skills to obtain and clarify information;

(C) identify various forms of digital communication for educators such as email, blogs, wikis, podcasts, vlogs, digital streaming, infographics, digital portfolios, or social media;

(D) construct effective and professional electronic communication with parents and stakeholders such as newsletters, emails, and websites;

(E) demonstrate effective professional collaboration and communication such as participation in professional learning communities, peer-coaching, and mentoring;

(F) demonstrate effective student-teacher communication such as assignment feedback and one-on-one interaction;

(G) facilitate effective student group work and multiple strategies for student engagement; and

(H) differentiate between approaches to communication based on student needs, including considerations for special populations and nonverbal communication.

(4) The student applies digital literacy concepts to communication with students and stakeholders. The student is expected to:

(A) apply digital literacy practices in communications to students and stakeholders such as desktop publishing, elements of art and design, and design thinking;

(B) demonstrate appropriate search strategies for finding resources on the internet such as Boolean searches;

(C) compare various digital media technologies such as digital books, databases, websites, interactive games, and digital videos; and

(D) evaluate and select appropriate software for specific purposes such as communication and research.

(5) The student evaluates technology and applications for classroom use. The student is expected to:

(A) demonstrate understanding of laws regarding classroom technology use such as Family Educational Rights and Privacy Act (FERPA), Children's Online Privacy Protection Act (COPPA), end-user license agreements (EULAs), and age restrictions;

(B) apply laws related to the legal use of electronic materials such as copyright, fair use, public domain, and open source;

(C) evaluate usage of classroom technology using a model such as substitution augmentation modification redefinition (SAMR) and technological pedagogical content knowledge (TPaCK);

(D) describe methods for approval of technology use in the district such as inventorying, licensing, and budgeting; and

(E) identify classroom management strategies appropriate for technology use in the classroom.

(6) The student creates engaging lessons and lesson plans incorporating technology. The student is expected to:

(A) analyze the relationship between technology and student engagement in the classroom;

(B) design learning experiences that incorporate 21st century learning skills such as creativity, collaboration, critical thinking, communication, and resiliency;

(C) create lessons using different types of technology such as presentation software, spreadsheet software, image editing software, video creation software, polling software, and word processing software;

(D) apply technology to assess student learning at the beginning of, during, and at the end of a lesson;

(E) design authentic learning experiences that align with content-area Texas Essential Knowledge and Skills and use technology to maximize active, deep learning across grade levels to show appropriate use based on age;

(F) create an interactive lesson that utilizes appropriate technology; and

(G) create a differentiated lesson that incorporates the appropriate use of technology.

§127.325. Instructional Practices (Two Credits), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. **Prerequisite: At least one credit in a course from the education and training career cluster.** Recommended prerequisites: Principles of Education and Training, Human Growth and Development, or Child Development. Students shall be awarded two credits for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Education and Training Career Cluster focuses on planning, managing, and providing education and training services and related learning support services.

(3) Instructional Practices is a field-based (practicum) course that provides students with background knowledge of child and adolescent development as well as principles of effective teaching and training practices. Students work under the joint direction and supervision of both a teacher with knowledge of early childhood, middle childhood, and adolescence education and exemplary educators or trainers in direct instructional roles with elementary-, middle school-, and high school-aged students. Students learn to plan and direct individualized instruction and group activities, prepare instructional materials, develop materials for educational environments, assist with record keeping, and perform other duties of teachers, trainers, paraprofessionals, or other educational personnel.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by the education profession and other related occupations. The student is expected to:

(A) demonstrate written communication;

(B) perform job-appropriate numerical and arithmetic application;

(C) practice various forms of communication such as verbal and non-verbal communication skills and appropriate uses of social media in educational and career settings;

(D) exhibit teamwork skills;

(E) apply decision-making skills;

(F) implement problem-solving techniques;

(G) acquire conflict-management skills;

(H) develop leadership skills;

(I) demonstrate professionalism to include appropriate attire expected of professionals in educational settings; and

(J) develop effective work ethic practices.

(2) The student identifies strategies that promote health and wellness by balancing the unique challenges of being an educator with personal responsibilities. The student is expected to:

(A) identify signs of personal stress and anxiety;

(B) choose appropriate boundaries for a healthy work-life balance; and

(C) implement strategies to manage health and wellness.

(3) The student explores the teaching and training profession. The student is expected to:

(A) demonstrate an understanding of the historical foundations of education and training in the United States;

(B) **summarize and apply acquired** [~~**determine and implement**~~] pedagogical knowledge and skills [~~**learned in this course and**~~] needed by teaching and training professionals;

(C) identify qualities of effective schools;

(D) discuss non-traditional settings for teaching and training careers such as those in corporations, community outreach programs, nonprofits, and government entities; and

(E) formulate a professional philosophy of education based on a personal set of beliefs.

(4) The student understands the learner and the learning process. The student is expected to:

(A) relate and implement principles and theories of human development to teaching and training situations;

(B) relate and implement principles and theories about the learning process to teaching and training situations;

(C) demonstrate and implement behaviors and skills that facilitate the learning process;

(D) explain the relationship between effective instructional practices and **providing support for** learning differences, learner exceptionality, and learners with special needs;

(E) evaluate backgrounds, strengths, and skills of students when planning instruction; and

(F) demonstrate techniques for developing effective relationships with students that foster mutual respect and rapport and result in effective instruction.

(5) The student interacts effectively in the role of an educator. The student is expected to:

(A) demonstrate effective interaction skills with stakeholders such as students, educators, parents/guardians, community members, and other professionals;

(B) demonstrate methods for promoting stakeholder partnerships in improving educational outcomes; and

(C) describe the procedure for handling and reporting physical or emotional abuse.

(6) The student plans and develops effective instruction. The student is expected to:

(A) explain the role of the Texas Essential Knowledge and Skills in planning and evaluating instruction;

(B) explain the rationale for having a fundamental knowledge of the subject matter in order to plan, prepare, and deliver effective instruction;

(C) explain the rationale for and process of instructional planning components such as vertical alignment and scope and sequence;

(D) describe principles and theories that impact instructional planning;

(E) create clear short-term and long-term learning objectives that are developmentally appropriate for students; and

(F) demonstrate lesson planning to meet instructional goals.

(7) The student creates an effective learning environment. The student is expected to:

(A) describe and implement a safe and an effective learning environment that incorporates the principles of universal design;

(B) analyze and evaluate strategic student grouping techniques that result in effective instruction;

(C) demonstrate teacher and trainer practices that promote an effective learning environment;

(D) evaluate materials and equipment to determine age and grade level appropriateness and to meet the needs of diverse learners;

(E) identify classroom management techniques that promote an effective learning environment; and

(F) demonstrate communication, conflict-management, and mediation techniques supportive of an effective learning environment.

(8) The student assesses teaching and learning. The student is expected to:

(A) describe the role of assessment as part of the learning process;

(B) create assessments to measure student learning;

(C) analyze the assessment process;

(D) use appropriate assessment strategies in an instructional setting; and

(E) use assessment data to evaluate and revise lesson plans.

(9) The student understands the relationship between school and society. The student is expected to:

(A) explain the relationship between school and society;

(B) recognize and use resources for professional growth such as family, school, and community resources; and

(C) collaborate with stakeholders such as family, school, and community to promote learning.

(10) The student develops technology skills. The student is expected to:

(A) describe the role of technology in the instructional process;

(B) use technology applications appropriate for specific subject matter and student needs; and

(C) demonstrate skillful use of technology as a tool for instruction, evaluation, and management.

(11) The student understands the professional, ethical, and legal responsibilities in teaching and training. The student is expected to:

(A) describe teacher and trainer practices that promote professional and ethical conduct;

(B) analyze professional and ethical standards that apply to educators and trainers;

(C) analyze situations requiring decisions based on professional, ethical, and legal considerations; and

(D) analyze expected effects of compliance and non-compliance with the Code of Ethics and Standard Practices for Texas Educators.

(12) The student participates in field-based experiences in education and training. The student is expected to:

(A) apply instructional strategies and concepts within a local educational or training facility; and

(B) document, assess, and reflect on instructional experiences.

(13) The student documents technical knowledge and skills. The student is expected to:

(A) update professional portfolio components such as resume, samples of work, service-learning log, assessment results, and mock scholarship applications; and

(B) present the portfolio to interested stakeholders.

(14) The student demonstrates the knowledge and skills needed to provide meaningful, specific, and timely feedback to students, families, and other school personnel on the growth of students in relation to classroom goals while maintaining student confidentiality. The student is expected to:

(A) explain the role feedback plays in the learning process;

(B) provide guidance and feedback to motivate student behavior and outcomes;

(C) demonstrate methods of providing feedback to students such as checklists, classroom processes, and written documentation;

(D) demonstrate methods of accepting and reflecting on feedback to determine plans for improvement of educational outcomes; and

(E) apply questioning strategies to facilitate student discussion.

(15) The student demonstrates knowledge and understanding of teacher responsibility with regard to accommodations and modifications for students with special needs. The student is expected to:

(A) identify the Individuals with Disabilities Education Act and Section 504 of the Rehabilitation Act of 1973;

(B) [~~(A)~~] explain the structure and components of an individualized education program (IEP);

(C) [~~(B)~~] explain the structure and components of a **Section** 504 **Plan [~~plan~~]** ; and

(D) [~~(C)~~] compare accommodations and modifications for students with special needs.

(16) The student demonstrates proper record-keeping strategies needed by teachers to demonstrate evidence of student progress. The student is expected to:

(A) understand and demonstrate the use of learning management systems and record-keeping tools;

(B) outline school district policies related to teacher record keeping; and

(C) identify the essential components of behavioral and academic records according to state and school district policy.

(17) The student uses standard observation techniques to observe a variety of educational settings. The student is expected to:

(A) evaluate teaching styles, learning environments, and classroom management utilizing observation checklists or other observation and evaluation tools; and

(B) use observation and evaluation reports to reflect on teaching practices and develop strategies for improvement.

(18) The student assesses the benefits of how a mentor relationship impacts a teaching career. The student is expected to:

(A) recognize the benefits of a mentor relationship such as increased teacher retention, mentor guidance, and coaching; and

(B) seek out and foster mentorship opportunities.

(19) The student analyzes teacher employment requirements and professional growth opportunities for those in the education profession such as required education and certification. The student is expected to:

(A) describe required education needed to become a certified teacher;

(B) explain the steps for becoming a certified teacher in Texas;

(C) compare certification requirements for various content and grade level areas of interest; and

(D) identify various financial aid sources available for teacher candidates such as scholarships, student loans, and student loan forgiveness options once certified.

§127.326. Practicum in Education and Training (Two Credits), Adopted 2021.

(a) General requirements. This course is recommended for students in Grade 12. Prerequisite: Instructional Practices. Recommended prerequisites: Principles of Education and Training, Human Growth and Development, and Child Development. Students shall be awarded two credits for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Education and Training Career Cluster focuses on planning, managing, and providing education and training services and related learning support services.

(3) Practicum in Education and Training is a field-based course that provides students background knowledge of child and adolescent development principles as well as principles of effective teaching and training practices. Students in the course work under the joint direction and supervision of both a teacher with knowledge of early childhood, middle childhood, and adolescence education and exemplary educators in direct instructional roles with elementary-, middle school-, and high school-aged students. Students learn to plan and direct individualized instruction and group activities, prepare instructional materials, assist with record keeping, make physical arrangements, and perform other duties of classroom teachers, trainers, paraprofessionals, or other educational personnel.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by teaching and training profession. The student is expected to:

(A) demonstrate advanced written communication skills;

(B) perform job-appropriate numerical and arithmetic application;

(C) demonstrate appropriate forms of communication such as verbal and non-verbal communication used in educational and career settings;

(D) promote and exhibit teamwork skills;

(E) analyze and apply decision-making skills;

(F) implement problem-solving techniques effectively;

(G) analyze and demonstrate conflict-management skills;

(H) assess personal leadership skills in education settings;

(I) describe and demonstrate professionalism; and

(J) analyze and demonstrate effective work ethic practices.

(2) The student analyzes strategies that promote health and wellness to address the unique challenges in balancing work and personal responsibilities for educators. The student is expected to:

(A) examine signs of personal stress and anxiety;

(B) describe and develop appropriate boundaries for a healthy work-life balance; and

(C) identify and implement strategies to manage health and wellness.

(3) The student explores the teaching and training field and profession. The student is expected to:

(A) analyze current trends and issues that impact education such as political, societal, and economic trends and issues;

(B) analyze practices of effective teaching and training professionals;

(C) analyze qualities of effective schools;

(D) develop a written summary of professional beliefs and values about education and training;

(E) determine the **educational and academic** **[~~educational/academic~~]** requirements and possible **degrees and certifications** **[~~degrees/certifications~~]** necessary for a profession of interest in teaching and training;

(F) refine a personal career plan in preparation for a career in the field of education or training;

(G) research and identify teaching and training opportunities in non-traditional settings such as those in corporations, community outreach programs, nonprofits, and government entities; and

(H) research and identify educational high-needs and teacher-shortage areas.

(4) The student understands the learner and learning process. The student is expected to:

(A) apply principles and theories of human development appropriate to specific teaching or training situations;

(B) apply principles and theories about the learning process to specific teaching or training situations;

(C) analyze the dynamics of educator and student behaviors that facilitate the learning process;

(D) analyze teaching skills that facilitate the learning process; and

(E) demonstrate and evaluate effective instructional practices to accommodate diversity such as learning differences, learner exceptionality, and special needs.

(5) The student interacts effectively in the role of an educator. The student is expected to:

(A) demonstrate and evaluate effective interaction skills with stakeholders such as students, educators, parents/guardians, community members, and other professionals; and

(B) demonstrate and evaluate techniques that promote literacy.

(6) The student plans and uses effective instruction. The student is expected to:

(A) apply principles and theories that impact instructional planning;

(B) use lesson planning tools such as unit plans and scope and sequence and vertical alignment documents;

(C) develop instructional materials that align with the Texas Essential Knowledge and Skills;

(D) demonstrate competency in foundation and enrichment subject areas;

(E) apply research-based practices to create lessons plans that meet instructional goals;

(F) analyze the development of effective instructional strategies;

(G) evaluate and analyze effectiveness of lessons plans and instructional strategies used in a lesson or series of lessons; and

(H) explain how learner and professional feedback is used to guide selection and adjustment of instructional strategies.

(7) The student creates and maintains an effective learning environment. The student is expected to:

(A) apply principles of universal design to create and maintain a safe and effective learning environment;

(B) integrate teacher or trainer practices that promote an effective learning environment;

(C) apply classroom management techniques that promote an effective learning environment; and

(D) demonstrate specific conflict-management and mediation techniques supportive of an effective learning environment.

(8) The student assesses instruction and learning. The student is expected to:

(A) develop and apply formative and summative assessments to foster student learning;

(B) use assessment strategies to promote personal growth and teaching or training improvement;

(C) use self-reflection techniques to promote personal growth and teaching or training improvement; and

(D) use classroom and standardized test assessment data to drive instructional strategy.

(9) The student understands the relationship between school and society. The student is expected to:

(A) identify ways to support learning through advocacy;

(B) identify and select family, school, and community resources that support learning; and

(C) promote learning and build support through positive school partnership activities with stakeholders such as families, schools, communities, and business/industry.

(10) The student develops technology skills. The student is expected to:

(A) access and use current technology applications appropriate for specific subject matter and student needs; and

(B) integrate the use of technology as a tool for instruction, evaluation, and management effectively.

(11) The student understands the professional, ethical, and legal responsibilities in teaching and training. The student is expected to:

(A) analyze teacher and trainer practices that promote professional and ethical conduct;

(B) analyze professional and ethical standards that apply to educators and trainers;

(C) analyze situations requiring decisions based on professional, ethical, and legal considerations; and

(D) analyze potential consequences related to non-compliance with the Code of Ethics and Standard Practices for Texas Educators.

(12) The student explores the need and opportunities for continued professional development for educators and trainers. The student is expected to:

(A) identify strategies and resources for the professional development of educators or trainers such as research and assessment;

(B) demonstrate teacher or trainer practices that promote ongoing professional development and lifelong learning; and

(C) develop a plan for professional growth.

(13) The student participates in field-based experiences in education or training. The student is expected to:

(A) apply instructional strategies and concepts within a local educational or training facility; and

(B) document, assess, and reflect on instructional experiences.

(14) The student documents technical knowledge and skills. The student is expected to:

(A) gather artifacts and documentation that support attainment of technical skill competencies;

(B) update a professional portfolio to include components such as a resume, samples of work, service-learning logs, recognitions, awards, scholarship essays, letters of recommendation, certifications, and evaluations; and

(C) present a professional portfolio to interested stakeholders.

Chapter 127. Texas Essential Knowledge and Skills for Career Development and Career and Technical Education

Subchapter I. Health Science

§127.416. Implementation of Texas Essential Knowledge and Skills for Health Science, Adopted 2021.

(a) The provisions of this subchapter shall be implemented by school districts beginning with the 2022-2023 school year.

(b) No later than August 31, 2022, the commissioner of education shall determine whether instructional materials funding has been made available to Texas public schools for materials that cover the essential knowledge and skills for career and technical education as adopted in §§127.417-127.433 of this subchapter.

(c) If the commissioner makes the determination that instructional materials funding has been made available under subsection (b) of this section, §§127.417-127.433 of this subchapter shall be implemented beginning with the 2022-2023 school year and apply to the 2022-2023 and subsequent school years.

(d) If the commissioner does not make the determination that instructional materials funding has been made available under subsection (b) of this section, the commissioner shall determine no later than August 31 of each subsequent school year whether instructional materials funding has been made available. If the commissioner determines that instructional materials funding has been made available, the commissioner shall notify the State Board of Education and school districts that §§127.417-127.433 of this subchapter shall be implemented for the following school year.

§127.417. Medical Terminology (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostics services, health informatics, support services, and biotechnology research and development.

(3) The Medical Terminology course is designed to introduce students to the structure of medical terms, including prefixes, suffixes, word roots, singular and plural forms, and medical abbreviations. The course allows students to achieve comprehension of medical vocabulary appropriate to medical procedures, human anatomy and physiology, and pathophysiology.

(4) To pursue a career in the health science industry, students should learn to reason, think critically, make decisions, solve problems, and communicate effectively. Students should recognize that quality health care depends on the ability to work well with others.

(5) The health science industry is comprised of diagnostic, therapeutic, health informatics, support services, and biotechnology research and development systems that function individually and collaboratively to provide comprehensive health care. Students should identify the employment opportunities, technology, and safety requirements of each system. Students are expected to learn the knowledge and skills necessary to pursue a health science career through further education and employment.

(6) Professional integrity in the health science industry is dependent on acceptance of ethical and legal responsibilities. Students are expected to employ their ethical and legal responsibilities, recognize limitations, and understand the implications of their actions.

(7) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(8) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) express ideas in a clear, concise, and effective manner;

(B) exhibit the ability to cooperate, contribute, and collaborate as a member of a team; and

(C) exemplify professional work standards such as appearance, attire, time management, organizational skills, and responsibilities.

(2) The student recognizes the terminology related to the health science industry. The student is expected to:

(A) identify abbreviations, acronyms, and symbols related to the health science industry;

(B) recognize the incorrect use of abbreviations, acronyms, and symbols through review of The Joint Commission's "Do Not Use List";

(C) identify and define the component parts of medical words, including root, prefix, suffix, and combining vowels;

(D) practice word-building skills;

(E) research the origins of eponyms;

(F) recall directional terms and anatomical planes related to body structure;

(G) define and accurately spell occupationally specific terms such as those relating to the body systems, surgical and diagnostic procedures, diseases, and treatment; and

(H) use prior knowledge and experiences to understand the meaning of terms as they relate to the health science industry.

(3) The student demonstrates communication skills using the terminology applicable to the health science industry. The student is expected to:

(A) demonstrate appropriate verbal **strategies such as correct pronunciation of medical terms** and written strategies such as correct **[~~pronunciation of medical terms and~~]** spelling in a variety of health science scenarios;

(B) employ increasingly precise language to communicate; and

(C) translate technical material related to the health science industry.

(4) The student examines available resources. The student is expected to:

(A) examine medical and dental dictionaries and multimedia resources;

(B) integrate resources to interpret technical materials; and

(C) investigate electronic and digital media with appropriate supervision.

(5) The student interprets medical abbreviations. The student is expected to:

(A) distinguish medical abbreviations used throughout the health science industry; and

(B) translate medical abbreviations in simulated technical material such as physician progress notes, radiological reports, and laboratory reports.

(6) The student appropriately translates health science industry terms. The student is expected to:

(A) interpret, transcribe, and communicate vocabulary related to the health science industry;

(B) translate medical terms to conversational language to facilitate communication;

(C) distinguish medical terminology associated with medical specialists such as geneticists, pathologists, and oncologists;

(D) summarize observations using medical terminology; and

(E) interpret contents of medical scenarios correctly.

§127.418. Health Informatics (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Medical Terminology. Recommended prerequisites: Principles of Health Science and Business Information Management I. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) The Health Informatics course is designed to provide knowledge of one of the fastest growing areas in both academic and professional fields. Healthcare information technology has increased demand for information and health professionals who can effectively design, develop, and use technologies such as electronic medical records, patient monitoring systems, and digital libraries. This course will include a focus on billing and coding.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate verbal and non-verbal communication in a clear, concise, and effective manner;

(B) demonstrate adaptability skills such as problem solving and critical and creative thinking;

(C) develop a career plan;

(D) exhibit teamwork;

(E) create a job-specific resume; and

(F) exemplify professional work standards such as appearance, attire, time management, organizational skills, and responsibilities.

(2) The student interprets fundamental knowledge of concepts of health information systems technology and the tools for collecting, storing, and retrieving health care data. The student is expected to:

(A) discuss, define, and differentiate the common health information systems such as electronic medical records and electronic health records, practice management software, master patient index (MPI), patient portals, remote patient monitoring, and clinical decision support; and

(B) explain how various health information systems support the administrative, financial, clinical, and research needs of a health care enterprise.

(3) The student employs the various types of databases in relation to health informatics. The student is expected to:

(A) define the function of a database management system;

(B) identify the purpose of data modeling;

(C) define the customary steps in the data modeling process;

(D) differentiate between entities, attributes, and relationships in a data model; and

(E) explain various types of organizational databases.

(4) The student distinguishes between data and information. The student is expected to:

(A) discuss the importance of data security, accuracy, integrity, reliability, and validity; and

(B) demonstrate an understanding of data information concepts for health information systems, electronic health records, and patient registries.

(5) The student examines the evolution of the health information system. The student is expected to:

(A) evaluate the growing role of the electronic health record;

(B) review the progress of the development of the electronic health record;

(C) explain functional requirements for electronic health records; and

(D) explain the concept and importance of the interoperability of electronic health records and other health information systems.

(6) The student examines the process of medical diagnostic and coding concepts as well as current procedural practices. The student is expected to:

(A) examine Health Insurance Portability and Accountability Act (HIPAA) guidelines for confidentiality, privacy, and security of a patient's information within the medical record;

(B) differentiate between insurance fraud and insurance abuse;

(C) discuss the linkage between current procedural terminology (CPT) codes; International Classification of Diseases, 10th revision, Clinical Modification (ICD-10-CM) codes; and medical necessity for reimbursement for charges billed;

(D) search ICD-10-CM code system for correct diagnosis code using patient information;

(E) identify the two types of codes in the health care common procedure coding system (HCPCS); and

(F) explain how medical coding affects the payment process.

(7) The student identifies agencies involved in the health insurance claims process. The student is expected to:

(A) define fiscal intermediary;

(B) define Medicaid and Medicare;

(C) discuss health care benefit programs such as TRICARE and Civilian Health and Medical Program of the Department of Veterans Affairs (CHAMPVA);

(D) explain how to manage a worker's compensation case;

(E) complete a current health insurance claim form such as the Centers for Medicare and Medicaid Service (CMS-1500) form; and

(F) identify three ways to transmit electronic claims.

§127.419. Healthcare Administration and Management (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Medical Terminology **[~~and Business Information Management I~~]** . Recommended **[prerequisites] [~~prerequisite~~]** : Principles of Health Science **and Business Information Management I**. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) Healthcare Administration and Management is designed to familiarize students with the concepts related to healthcare administration as well as the functions of management, including planning, organizing, staffing, leading, and controlling. Students will also demonstrate interpersonal and project-management skills.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills required by the healthcare industry. The student is expected to:

(A) role play examples of effective written and oral communication in various scenarios such as customer service, marketing, and public relations;

(B) demonstrate collaboration skills through teamwork;

(C) demonstrate professionalism by conducting oneself in a manner appropriate for the profession and workplace;

(D) demonstrate a positive, productive work ethic by performing assigned tasks as directed;

(E) comply with all applicable rules, laws, and regulations; and

(F) demonstrate time-management skills by prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that uses time wisely and optimizes efficiency and results.

(2) The student demonstrates an understanding of the healthcare management concept. The student is expected to:

(A) define the term healthcare management;

(B) explain the roles and responsibilities of healthcare professionals, including the management functions of planning, organizing, staffing, leading, and controlling;

(C) explain how organizational behavior and teamwork in healthcare impact patient outcomes and effective day-to-day operations;

(D) explore and discuss the factors that influence healthcare management such as governmental regulations, payment models, employee turnover, and workforce shortages;

(E) define ethical workplace behavior and role play how to make ethical decisions; and

(F) explain how socially responsible management policies such as **healthcare** **[~~health~~]** equity **access** , inclusion, and diversity policies are initiated and implemented.

(3) The student recognizes the business functions of healthcare systems. The student is expected to:

(A) differentiate among the major healthcare delivery systems such as hospitals, outpatient care facilities, community-based organizations, insurance companies, and pharmaceutical companies;

(B) define and discuss healthcare quality and quality improvement;

(C) specify various types of health information technology and discuss barriers to health information technology adoption;

(D) investigate healthcare financing models;

(E) explain the difference between and provide examples of healthcare revenues and healthcare expenses;

(F) define revenue-cycle management; and

(G) describe the roles of customer service and marketing in health care.

(4) The student evaluates ethical behavioral standards and legal responsibilities. The student is expected to:

(A) research and describe the role of professional associations and regulatory agencies;

(B) examine legal and ethical behavior standards such as Patient Bill of Rights, Advanced Directives, and the Health Insurance Portability and Accountability Act (HIPAA);

(C) investigate the legal and ethical ramifications of unacceptable behavior;

(D) identify examples of conflicts of interest; and

(E) differentiate between the concepts of fraud, waste, and abuse.

§127.420. World Health and Emerging Technologies (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: one credit in biology and **at least one credit in a Level 2 or higher course from the health science career cluster** **[~~Principles of Health Science. Recommended prerequisite: Medical Terminology.~~]** Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) The World Health and Emerging Technologies course is designed to examine major world health problems and emerging technologies as solutions to these medical concerns. It is designed to improve students' understanding of cultural, infrastructural, political, educational, and technological constraints and inspire ideas for appropriate technological solutions to global medical care issues.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate verbal and non-verbal communication in a clear, concise, and effective manner;

(B) exhibit the ability to cooperate, contribute, and collaborate as a member of a team; and

(C) exemplify professional work standards such as appearance, attire, time management, organizational skills, and responsibilities.

(2) The student explores and discusses current major human health problems in the world. The student is expected to:

(A) describe the pathophysiology of the three leading causes of death in developing and developed countries;

(B) discuss history of diseases and the evolution of medical technology over time;

(C) contrast health problems in developing and developed countries;

(D) compare the functions of public health organizations **, including the Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO),** at the local **, [;]** state **, [;]** national, **[~~including the Centers for Disease Control and Prevention (CDC);~~]** and international **[, ~~including the World Health Organization (WHO).~~]** levels;

(E) define and calculate incidence, morbidity, and mortality;

(F) identify and describe the challenges in global health that can have the greatest impact on health in developing nations; and

(G) investigate various social determinants of health such as food insecurity, homelessness, or financial insecurities.

(3) The student explains who pays for health care in the world today. The student is expected to:

(A) compare the availability **and quality** of health care in developing and developed countries;

(B) discuss and contrast the four basic healthcare system models, including the Beveridge Model, Bismarck Model, National Health Insurance Model, and the Out-of-Pocket Model, and compare these models to existing payment mechanisms in the United States of America;

(C) explain how countries that have different healthcare systems such as Canada, the United Kingdom, Japan, Germany, Taiwan, Switzerland, and the United States of America pay for health care and compare their patient outcomes such as infant mortality rates, rate of cancer, or rate of heart disease;

(D) describe how healthcare expenditures have changed over time; and

(E) identify the major contributors to the rising healthcare industry costs.

(4) The student describes the engineering technologies developed to address clinical needs. The student is expected to:

(A) describe technologies that support the prevention and treatment of infectious diseases;

(B) explain the implication of vaccines on the immune system and on public health;

(C) discuss the dangers of antibiotic overuse and misuse;

(D) investigate technologies such as genetics and molecular diagnostics used for the early detection and treatments of several types of cancers;

(E) describe and discuss the technologies used in the diagnosis and treatment of heart disease;

(F) describe and discuss technologies developed to support vital organ failure; and

(G) investigate emerging digital technology such as telehealth and remote monitoring and its impact on healthcare delivery.

(5) The student explores how human clinical trials are designed, conducted, and evaluated. The student is expected to:

(A) describe and discuss types of clinical trials, including the role of the institutional review board;

(B) define and calculate a sample size;

(C) identify quantitative and qualitative methods used in clinical trials; and

(D) compare and contrast different phases of pharmaceutical trials.

(6) The student recognizes the ethical and legal aspects involved in clinical research. The student is expected to identify issues and explain the ethical and legal guidelines **, including informed consent and patient confidentiality,** for the conduct of research involving human subjects **[, ~~including informed consent and patient confidentiality~~]** .

(7) The student explains how research guides the development of new medical technologies. The student is expected to:

(A) describe how health science research is funded;

(B) explain the role of the U.S. Food and Drug Administration in approving new drugs and medical devices; and

(C) analyze factors that affect the dissemination of new medical technologies.

(8) The student applies research principles to create a project that addresses a major health topic. The student is expected to:

(A) facilitate data analysis and communicate experimental results clearly by effectively using technology such as creating visual aids; and

(B) present the project to classmates, health professionals, parents, or instructors.

§127.421. Medical Billing and Coding (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Medical Terminology. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) Medical Billing and Coding familiarizes students with the process, language, medical procedure codes, requirements of Health Insurance Portability and Accountability Act (HIPAA), and skills they will need to make accurate records. Students will develop an understanding of the entire process of the revenue cycle and how to effectively manage it. The program is designed to prepare students for employment in a variety of health care settings as entry level coder, medical billing specialist, and patient access representative.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills required by the healthcare industry. The student is expected to:

(A) demonstrate the ability to communicate and use interpersonal skills effectively;

(B) compose written communication, including emails using correct spelling, grammar, formatting, and confidentiality;

(C) use appropriate medical terminology and abbreviations; and

(D) model courtesy and respect for patients and team members in the multi-disciplinary healthcare setting and maintain good interpersonal relationships.

(2) The student explores career opportunities in revenue cycle management. The student is expected to:

(A) identify professional opportunities within the medical billing and revenue cycle management professions;

(B) demonstrate ethical billing and coding practices as outlined by professional associations guidelines; and

(C) investigate professional associations applicable to the field of health informatics such as American Academy of Professional Coders (AAPC), American Health Information Management Association (AHIMA), Healthcare Billing and Management Association (HBMA), and American Association of Healthcare Administrative Management (AAHAM).

(3) The student explains the ethical and legal responsibilities of personnel in medical billing and coding. The student is expected to:

(A) identify major administrative agencies that affect billing and coding such as Centers for Medicare and Medicaid Services (CMS) and the Office of the Inspector General (OIG);

(B) identify major laws and regulations that impact health information, including HIPAA, the Stark Law, the Fair Debt Collection Practices Act, and the False Claims Act;

(C) analyze legal and ethical issues related to medical billing and coding, revenue cycle management, and documentation within the medical record;

(D) research compliance laws;

(E) identify appropriate documentation required for the release of patient information;

(F) differentiate between informed and implied consent;

(G) compare and contrast use of information and disclosure **of** [~~**or**~~] information; and

(H) evaluate cases for insurance fraud and abuse.

(4) The student identifies the body systems to support proficiency in billing and coding. The student is expected to:

(A) explain the sections and organizations of the International Classification of Diseases and Related Health Problems, 10th Revision, Clinical Modification (ICD-10-CM) and Current Procedural Terminology (CPT) coding manuals by identifying the anatomy and physiology of body systems and how they apply to medical billing and coding, including:

(i) the integumentary system;

(ii) the skeletal system;

(iii) the muscular system;

(iv) the cardiovascular system;

(v) the respiratory system;

(vi) the digestive system;

(vii) the endocrine system;

(viii) the urinary system;

(ix) the reproductive system; and

(x) the nervous system and special senses; and

(B) identify mental, behavioral, and neurodevelopmental disorders and how they apply to medical billing and coding.

(5) The student demonstrates proficiency in the use of the ICD-10-CM, CPT, and Healthcare Common Procedure Coding System (HCPCS) coding systems. The student is expected to:

(A) apply coding conventions and guidelines for appropriate charge capture;

(B) describe the process to update coding resources;

(C) assign and verify diagnosis and procedure codes to the highest level of specificity, and, as applicable, HCPCS level II codes and modifiers in accordance with official guidelines;

(D) describe the concepts of disease groupings and procedure-code bundling; and

(E) identify coding compliance, including medical necessity.

(6) The student understands revenue cycle management. The student is expected to:

(A) define revenue cycle management;

(B) differentiate between various types of employer-sponsored and government-sponsored insurance models, including health maintenance organization (HMO), preferred-provider organization (PPO), Medicare, Medicaid, TRICARE, high deductible health plans, and workers' compensation;

(C) define Medicare Administrative Contractors (MACs) and investigate the administrative services provided by the MAC for Texas;

(D) describe the patient scheduling and check-in process, including verifying insurance eligibility, obtaining pre-authorization, and processing appropriate patient authorization and referral forms;

(E) describe the sections of the CMS-1500 form to prepare and submit mock clean claims electronically or manually;

(F) differentiate between primary and secondary insurance plans to initially process crossover claims;

(G) interpret remittance advice to determine financial responsibility of insurance company and patient, including a cash-paying patient;

(H) analyze reason for insurance company denials or rejections and determine corrections or appeals required; and

(I) analyze an aging report and how it relates to the revenue cycle.

§127.422. Health Science Theory (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 10-12. Prerequisites: one credit in biology and **at least one credit in a course from the health science career cluster** **[~~one credit from a level one course or level two course within a health science program of study~~]** . Recommended prerequisite: Medical Terminology. Recommended corequisite: Health Science Clinical. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) The Health Science Theory course is designed to provide for the development of advanced knowledge and skills related to a wide variety of health careers. **Students will become familiar with industry-based standards for documenting and maintaining medical information; research industry employment requirements, including education, certification, and licensing requirements; and evaluate ethical and legal responsibilities of health science professionals.** Students will employ hands-on experiences for continued **clinical** knowledge and skill development.

(4) To pursue a career in the health science industry, students should learn to reason, think critically, make decisions, solve problems, and communicate effectively. Students should recognize that quality health care depends on the ability to work well with others.

(5) The health science industry is comprised of diagnostic, therapeutic, health informatics, support services, and biotechnology research and development systems that function individually and collaboratively to provide comprehensive health care. Students should identify the employment opportunities, technology, and safety requirements of each system. Students are expected to learn the knowledge and skills necessary to pursue a health science career through further education and employment.

(6) Professional integrity in the health science industry is dependent on acceptance of ethical and legal responsibilities. Students are expected to employ their ethical and legal responsibilities, recognize limitations, and understand the implications of their actions.

(7) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(8) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) express ideas in a clear, concise, and effective manner;

(B) exhibit the ability to cooperate, contribute, and collaborate as a member of a team; and

(C) model industry expectations of professional conduct such as attendance, punctuality, appropriate professional dress, proper hygiene, and time management.

(2) The student demonstrates patient-centered skills and interactions that foster trust and lead to a quality customer service experience. The student is expected to:

(A) demonstrate care, empathy, and compassion;

(B) communicate medical information accurately and efficiently in language that patients can understand; and

(C) comply with Health Insurance Portability and Accountability Act (HIPAA) policy standards.

(3) The student applies mathematics, science, English language arts, and social studies in health science. The student is expected to:

(A) solve mathematical calculations appropriate to situations in a healthcare-related environment;

(B) express ideas clearly in writing and develop skills in documentation related to health science;

(C) interpret complex technical material related to the health science industry;

(D) summarize biological and chemical processes in the body such as maintaining homeostasis; and

(E) research topics related to health science such as the global impact of disease prevention.

(4) The student demonstrates verbal, non-verbal, and electronic communication skills. The student is expected to:

(A) demonstrate therapeutic communication appropriate to the situation;

(B) use appropriate verbal and non-verbal skills when communicating with persons with sensory loss and language barriers in a simulated setting; and

(C) use electronic communication devices in the classroom or clinical setting appropriately.

(5) The student analyzes and evaluates communication skills for maintaining healthy relationships in the healthcare workplace. The student is expected to:

(A) evaluate how healthy relationships influence career performance;

(B) identify the role of communication skills in building and maintaining healthy relationships;

(C) demonstrate strategies for communicating needs, wants, and emotions in a healthcare setting; and

(D) evaluate the effectiveness of conflict-resolution techniques in various simulated healthcare workplace situations.

(6) The student documents and records medical information into a permanent health record. The student is expected to:

(A) research document formats such as dental or medical records;

(B) prepare health documents or records according to industry-based standards; and

(C) record health information on paper and electronic formats such as patient history, vital statistics, and test results.

(7) The student describes industry requirements necessary for employment in health science occupations. The student is expected to:

(A) research education, certification, licensing, and continuing education requirements and salary related to specific health science careers; and

(B) practice employment procedures for a specific health science career such as resume building, application completion, and interviewing.

(8) The student identifies problems and participates in the decision-making process. The student is expected to:

(A) apply critical-thinking, adaptability, and consensus-building skills to solve problems relevant to health science;

(B) evaluate the impact of decisions in health science; and

(C) suggest modifications to a decision or plan based on healthcare outcomes.

(9) The student demonstrates comprehension and proficiency of clinical skills used by health science professionals in a classroom or clinical setting. The student is expected to:

(A) comply with specific industry standards related to safety requirements;

(B) employ medical vocabulary specific to the healthcare setting;

(C) perform admission, discharge, and transfer functions in a simulated setting;

(D) demonstrate skills related to assisting patients with activities of daily living such as dressing, undressing, grooming, bathing, and feeding;

(E) determine proper equipment needed for patient ambulation such as gait belts, wheelchairs, crutches, or walkers;

(F) demonstrate skills related to assessing range of motion and assisting with mobility, including positioning, turning, lifting, and transferring patients for treatment or examination;

(G) role play techniques used in stressful situations such as situations involving trauma and chronic and terminal illness;

(H) demonstrate first aid, vital signs, cardiopulmonary resuscitation, and automated external defibrillator skills; and

(I) identify basic skills specific to a health science profession such as medical assistant, dental assistant, emergency medical technician-basic, phlebotomy technician, and pharmacy technician.

(10) The student evaluates ethical behavioral standards and legal responsibilities of a health science professional. The student is expected to:

(A) research and describe the role of professional associations and regulatory agencies;

(B) examine legal and ethical behavior standards such as Patient Bill of Rights, advanced directives, and HIPAA; and

(C) investigate the legal, ethical, and professional ramifications of unacceptable or discriminatory behavior.

(11) The student exhibits the leadership skills necessary to function in a healthcare setting. The student is expected to:

(A) identify essential leadership skills of health science professionals;

(B) assess group dynamics in real or simulated groups; and

(C) integrate consensus-building techniques.

(12) The student maintains a safe work environment. The student is expected to:

(A) describe governmental regulations and guidelines from entities such as the World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), Occupational Safety and Health Administration (OSHA), U.S. Food and Drug Administration (FDA), The Joint Commission, and the National Institute of Health (NIH) **, and Texas Department of State Health Services (DSHS)** ;

(B) explain protocols related to hazardous materials and situations such as personal protective equipment (PPE) and blood borne pathogen exposure;

(C) describe how to assess and report unsafe conditions;

(D) identify the benefits of recycling and waste management for cost containment and environmental protection; and

(E) demonstrate proper body mechanics to reduce the risk of injury.

(13) The student assesses wellness strategies for the prevention of disease. The student is expected to:

(A) research wellness strategies for the prevention of disease;

(B) evaluate positive and negative effects of relationships on physical and emotional health;

(C) explain the benefits of positive relationships between community members and health professionals in promoting a healthy community;

(D) research and analyze the effects of access to quality health care;

(E) research alternative health practices and therapies; and

(F) explain the changes in structure and function of the body due to trauma and disease.

§127.423. Anatomy and Physiology (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: one credit in biology **and one credit in chemistry, Integrated Physics and Chemistry, or physics** **[~~and one additional credit of high school science. Recommended prerequisite: a course from the Health Science Career Cluster~~]** . This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) The Anatomy and Physiology course is designed for students to conduct laboratory and field investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students in Anatomy and Physiology will study a variety of topics, including the structure and function of the human body and the interaction of body systems for maintaining homeostasis.

(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(5) Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(6) Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

(7) Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(8) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(9) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(10) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) Employability skills. The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate verbal and non-verbal communication in a clear, concise, and effective manner;

(B) exhibit the ability to cooperate, contribute, and collaborate as a member of a team; and

(C) investigate necessary skills for heath careers related to anatomy and physiology.

(2) Scientific and engineering practices. The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as lab notebooks or journals, calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various

prepared slides, stereoscopes, metric rulers, meter sticks, electronic balances, micro pipettors, hand lenses, Celsius thermometers, hot plates, timing devices, Petri dishes, agar, lab incubators, dissection equipment, **[~~models, diagrams, or samples of biological specimens or structures,~~|** reflex hammers, pulse oximeters, stethoscope, otoscope, **blood pressure monitors (** sphygmomanometers **)** , pen lights, **[~~and~~|** ultrasound equipment **, models, diagrams, or samples of biological specimens or structures** ;

(E) collect quantitative data using the International System of Units (SI) and United States customary units and qualitative data as evidence;

(F) organize quantitative and qualitative data using lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish among scientific hypotheses, theories, and laws.

(3) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(4) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(5) Scientific and engineering practices. The student knows the contributions of scientists and engineers and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists and engineers as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) or health science field in order to investigate careers.

(6) Human body organization. The student demonstrates an understanding of the anatomic and physiological basis of life and the ability to explain the interdependence of structure and function in biological systems. The student is expected to:

(A) distinguish between the six levels of structural organization in the human body, including chemical, cellular, tissue, organ, system, and organism, and explain their interdependence;

(B) identify and use appropriate directional terminology when referring to the human body, including directional terms, planes, body cavities, and body quadrants;

(C) identify and describe the major characteristics of living organisms, including response to stimuli, growth and development, homeostasis, cellular composition, metabolism, reproduction, and the ability to adapt to the environment;

(D) research and describe negative and positive feedback loops as they apply to homeostasis; and

(E) research and identify the effects of the failure to maintain homeostasis as it relates to common diseases in each of the body systems.

(7) Histology. The student demonstrates the ability to analyze the structure and function of eukaryotic cells in relation to the formation of tissue. The student is expected to:

(A) define tissue and identify the four primary tissue types, their subdivisions, and functions;

(B) compare epithelial tissue and connective tissue in terms of cell arrangement and interstitial materials;

(C) describe the process of tissue repair involved in the normal healing of a superficial wound; and

(D) describe the general metabolic pathways of carbohydrates, lipids, and proteins.

(8) Skeletal system. The student analyzes the relationships between the anatomical structures and physiological functions of the skeletal system. The student is expected to:

(A) identify and differentiate between the axial skeleton and appendicular skeleton;

(B) identify the types of joints, including gliding, hinge, pivot, saddle, and ball and socket, and describe the movements of each;

(C) identify and locate the anatomy of [~~**spongy and compact**~~] bone, including **spongy and compact tissue,** epiphysis, diaphysis, medullary cavity, periosteum, bone marrow, and endosteum;

(D) explain the major physiological functions of the skeletal system;

(E) describe the role of osteoblasts, osteocytes, and osteoclasts in bone growth and repair;

(F) identify and describe the different types of fractures such as compound, complete, simple, spiral, greenstick, hairline, transverse, and comminuted; and

(G) identify and describe common diseases and disorders of the skeletal system such as scoliosis, osteoporosis, and bone cancer.

(9) Integumentary system. The student analyzes the relationships between the anatomical structures and physiological functions of the integumentary system. The student is expected to:

(A) identify and describe the structures of the integumentary system, including layers of the skin, accessory organs within each layer, and glandular components in each layer;

(B) describe the factors that can contribute to skin color;

(C) describe and explain the process of tissue repair and scar formation; and

(D) identify and describe common diseases and disorders of the integumentary system such as skin cancer and psoriasis.

(10) Muscular system. The student analyzes the relationships between the anatomical structures and physiological functions of the muscular system. The student is expected to:

(A) explain the major physiological functions of the muscular system, including voluntary movement, involuntary movement, heat production, and maintaining posture;

(B) explain the coordination of muscles, bones, and joints that allows movement of the body, including the methods of attachment of ligaments and tendons;

(C) examine common characteristics of muscle tissue, including excitability, contractibility, extensibility, and elasticity;

(D) identify and describe the appearance, innervation, and function of the three muscle types, including cardiac, skeletal, and smooth;

(E) examine the microscopic anatomy of a muscle fiber, including sarcomere, actin, and myosin;

(F) describe the mechanisms of muscle contraction at the neuromuscular junction;

(G) name, locate, and describe the action of major voluntary muscles in regions of the body, including the head and neck, trunk, upper extremity, and lower extremity;

(H) identify and describe common diseases and disorders of the muscular system such as muscle strains and muscular dystrophy; and

(I) analyze and describe the effects of pressure, movement, torque, tension, and elasticity on the human body.

(11) Nervous system. The student analyzes the relationship between the anatomical structures and physiological functions of the nervous system. The student is expected to:

(A) summarize and distinguish **between** the major physiological functions of the nervous system, including sensation, integration, and motor response;

(B) identify the senses and explain their relationship to nervous system;

(C) investigate and explain the interdependence between the cranial and spinal nerves with the special senses of vision, hearing, smell, and taste;

(D) describe the anatomy of the structures associated with the senses, including vision, hearing, smell, taste, and touch;

(E) identify the anatomical and physiological divisions of the peripheral nervous system and central nervous system;

(F) explain the glial cells within the central nervous system and peripheral nervous system and their associated functions;

(G) analyze the functional and structural differences between gray and white matter relative to neurons;

(H) distinguish between the types of neurons and explain the initiation of a nerve impulse during resting and action potential;

(I) categorize the major neurotransmitters by chemical and physical mechanisms; and

(J) identify and describe common diseases and disorders of the nervous system such as epilepsy, neuralgia, Parkinson's disease, and Alzheimer's disease.

(12) Endocrine system. The student analyzes the relationships between the anatomical structures and physiological functions of the endocrine system. The student is expected to:

(A) identify and locate the nine glands associated with the endocrine system, including the ovaries, testes, pineal gland, pituitary gland, thyroid gland, parathyroid glands, thymus, pancreas, and adrenal glands;

(B) compare and contrast endocrine and exocrine glands and identify the glands associated with each;

(C) describe the hormones associated with each endocrine gland;

(D) research the impact of the endocrine systems on homeostatic mechanisms and other body systems such as the integration between the hypothalamus and the pituitary gland;

(E) explain how the endocrine glands are regulated, including neural, hormonal, and humoral control; and

(F) identify and describe common diseases and disorders of the endocrine system such as hypothyroidism, pancreatic cancer, and diabetes.

(13) Urinary system. The student analyzes the relationships between the anatomical structures and physiological functions of the urinary system. The student is expected to:

(A) identify and describe the anatomical structures and functions of the urinary system, including the kidney, ureters, bladder, and urethra;

(B) compare and contrast the anatomical structures and describe the functions of the male and female urinary system;

(C) summarize and illustrate the structures, functions, and types of nephrons;

(D) examine the methods of fluid balance and homeostasis in the urinary system, including fluid intake and output;

(E) analyze the composition of urine and the process of urine formation, including filtration, reabsorption, and secretion;

(F) describe the relationship between the nervous system, renal system, and muscular system before and during micturition; and

(G) identify and describe common diseases and disorders of the urinary system such as chronic kidney disease, kidney stones, urinary tract infections, and renal cancer.

(14) Cardiovascular system. The student analyzes the relationships between the anatomical structures and physiological functions of the cardiovascular system. The student is expected to:

(A) identify the major functions of the cardiovascular system, including transport, maintaining homeostasis, and immune response;

(B) compare and contrast the anatomical structure of arteries, arterioles, capillaries, venules, and veins;

(C) investigate and illustrate how systemic circulation transports blood, gasses, and nutrients from the heart to the internal **anatomy of the heart, including tissue layers, chambers, and valves,** and external anatomy of the heart, including [~~**tissue layers, chambers, valves, and**~~] coronary vessels;

(D) describe the relationship between blood flow and blood pressure, including systolic and diastolic pressure, pulse pressure, and mean arterial pressure;

(E) compare and contrast coronary, pulmonary, and systemic circulation, and describe the major vessels of each;

(F) illustrate how the PQRST waves of an electrocardiogram (EKG) demonstrate the conduction of electricity through the structures of the heart;

(G) describe the relationship between the cardiovascular system, nervous system, and muscular system in regulating cardiac output; and

(H) identify and describe common diseases and disorders of the cardiovascular system such as heart disease, myocardial infarction, ischemia, and hypertrophic cardiomyopathy.

(15) Lymphatic system. The student analyzes the relationships between the anatomical structures and physiological functions of the lymphatic system and understands the immune response. The student is expected to:

(A) evaluate the interaction of the lymphatic system with other body systems such as the circulatory system;

(B) describe the structure and function of the lymphatic organs and explain how lymph moves through the body;

(C) identify and describe the role and function of the immune cells, including T cells and B cells, within the lymphatic system structures;

(D) identify and determine antigens associated with ABO blood typing, including Rhesus (Rh) factor;

(E) summarize the ways the body protects and defends against disease, including inflammation, barrier defenses, and active and passive immunity;

(F) describe the role of antigens and antibodies in the immune response; and

(G) identify and describe common diseases and disorders associated with the lymphatic and immune systems such as inherited or acquired immunodeficiencies, autoimmune diseases, and lymphomas.

(16) Digestive system. The student analyzes the relationships between the anatomical structures and physiological functions of the digestive system. The student is expected to:

(A) examine the anatomical structures and function of the alimentary canal and accessory organs;

(B) compare and contrast mechanical and chemical digestive processes;

(C) evaluate the modes by which energy is processed and stored within the body, including ingestion, propulsion, absorption, and elimination; and

(D) identify and describe common diseases and disorders of the digestive system such as gallstones, Crohn's disease, irritable bowel syndrome, and gastroesophageal reflux disorder.

(17) Respiratory system. The student analyzes the relationships between the anatomical structures and physiological functions of the respiratory system. The student is expected to:

(A) identify and sequence the anatomical structures and functions of the respiratory system;

(B) compare and contrast the functions of upper and lower respiratory tract;

(C) describe the physiology of respiration, including internal and external respiration and gas exchange;

(D) describe the relationship between the respiratory and cardiovascular systems during pulmonary circulation;

(E) investigate factors that affect respiration, including exercise and environmental changes such as altitude; and

(F) identify and describe common diseases of the respiratory system such as asthma, emphysema, pneumonia, viruses, and allergies.

(18) Reproductive system. The student analyzes the relationships between the anatomical structures and physiological functions of the reproductive system. The student is expected to:

(A) explain embryological development of cells, tissues, organs, and systems;

(B) describe and examine the location, structure, and functions of the internal and external female and male reproductive organs and accessory glands;

(C) describe and compare the process of oogenesis and spermatogenesis;

(D) research and discuss the physiological effects of hormones on the stages of the menstrual cycle;

(E) identify and distinguish the hormones involved in maturation and development throughout the life cycle, including puberty, gestation, and menopause; and

(F) identify and describe common diseases and disorders of the reproductive system such as sexually transmitted diseases and cancers of the female and male reproductive systems.

(19) Emerging technologies. The student identifies emerging technological advances in science and healthcare treatment and delivery. The student is expected to:

(A) research and discuss advances in science and medicine at the organ and tissue level such as bionics and wearable monitoring technologies; and

(B) research and describe advances in science and medicine at the cellular level such as stem cells and gene therapy.

§127.424. Pathophysiology (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: one credit in biology **, [~~and~~]** one credit in chemistry **, and at least one credit in a Level 2 or higher course from the health science career cluster**. Recommended prerequisite: Anatomy and Physiology. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) The Pathophysiology course is designed for students to conduct laboratory and field investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students in Pathophysiology will study disease processes and how humans are affected. Emphasis is placed on prevention and treatment of disease.

(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(5) Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(6) Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare

results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

(7) Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(8) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(9) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(10) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate verbal and non-verbal communication in a clear, concise, and effective manner; and

(B) demonstrate the ability to cooperate, contribute, and collaborate as a member of a team.

(2) The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micro pipettors, hand lenses, Celsius thermometers, hot plates, timing devices, Petri dishes, lab incubators, biochemical media and stains dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;

(E) collect quantitative data using the International System of Units (SI) and United States customary units and qualitative data as evidence;

(F) organize quantitative and qualitative data using lab notebooks or journals, lab reports, labeled drawings, graphic organizers, peer reviewed medical journals, summaries, oral reports, and technology-based reports;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(3) The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(4) The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(5) The student knows the contributions of scientists and engineers and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists and engineers as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) or health science field in order to investigate careers.

(6) The student analyzes the mechanisms of pathology. The student is expected to:

(A) describe abnormal biological and chemical processes at the cellular level;

(B) examine and analyze changes resulting from mutations and neoplasms by examining cells, tissues, organs, and systems;

(C) investigate factors that contribute to disease, including age, gender, environment, lifestyle, and heredity; and

(D) analyze and describe how the body's compensating mechanisms attempt to maintain homeostasis when changes occur.

(7) The student examines the process of pathogenesis. The student is expected to:

(A) differentiate and identify pathogenic organisms using microbiological techniques such as gram staining, biochemical identification, and microscopic observation;

(B) research and summarize the stages of pathogenesis, including incubation period, prodromal period, and exacerbation or remission;

(C) analyze the body's natural defense systems against infection, including barriers, the inflammatory response, and the immune response;

(D) analyze other mechanisms of disease prevention and treatment such as vaccinations, antibiotics, chemotherapy, and immunotherapy; and

(E) evaluate the effects of chemical agents, environmental pollution, and trauma on the disease process.

(8) The student examines diseases throughout the body's systems. The student is expected to:

(A) investigate the etiology, signs and symptoms, diagnosis, prognosis, and treatment of diseases;

(B) explore and describe advanced technologies for the diagnosis and treatment of disease;

(C) research and describe reemergence of diseases such as malaria, tuberculosis, polio, and measles;

(D) research [~~**and differentiate between**~~] the causes, prevention, and impact of nosocomial infections **and differentiate between the causes, prevention, and impact of nosocomial infections** versus community-acquired infections;

(E) research and describe antibiotic-resistant diseases such as methicillin-resistant *Staphylococcus aureus*;

(F) differentiate between various types of diseases and disorders, including hereditary, infectious, and auto-immune; and

(G) investigate ways diseases such as diabetes, Parkinson's, lupus, and congestive heart failure affect multiple body systems.

(9) The student integrates the effects of disease prevention and control. The student is expected to:

(A) evaluate public health issues related to asepsis, isolation, immunization, and quarantine;

(B) analyze the effects of stress and aging on the body;

(C) analyze patient medical data and interpret medical laboratory test results to inform diagnosis and treatment;

(D) analyze and interpret epidemiological data to determine common trends and predict outcomes in disease progression;

(E) research and summarize diseases that threaten world health and propose intervention strategies; and

(F) develop a prevention plan that considers how behaviors contribute to lifestyle diseases.

§127.425. Pharmacy I (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 10 and 11. Recommended prerequisites: Introduction to Pharmacy Science or Principles of Health Science and one credit in biology. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) The goal of Pharmacy I is for the student to gain a strong foundation in the knowledge and skills needed to pursue a career in the pharmaceutical field (e.g., pharmacy technician, pharmacist). Knowledge includes pharmacology, pharmacy law, medication safety, the dispensing process, and inventory. Pharmacy I is designed to be the second course in a pathway leading to college and career readiness in the healthcare therapeutics professions. The course content aligns with the competencies of pharmacy technician certification examinations.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student exhibits personal and interpersonal knowledge and skills. The student is expected to:

(A) model ethical conduct in complex situations;

(B) model a respectful and professional attitude when interacting with diverse patient populations, colleagues, and professionals;

(C) apply self-management skills such as stress and change management;

(D) apply interpersonal skills, including negotiation skills, conflict resolution, customer service, and teamwork;

(E) practice problem-solving skills in respect to complex ethical decision making; and

(F) compare unethical and illegal conduct in the workplace.

(2) The student communicates effectively with diverse populations. The student is expected to:

(A) practice a respectful and professional attitude when interacting with diverse patient populations, colleagues, and professionals; and

(B) compare communication techniques that are effective for various population clients such as terminally ill, intellectually disabled, visually/hearing impaired, and elderly/pediatric populations.

(3) The student interprets pharmacy correspondence utilizing medical abbreviations and terminology typically found in the pharmacy setting. The student is expected to:

(A) employ pharmacy terminology and abbreviations in creating and utilizing correspondence in the pharmacy such as prescriptions, medication administration records (MARs), and patient order sheets;

(B) compare terminology typically used in the community and institutional pharmacy settings; and

(C) translate sig codes and abbreviations used in the pharmacy.

(4) The student distinguishes between the requirements of various federal agencies. The student is expected to:

(A) explain the handling and disposal of non-hazardous, hazardous, and pharmaceutical substances and waste;

(B) discuss the requirements for controlled substance prescriptions, including new, refill, and transfer prescriptions, according to the Drug Enforcement Administration (DEA) controlled substances schedules;

(C) describe Food and Drug Administration (FDA) recall requirements based on classification for medications, devices, supplies, and supplements;

(D) interpret and apply state and federal laws pertaining to processing, handling, and dispensing of medications, including controlled substances;

(E) interpret state and federal laws and regulations pertaining to pharmacy technicians; and

(F) explain pharmacy compliance with professional standards and relevant legal, regulatory, formulary, contractual, and safety requirements.

(5) The student recalls drug information. The student is expected to:

(A) identify brand name, generic name, classification, and indication of use for common medications with automaticity;

(B) discuss common and life-threatening drug interactions and contraindications;

(C) identify narrow therapeutic index (NTI) medications; and

(D) access and use references such as United States Pharmacopeia (USP) standards, drug reference books, and clinical information sources as needed to perform job duties.

(6) The student explains the dispensing process. The student is expected to:

(A) identify a prescription or medication order for completeness, including drug strength, dosage form, directions, quantity, and refills, and obtain missing information if needed;

(B) communicate with patients to obtain information, including demographics, medication history, health conditions, allergies, and insurance, for the patient profile;

(C) practice assisting pharmacists in collecting, organizing, and recording demographic and clinical information for the *Pharmacists' Patient Care Process*;

(D) perform the necessary mathematical calculations required for order entry, including formulas, ratios, concentrations, percent strength, dilutions, proportions, and allegations;

(E) identify equipment and supplies, including diabetic supplies, spacers, and oral/injectable syringes, required for drug administration based on the package size and unit dose;

(F) identify and describe the importance of lot numbers, expiration dates, and National Drug Codes (NDC) on drug packaging;

(G) practice and adhere to effective infection control procedures;

(H) apply appropriate cleaning standards, including hand washing and cleaning counting trays, countertops, and equipment; and

(I) explain the state pharmacy boards' roles in the regulation of pharmacy technicians and that differences exist between states in the processing, handling, and dispensing of prescription medications.

(7) The student identifies common medication errors and explains error prevention strategies. The student is expected to:

(A) identify high-alert/risk and look-alike/sound-alike (LASA) medications;

(B) describe error prevention strategies, including using Tall Man lettering, trailing/leading zeros, and barcodes; separating inventory; and limiting use of error-prone abbreviations;

(C) describe types of prescription errors, including abnormal doses, early refill, incorrect quantity, incorrect patient, and incorrect drug;

(D) explain pharmacy professional standards for and the role of the pharmacy technician in the patient care process;

(E) identify opportunities to assist pharmacists in the identification of patients who desire or require counseling to optimize the use of medications, equipment, and devices;

(F) discuss the pharmacy technician's role in patient and medication safety practices such as how to calculate dosage of pediatric over-the-counter drugs;

(G) explain how pharmacy technicians assist pharmacists in responding safely and legally to emergent patient situations; and

(H) explain basic safety and emergency preparedness procedures applicable to pharmacy services.

(8) The student performs inventory procedures according to federal, state, local, and facility guidelines. The student is expected to:

(A) identify proper storage for medications in regard to temperature, light sensitivity, product demand, fast movers, cost, and restricted access;

(B) explain the definition and purpose of a formulary or approved/preferred product list;

(C) describe procedures for inventory control, including removal of **expired and recalled** **[~~expired/recalled~~]** drug products, rotating inventory, performing a physical inventory, ordering **medication and supplies** **[~~medications/supplies~~]** , monitoring periodic automatic replenishment (PAR) levels, and using just-in-time ordering;

(D) explain accepted procedures in purchasing pharmaceuticals, devices, and supplies; and

(E) explain accepted procedures for identifying and disposing of expired medications.

§127.426. Pharmacy II (Two Credits), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: one credit in biology **. [~~and~~]** one credit in chemistry **, and one credit in Pharmacy I**. Recommended prerequisite**s**: Algebra I and Introduction to Pharmacy Science. Students shall be awarded two credits for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) The Pharmacy II course provides students with the advanced knowledge and skills to explore various careers in the pharmacy field, including pharmacology, pharmacy law, medication errors, inventory pharmacy calculations, compounding, and workflow expectations in a pharmacy setting. Pharmacy II is designed to be the third course in a pathway leading to college and career readiness in the healthcare therapeutics professions. The course content aligns with the competencies of pharmacy technician certification examinations.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student exhibits personal and interpersonal knowledge and skills. The student is expected to:

(A) apply appropriate verbal communication in a clear, concise, and effective manner;

(B) apply appropriate non-verbal communication in a clear, respectful, and effective manner;

(C) apply appropriate adaptability skills such as problem solving and creative thinking;

(D) create or evaluate a career plan using methods such as identifying educational pathways, developing career goals, and assessing individual aptitudes;

(E) demonstrate teamwork;

(F) create an occupation-specific resume; and

(G) identify soft skills desired by employers.

(2) The student communicates effectively with diverse populations. The student is expected to:

(A) practice a respectful and professional attitude in communications with diverse patient populations, colleagues, and professionals such as written, oral, and electronic communications;

(B) demonstrate communication techniques that are effective for various **populations** **[~~population~~]** such as terminally ill, intellectually disabled, visually/hearing impaired, and elderly/pediatric populations; and

(C) demonstrate skills for supporting communication between various stakeholders such as serving as a liaison between the nurse and the patient.

(3) The student demonstrates the use of medical terminology and abbreviations in a pharmacy setting. The student is expected to:

(A) interpret and translate prescription and medication orders according to pharmacy settings such as community and hospital environments;

(B) create pharmacy correspondence such as prescriptions, medication administration records (MARs), and patient order sheets using medical terminology and abbreviations;

(C) use medical terminology found in various pharmacy settings to communicate appropriately; and

(D) translate sig codes and abbreviations used in the pharmacy to communicate instructions to patients.

(4) The student applies the strictest requirements using the laws of local, state, and federal agencies. The student is expected to:

(A) demonstrate the proper handling and disposal of non-hazardous, hazardous, and pharmaceutical substances and waste;

(B) apply the requirements for controlled substance prescriptions, including new, refill, and transfer prescriptions;

(C) apply the requirements for receiving, storing, ordering, labeling, and dispensing controlled substances and the reverse distribution, take-back, and loss or theft of controlled substances;

(D) classify controlled substances such as cocaine, heroin, marijuana, fentanyl, dextroamphetamine, amphetamine salts, benzodiazepines, and anabolic steroids according to their Drug Enforcement Administration (DEA) schedules;

(E) identify the federal requirements for restricted drugs such as pseudoephedrine and related medication processing programs such as Risk Evaluation and Mitigation Strategies (REMS) and iPLEDGE;

(F) demonstrate the process for Food and Drug Administration (FDA) recalls based on classification for medications, devices, supplies, and supplements; and

(G) explain pharmacy compliance with professional standards such as scope of practice and relevant legal, regulatory, formulary, contractual, and safety requirements.

(5) The student interprets drug information. The student is expected to:

(A) apply knowledge of brand name, generic name, classification, and indication of use for common medications such as the top 200 drugs with automaticity in a pharmacy setting;

(B) analyze the common and life-threatening drug interactions and contraindications such as drug-disease, drug-drug, drug-lab, and drug-food;

(C) apply knowledge of the narrow therapeutic index (NTI) to drug use evaluations; and

(D) integrate the use of digital and hard copy references such as United States Pharmacopeia (USP) standards, drug reference books, and clinical information sources as needed to perform job duties.

(6) The student demonstrates the dispensing process in various pharmacy settings. The student is expected to:

(A) analyze a prescription and medication order for completeness, including drug strength, dosage form, directions, quantity, date, and refills, and obtain missing information if needed;

(B) communicate with patients or care givers using the appropriate modality to obtain information, including demographics, medication history, health conditions, allergies, and insurance, for the patient profile;

(C) collect, organize, and record demographic and clinical information accurately for patient continuity of care;

(D) identify the required steps in preparing sterile compounded products, including **putting on (** donning **)** personal protective equipment (PPE), cleaning the vertical or horizontal flow hoods, selecting correct supplies, and preparing the product for dispensing;

(E) select the appropriate equipment and supplies, including diabetic supplies, spacers, and oral/injectable syringes, for drug administration based on package size and unit dose;

(F) apply lot numbers, expiration dates, and National Drug Codes (NDC) on drug packaging for the dispensing of medication; and

(G) differentiate between the use of effective infection control procedures such as sterile and non-sterile compounding in various pharmacy related settings.

(7) The student analyzes common medication errors and practices error prevention strategies. The student is expected to:

(A) use knowledge of high alert/risk and look-alike/sound-alike (LASA) medications to prevent medication errors;

(B) apply knowledge of current error prevention strategies such as using Tall Man lettering, trailing/leading zeros, and barcodes; separating inventory; and limiting use of error-prone abbreviations to prevent medication errors;

(C) apply knowledge of various prescription errors such as abnormal dose, early refill, incorrect quantity, incorrect patient, and incorrect drug for improved accuracy;

(D) demonstrate how to assist pharmacists in recognizing issues that require intervention such as adverse drug events, drug utilization review (DUR), and use of equipment and devices; and

(E) demonstrate knowledge of medication errors such as near miss and adverse events and various reporting procedures such as MedWatch, vaccine adverse event reporting system (VAERS), and route-cause analysis (RCA).

(8) The student applies pharmacy workflow procedures according to federal, state, local, and facility guidelines. The student is expected to:

(A) describe the process for creating a prescription or medication order in compliance with pharmacy standards such as standards for patient rights, completeness of a prescription or medication order, and authorization;

(B) discuss the steps in verifying a prescription or medication order such as right patient, right drug, right dosage, right time, and right route;

(C) identify the proper procedures for entering a prescription or medication order, including procedures for workstation, use of technology, validation with drug enforcement administration (DEA) calculations, and transcribing such as using military time and Roman numerals;

(D) apply the proper techniques for filling a prescription or medication order such as techniques for use of technology, counting, and selecting the correct medication;

(E) explain the proper procedure for the administration of prescription or medication orders such as ear drops, eye drops, inhalations, parenteral, and enteral;

(F) demonstrate knowledge of the workflow process for prescriptions and medication orders such as creation of the order, order entry, adjudication, verification, filling, labeling, billing, dispensing, and administration; and

(G) describe the elements of third-party billing for out-patient dispensing, including prescription insurance ID cards, group numbers, BIN numbers, prior authorization, quantity limits, patient co-pays, maximum out-of-pocket costs, and deductibles.

(9) The student evaluates mathematical process standards related to the practice of pharmacy. The student is expected to:

(A) calculate dosage calculations for adults and special populations using conversions, ratios, and dimensional analysis to perform duties in a pharmacy setting;

(B) apply conversions to systems of measurements, including apothecary, metric, and household, to perform duties in a pharmacy setting;

(C) calculate the flow rate (or rate of administration) for an IV solution using ratios and conversions such as milliliters to drops, weight, or hours to minutes;

(D) calculate days supply for a prescription order given a dose and sig;

(E) calculate volume or mass of each of the total parenteral nutrition (TPN) components such as lipids, amino acids, dextrose, calcium, and magnesium;

(F) calculate volume or mass of ingredients needed for compounding both sterile and non-sterile products;

(G) calculate amount needed for percent of weight-to-volume, volume-to-volume, and weight-to-weight based on stock concentration; and

(H) use calculations related to business math in a pharmacy setting, including profit, net profit, discounts, mark-ups, dispensing fee, average wholesale price, depreciation, and third-party.

(10) The student demonstrates the use of technology in a pharmacy setting. The student is expected to:

(A) identify the types and uses of automated dispensing technology such as cabinets, units, and carousels;

(B) demonstrate knowledge and components of pharmacy dispensing software used in the out-patient setting, the in-patient setting, and in-office use dispensing;

(C) apply professional standards using communication technology such as telephone, emails, fax, electronic prescriptions, and social media appropriate for a pharmacy setting;

(D) apply knowledge of technology hardware devices for input and output such as computers, scanners, printers, interface devices, and other devices; and

(E) select and use appropriate technology tools to search for drug information such as pill identification, adverse events, and contraindications.

(11) The student uses critical thinking, scientific reasoning, research, or problem solving to make informed decisions and communicate within and outside the classroom. The student is expected to:

(A) critique the validity and reliability of scientific research such as assessing for bias, conflict of interest, and study design;

(B) demonstrate the ability to independently find valid and reliable sources such as primary, secondary, and tertiary literature;

(C) identify safe use of online resources that maintain the privacy and confidentiality of the user and patient;

(D) analyze online resources used in scientific research;

(E) describe the recent innovations and advances in pharmacy;

(F) identify opportunities for extended learning experiences such as community services, career and technical service organizations (CTSOs), and professional organizations; and

(G) evaluate scientific information extracted from various sources such as accredited scientific journals, institutions of higher learning, current events, news reports, published journal articles, and marketing and promotional materials.

(12) The student performs inventory procedures according to federal, state, local, and facility guidelines. The student is expected to:

(A) analyze proper storage for medications in regard to temperature, light sensitivity, product demand, cost, and restricted access;

(B) analyze therapeutic substitutions and product selection using the knowledge of formularies or preferred product list;

(C) practice procedures for inventory control such as removal of expired/recalled drug products, rotating inventory, performing a physical inventory, and ordering medications/supplies;

(D) explain how just-in-time or drop ship ordering and periodic automatic replenishment (PAR) levels are used to maintain pharmacy inventory;

(E) analyze how laws affect the procedures for purchasing or ordering medications, devices, and supplies; and

(F) analyze lot numbers, expiration dates, and National Drug Codes (NDC) on drug packaging for inventory accuracy.

(13) The student demonstrates knowledge of safety procedures in a pharmacy setting. The student is expected to:

(A) apply appropriate hygiene and cleaning standards, including hand washing and cleaning counting trays, countertops, and equipment;

(B) perform basic safety and emergency preparedness procedures such as basic life support (BLS) and first aid applicable to pharmacy services;

(C) explain the risks of drug diversion to employees, patients, and the community;

(D) explain the potential solutions to minimize drug diversion such as identifying red flags, controlling inventory, and monitoring the prescription drug monitoring program (PDMP);

(E) explain the types and uses of personal protective equipment (PPE) and the steps for **putting on (** donning **)** and **removing (** doffing **)** PPE; and

(F) explain why collecting and documenting patient allergies are important steps in medication safety.

§127.427. Medical Assistant (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite or corequisite: Anatomy and Physiology. Recommended prerequisite: Medical Terminology. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostics services, health informatics, support services, and biotechnology research and development.

(3) The Medical Assistant course provides students with the knowledge and skills to pursue a career as a medical assistant and to improve college and career readiness. Students will obtain communication skills, clinical ethics knowledge, safety awareness, and information related to medical assisting career opportunities.

(4) To pursue a career in the health science industry, students should learn to reason, think critically, make decisions, solve problems, and communicate effectively. Students should recognize that quality health care depends on the ability to work well with others.

(5) Professional integrity in the health science industry is dependent on acceptance of ethical and legal responsibilities. Students are expected to employ their ethical and legal responsibilities, recognize limitations, and understand the implications of their actions.

(6) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(7) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student applies professional standards/employability skills as required by business and industry. The student is expected to:

(A) apply appropriate verbal communication in a clear, concise, and effective manner;

(B) apply appropriate non-verbal communication in a clear, respectful, and effective manner;

(C) apply appropriate adaptability skills such as problem solving and creative thinking;

(D) create or evaluate a career plan using methods such as identifying educational pathways, professional organizations, career goals, continuing education opportunities, and individual aptitudes;

(E) demonstrate teamwork;

(F) create an occupation-specific resume; and

(G) identify and demonstrate soft skills desired by employers in health care.

(2) The student evaluates the roles and responsibilities of the medical assistant as a member of the healthcare team. The student is expected to:

(A) explain the role of the medical assistant in various healthcare settings;

(B) discuss the scope of practice, including responsibilities and limitations of a medical assistant;

(C) explain the level of authority within the healthcare professional hierarchy; and

(D) identify the members of an interdisciplinary healthcare team and their roles such as licensed vocation nurse, registered nurse, primary care provider, specialists, and other allied health professionals.

(3) The student applies professional communication skills to provide information to patients and team members in a healthcare setting. The student is expected to:

(A) demonstrate the ability to report abnormal results in writing and orally to the patient's provider;

(B) demonstrate how to communicate with patients, caregivers, and the interdisciplinary team to assist in the planning, delivery, and coordination of patient-centered care;

(C) evaluate different communication techniques for responding to the needs of individuals in a diverse society;

(D) practice conflict-resolution techniques such as cooperation, contribution, compromise, and collaboration in various situations; and

(E) practice providing patient education on health-related topics such as clean catch urine collection, the risks and benefits of vaccinations, use of a peak-flow, and nebulizer treatments.

(4) The student demonstrates knowledge of healthcare ethical principles in their practice of medical assisting. The student is expected to:

(A) evaluate principles of ethical behavior, including beneficence, non-maleficence, justice, and autonomy;

(B) debate ethical issues related to technological advances in health care such as stem cells, robotics, and immunologic therapies in health care;

(C) evaluate ethical issues and legal ramifications related to malpractice, negligence, and liability; and

(D) summarize legal and ethical standards, including Patient Bill of Rights, Advanced Directives, and the Health Insurance Portability and Accountability Act (HIPAA).

(5) The student demonstrates knowledge of the administrative duties of a medical assistant in a healthcare setting. The student is expected to:

(A) identify considerations for scheduling a patient such as availability of test results, availability of staff, patient flow, triage, and coordination of care;

(B) discuss considerations related to managing an office schedule such as types of scheduling, under booking, over booking, cancellations, add-ons, and no-shows;

(C) define the terms used in medical billing such as diagnosis codes, billing codes, billing cycle, co-pay, deductibles, maximum out-of-pocket, and time of service;

(D) describe the elements of completing patient registration such as recording demographics, emergency contact, and insurance information;

(E) analyze different types of health insurance coverage, including Medicare, Medicaid, TRICARE, Civilian Health and Medical Program of the Department of Veterans Affairs (CHAMPVA), private insurance, employer-based insurance, and workers' compensation;

(F) identify the components of an insurance card such as plan name, group number, ID number, patient co-pay, co-insurance, and phone numbers;

(G) define insurance plan terminology such as prior authorization, formulary, explanation of benefits, denial, appeal, and referrals;

(H) define electronic health records systems and their components such as demographics, financial insurance information, orders and referrals, correspondence, and test results; and

(I) analyze the benefits and risks of electronic health records systems.

(6) The student uses appropriate medical terminology as a medical assistant. The student is expected to:

(A) use directional terms and anatomical planes related to body structure;

(B) use occupationally specific terms such as terms relating to the body systems, surgical and diagnostic procedures, diseases, and treatment; and

(C) apply knowledge of prefixes, suffixes, and root words to translate medical terms to conversational language to facilitate communication.

(7) The student practices or models patient intake skills as a medical assistant. The student is expected to:

(A) collect and document patient information during an intake interview, including chief complaint; patient care team; past medical, surgical, social, and family histories; patient allergies; and comprehensive medication list;

(B) explain how to use a medical chart to identify patient care needs;

(C) identify normal ranges for vital signs per age group, including blood pressure, temperature, heart rate, respiratory rate, and oxygen saturation;

(D) measure and record accurate vital signs, including manual blood pressure, temperature, heart rate, respiratory rate, and pain scale;

(E) measure and record accurate anthropometric measurements, including height, weight, and head circumference; and

(F) calculate accurate conversions between different units of measurement such as kilograms to pounds, centimeters to inches, and Fahrenheit to Celsius.

(8) The student demonstrates knowledge and application of point of care testing as a medical assistant. The student is expected to:

(A) define point of care testing;

(B) identify and correlate specimen types and collection methods, including throat swabs, capillary blood, and urine used in point of care testing;

(C) describe tests that might be performed as a point of care test in an office such as rapid strep, rapid flu, glucose, urine dip, urine pregnancy, vision screening, and electrocardiogram (EKG) tests;

(D) perform and document a vision screening using the Snellen eye chart; and

(E) locate landmarks for performing a 12-lead electrocardiogram (EKG).

(9) The student demonstrates knowledge of medication preparation and administration in a clinical setting specific to the role of a medical assistant. The student is expected to:

(A) apply the six rights of medication administration, including right patient, right medication, right dose, right time, right route, and right documentation;

(B) identify drug classifications and the indication for use;

(C) define drug-related terms, including adverse event, therapeutic response, side effect, drug interactions, and allergic reaction;

(D) calculate the amount of medication to administer based on the dosage ordered and the strength of medication supply on hand;

(E) evaluate a patient for known allergies and contraindications prior to administering any medication;

(F) identify routes of medication administration, including oral, buccal, sublingual, inhaled, intranasal, otic, ophthalmic, intravaginal, anal, topical, transdermal, intradermal, subcutaneous, intramuscular, intravenous, and intrathecal;

(G) use proper technique when preparing medications for administration, including injections, oral, sublingual, inhaled, otic, ophthalmic, and topical;

(H) use proper technique when administering medications, including injections, oral, sublingual, inhaled, otic, ophthalmic, and topical;

(I) identify appropriate muscle groups for intramuscular injections, including deltoid, vastus lateralis, and ventrogluteal;

(J) explain the factors that influence intramuscular injection site selection, including patient size, patient age, viscosity of medication, and muscular density;

(K) explain the factors that affect needle size and gauge selection, including medication viscosity, patient size, muscular density; and

(L) demonstrate knowledge of syringe styles and markings on various size syringes such as Luer Lock, oral, insulin, TB, 1ml, 3ml, 5ml, and 10ml syringes.

(10) The student demonstrates knowledge of collecting, labeling, storing, and transferring lab specimens. The student is expected to:

(A) identify how to properly store and transfer lab specimens such as blood, urine, fecal, and sputum samples;

(B) list the proper order of draw for blood collection tubes;

(C) select the proper collection tubes for specific types of blood tests such as complete blood count (CBC), comprehensive metabolic panel (CMP), and lipid panel;

(D) locate veins used for blood draws;

(E) demonstrate proper technique and post procedural care for veinous blood draws; and

(F) demonstrate proper labeling of lab specimens, including patient name, date of birth, source, date, time, and initials of collector.

(11) The student demonstrates knowledge of patient populations and their specific care considerations. The student is expected to:

(A) discuss and identify stages of development throughout a patient's lifespan;

(B) describe coping and defense mechanisms exhibited by patients such as emotion-focused behaviors, problem-focused behaviors, denial, displacement, intellectualization, projection, rationalization, and regression;

(C) identify and discuss end-of-life considerations such as advanced directives, power of attorney, stages of grief, and family support;

(D) practice appropriate methods of care for working with patients with mental, physical, and developmental disabilities;

(E) explain how socioeconomic factors such as income, transportation, access to community resources, employment, and education level can influence patient outcomes; and

(F) explain how various multicultural values can affect patient care decisions.

(12) The student demonstrates knowledge of safety practices and procedures as related to medical assisting. The student is expected to:

(A) employ standard precautions in a healthcare scenario;

(B) identify various modes of disease transmission, including vector borne, air borne, direct or indirect contact, and vehicle;

(C) distinguish between the types of isolation precaution signage used to address modes of disease transmission such as contact, droplet, and airborne;

(D) identify personal protective equipment (PPE);

(E) apply the knowledge of PPE used in various situations such as venipuncture, collecting a throat swab, or dipping urine;

(F) demonstrate proper donning and doffing of PPE;

(G) define the use of a sharps container, biohazard container, shredding bin, and trash receptacle;

(H) practice safe handling of sharps such as not recapping after injection and prompt disposal in a sharps container;

(I) identify symptoms of anaphylaxis and the proper emergency response;

(J) explain storage requirements for medications, vaccines, and lab specimens;

(K) locate and use the safety data sheets (SDS) to retrieve information such as proper storage, clean up, and exposure response; and

(L) define and apply knowledge of medical asepsis.

§127.428. Pharmacology (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: one credit in biology **. [~~and~~]** one credit in chemistry **, and at least one credit in a Level 2 or higher course from the health science career cluster**. **[~~Recommended prerequisite: a course from the Health Science Career Cluster.~~]** Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) The Pharmacology course is designed to study how natural and synthetic chemical agents such as drugs affect biological systems. Knowledge of the properties of therapeutic agents is vital in providing quality health care. It is an ever-changing, growing body of information that continually demands greater amounts of time and education from healthcare workers.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student applies professional standards/employability skills as required by the healthcare system. The student is expected to:

(A) apply appropriate verbal and non-verbal communication in a clear, concise, and effective manner;

(B) apply appropriate adaptability skills such as problem solving and creative thinking;

(C) create and evaluate a career plan using methods such as educational pathways, career goals, and individual aptitudes;

(D) demonstrate teamwork;

(E) create an occupation-specific resume; and

(F) identify and apply soft skills desired by employers.

(2) The student explores the field and foundation of pharmacology. The student is expected to:

(A) differentiate between pharmacology subdivisions, including pharmacodynamics, pharmacokinetics, pharmaceutics, and pharmacotherapeutics;

(B) use common drug information materials such as accredited scientific journals, institutions of higher learning, current events, news reports, published journal articles, textbooks, and marketing materials;

(C) list examples of primary, secondary, and tertiary drug information references;

(D) research and describe the history of pharmacy and contributions of the field;

(E) draw inferences based on data from promotional materials for products and services;

(F) analyze the societal impact of medication costs; and

(G) evaluate the impact of scientific research on society, including drug development and the natural environment, including drug disposal.

(3) The student identifies careers associated with pharmacology. The student is expected to:

(A) evaluate career pathways utilizing pharmacology;

(B) define the role of the pharmacy team; and

(C) research and describe emerging opportunities within the pharmacy profession.

(4) The student explains the ethical and legal responsibilities associated with pharmacology. The student is expected to:

(A) explain the causes, effects, and consequences associated with medical errors, including medication errors;

(B) define legal terminology associated with medical errors such as negligence, product liability, contributory negligence, and regulatory law;

(C) analyze the principles of medical ethics, including beneficence, autonomy, maleficence, and justice; and

(D) evaluate professional liability.

(5) The student uses medical terminology to communicate effectively with other healthcare professionals, patients, and caregivers. The student is expected to:

(A) use the appropriate medical terminology to identify different classes of drugs;

(B) communicate using medical terminology associated with pharmacology;

(C) analyze unfamiliar terms using the knowledge of word roots, suffixes, and prefixes; and

(D) interpret medical terminology to communicate with patients and caregivers.

(6) The student demonstrates mathematical knowledge and skills to solve problems with systems of measurement used in the pharmacy. The student is expected to:

(A) calculate medication dosages using formulas, ratios, proportions, and allegations;

(B) convert a measurement expressed in one standard unit within a system to a measurement expressed in another unit within the same system;

(C) convert a measurement expressed in one system to a unit of the same measurement in a different system, including metric, apothecary, avoirdupois, and household systems; and

(D) evaluate statistical data and its limitations such as patient compliance, study design, and controls.

(7) The student evaluates pharmaceutical agents, their dosage form, and routes of administration. The student is expected to:

(A) analyze the availability of different dosage forms such as solid, liquid, patch, and IV solution;

(B) give examples of the brand or generic names of drugs such as the top 200 drugs in each dosage form and routes of drug administration;

(C) define medical terminology associated with drug dosage forms;

(D) explain the difference between therapeutic effects, side effects, and toxic effects;

(E) identify the mechanism of action of different drug classifications such as drug receptors, agonists, and antagonist relationships;

(F) explain the dose response relationship concept such as the difference between oral and IV administration of drugs and explain the relationship between drug dosage, drug response, and time; and

(G) explain drug safety practices such as monitoring expiration dates and drug disposal.

(8) The student demonstrates knowledge and use of appropriate equipment, instruments, and technology. The student is expected to:

(A) identify technology components used in the pharmacy workflow such as ordering, entering, filling, and dispensing;

(B) describe how technology applications improve efficiency in the pharmacy; and

(C) identify and demonstrate proper use and maintenance of equipment and instruments used in a pharmacy setting such as IV drop sets, scales, glucose supplies, dispensing units or cabinets, and other laboratory supplies.

(9) The student practices safe protocols in preventing personal and client illness or injury. The student is expected to:

(A) employ safety standards such as workplace standards;

(B) interpret and apply pharmacy standards according to the strictest local, state, or federal regulations to enhance safety;

(C) examine the consequences of unsafe practices; and

(D) demonstrate safe procedures in the administration of client care in a simulated or clinical setting.

§127.429. Respiratory Therapy I (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. **Prerequisite: At least one credit in a course from the health science career cluster.** [**~~Prerequisite or corequisite:~~**

~~Anatomy and Physiology. Recommended prerequisite: a course from the Health Science Career Cluster.~~] Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) Respiratory Therapy I is a technical lab course that addresses knowledge and skills related to cardiopulmonary medicine. Respiratory therapists are specialized healthcare practitioners trained in cardiopulmonary medicine to work therapeutically with people suffering from cardiopulmonary diseases. Students will learn basic knowledge and skills performed by respiratory therapists using equipment such as: stethoscopes, sphygmomanometers, thermometers, pulse oximeters, oxygen delivery devices (nasal cannula, masks of various types), nebulizers, and airway clearance and hyperinflation therapy devices.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations, including:

(A) work-based experiences/learning; and

(B) volunteering/shadowing opportunities.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards and employability skills required by the respiratory therapy profession. The student is expected to:

(A) model professionalism associated with respiratory therapy such as adaptability, time management, punctuality, appreciation for diversity, decision-making, dedication, and organizational and leadership skills;

(B) demonstrate effective verbal and non-verbal communication in a clear and concise manner;

(C) demonstrate therapeutic communication appropriate to the situation, including communication with individuals with language differences/barriers and sensory loss;

(D) evaluate the effectiveness of conflict resolution techniques in various situations; and

(E) demonstrate the ability to cooperate, contribute, and collaborate as a member of a team.

(2) The student applies mathematics, science, English language arts, and social studies in respiratory therapy. The student is expected to:

(A) interpret complex technical material related to respiratory therapy;

(B) identify how [~~the impact of cultural diversity on patient care such as differences in~~] race, culture, and religion **impact patient care**;

(C) solve mathematical calculations related to respiratory therapy; and

(D) summarize biological and chemical processes that maintain homeostasis.

(3) The student investigates the history and profession of respiratory therapy, including education and licensure. The student is expected to:

(A) analyze the advancement of respiratory therapy practices over time;

(B) summarize the roles of respiratory therapists in various settings; and

(C) identify academic requirements for respiratory therapist and professional advancement opportunities such as professional organizations, credentials, certifications, registrations, licensure, continuing education, and advanced degrees.

(4) The student applies regulatory and safety standards in a respiratory therapy setting. The student is expected to:

(A) identify and conform to regulations and guidelines from entities such as the World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), Occupational Safety and Health Administration (OSHA), U.S. Food and Drug Administration (FDA), The Joint Commission, the National Institute of Health (NIH), Texas Commission on Environmental Quality (TCEQ), Texas Department of State and Health Services (DSHS), and American Association for Respiratory Care (AARC);

(B) identify infection control standard and transmission-based precautions in the patient care setting, including hand hygiene, equipment sterilization, and the use of personal protective equipment (PPE); and

(C) identify industry safety standards, including standards for body mechanics, fire prevention, electrical safety, oxygen safety, and the handling of hazardous materials.

(5) The student investigates the structure and function of cardiopulmonary anatomy. The student is expected to:

(A) analyze the cardiovascular system, including ventricles, atrium, valves, blood vessels, nerves, blood flow, and cardiac conduction system;

(B) explain the respiratory system, including airways, trachea, lungs, and pulmonary vessels that aid the body in the exchange of gases;

(C) trace the blood flow through the cardiopulmonary system; and

(D) examine a variety of human diseases and disorders affecting the cardiopulmonary system such as chronic obstructive pulmonary disease (COPD), asthma, pneumonia, cystic fibrosis, and lung cancer.

(6) The student develops knowledge pertaining to respiratory therapy procedures. The student is expected to:

(A) demonstrate the use of breathing exercises for patients with cardiopulmonary disease such as pursed lipped breathing and diaphragmatic breathing;

(B) explain the use of hyperinflation and airway clearance therapies;

(C) explain the use of tracheostomy and endotracheal tubes and oral and nasal airway devices for assisted breathing;

(D) identify anatomy of the heart and lungs and proper endotracheal tube placement on X-ray;

(E) explain the use of oximetry and arterial blood-gases for patient assessment;

(F) identify and explain the use of the equipment for oxygen therapies such as nasal cannula, high flow nasal cannula, simple masks, air-entrainment masks, partial rebreather masks, and non-rebreather masks; and

(G) demonstrate the administration of oxygen therapy using oxygen concentrators and portable cylinders.

(7) The student recognizes cardiopulmonary pharmaceutical agents and safety and protocol measures. The student is expected to:

(A) identify medications used in respiratory therapy, including bronchodilators and inhaled corticosteroids;

(B) summarize indications, contraindications, and side effects of respiratory medications;

(C) discuss delivery of respiratory medications such as nebulizers and meter dose inhalers (MDI); and

(D) assess the impact of cardiopulmonary agents on vital signs.

(8) The student implements the knowledge and skills of respiratory therapy professionals in a laboratory setting. The student is expected to:

(A) demonstrate patient assessment of vital signs, including blood pressure, pulse, respiratory rate, temperature, oxygenation, and ventilation status;

(B) demonstrate patient positioning for respiratory comfort and procedures;

(C) demonstrate patient care techniques used in high stress respiratory therapy situations such as non-compliant, combative, and distressed patients; and

(D) demonstrate correct cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) skills.

(9) The student evaluates ethical behavioral standards and legal responsibilities in the respiratory therapy profession. The student is expected to:

(A) examine legal and ethical behavior standards such as the Patient's Bill of Rights, advanced directives, and the Health Insurance Portability and Accountability Act (HIPAA);

(B) investigate and discuss the legal and ethical ramifications of unacceptable behavior in therapeutic practice;

(C) research and describe role of professional associations and regulatory agencies; and

(D) describe ethical dilemmas in health care.

§127.430. Respiratory Therapy II (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grade 12. Prerequisite: Respiratory Therapy I. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) Respiratory Therapy II is a technical lab course that addresses knowledge and skills related to critical care and cardiopulmonary medicine. Respiratory therapists are specialized healthcare practitioners trained in cardiopulmonary medicine to work therapeutically with people suffering from cardiopulmonary diseases. Students will learn advanced knowledge and skills performed by respiratory therapists using equipment such as stethoscopes, sphygmomanometers, thermometers, pulse oximeters and monitors, oxygen delivery devices (nasal cannula, masks of various types), nebulizers, airway clearance and hyperinflation therapy devices, spirometers, and intubation mannequin heads and equipment (endotracheal tubes, laryngoscopes, stylets).

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations, including

(A) work-based experiences/learning; and

(B) volunteering/shadowing opportunities.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards and employability skills required by the respiratory therapy profession. The student is expected to:

(A) model professionalism associated with respiratory therapy such as adaptability, time management, punctuality, appreciation for diversity, decision-making, dedication, and organizational and leadership skills;

(B) demonstrate effective verbal and non-verbal communication in a clear and concise manner;

(C) demonstrate therapeutic communication appropriate to the situation, including communication with individuals with language differences or barriers and sensory loss;

(D) evaluate the effectiveness of conflict resolution techniques in various situations;

(E) demonstrate the ability to cooperate, contribute, and collaborate as a member of a team; and

(F) explore career options for respiratory therapy and preparation necessary for employment such as creating a cover letter and resume, completing an application, and conducting mock interviews.

(2) The student applies mathematics, science, English language arts, and social studies in respiratory therapy. The student is expected to:

(A) analyze complex technical material related to respiratory therapy;

(B) identify how **[~~the impact of cultural diversity on patient care such as differences in~~]** race, culture, and religion **impact patient care**;

(C) apply mathematical calculations related to respiratory therapy; and

(D) analyze biological and chemical processes that affect homeostasis in relation to cardiopulmonary diseases.

(3) The student applies safety standards for a respiratory therapy setting. The student is expected to:

(A) evaluate and apply standards and guidelines from entities, including the American Association for Respiratory Care (AARC), World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), U.S. Food and Drug Administration (FDA), and Texas Commission on Environmental Quality (TCEQ), as they apply to cardiopulmonary diseases;

(B) demonstrate infection control standard and transmission-based precautions in the laboratory setting, including hand hygiene, equipment sterilization, and the use of personal protective equipment (PPE); and

(C) model industry safety standards, including standards for body mechanics, fire prevention, electrical safety, oxygen safety, and the handling of hazardous materials.

(4) The student explains the interactions between the cardiopulmonary and other body systems as they relate to wellness and diseases. The student is expected to:

(A) analyze the role of the autonomic nervous system in the regulation of the cardiopulmonary system as it pertains to health and illness;

(B) analyze the role of the urinary system in the regulation of the acid-base and fluid balance and in cardiopulmonary health and illness;

(C) investigate the interactions between body systems and cardiopulmonary diseases and disorders such as Guillain-Barré syndrome, Myasthenia Gravis, SARS-CoV-2 (Covid), Idiopathic Pulmonary Fibrosis (IPF), adult respiratory distress syndrome (ARDS), and congestive heart failure (CHF);

(D) differentiate between normal heart rhythms and common cardiac dysrhythmias such as ventricular fibrillation, ventricular tachycardia, and asystole attributed to malfunctions in other body systems; and

(E) discuss the role of respiratory therapists in the use of mechanical systems, including non-invasive and invasive mechanical ventilators and extracorporeal membrane oxygenation (ECMO), when the cardiopulmonary system fails.

(5) The student implements the knowledge and skills of a respiratory therapy professional used in a laboratory setting. The student is expected to:

(A) demonstrate breathing exercises commonly used for patients with cardiopulmonary disease;

(B) demonstrate airway management skills in a laboratory setting using equipment for intubation and airway maintenance such as endotracheal and tracheostomy tubes, endotracheal/tracheal suction catheters, laryngoscopes, bag valve mask devices, oral and nasal airways, tube fasteners, or tape;

(C) demonstrate airway clearance and hyperinflation therapies in a laboratory setting using equipment such as oscillating positive end pressure devices, high frequency chest wall oscillation devices, and an incentive spirometer;

(D) differentiate between normal lung and pathology in a chest X-ray;

(E) recognize typical and atypical arterial blood-gas values related to patient oxygenation and ventilation status;

(F) demonstrate the use of the oxygen therapy equipment such as nasal cannula, high flow nasal cannula, simple masks, air-entrainment masks, partial rebreather masks, non-rebreather masks, and non-invasive ventilators;

(G) demonstrate patient assessment methods, including inspection, auscultation, palpitation, and percussion;

(H) interpret and create a basic care plan for asthma and chronic obstructive pulmonary disease (COPD);

(I) demonstrate the role of a respiratory therapist during simulated emergency situations such as situations requiring a rapid response team and advanced cardiac life support; and

(J) describe the respiratory therapists' role in patient education regarding the disease process and proper use of medication and respiratory equipment.

(6) The student understands cardiopulmonary pharmaceutical agents and safety. The student is expected to:

(A) research and identify the application of medications used in respiratory therapy, including bronchodilators, inhaled corticosteroids, mucolytics, biologics, inhaled antibiotics, inhaled pulmonary vasodilators, and antivirals;

(B) evaluate indications, contraindications, and side effects of respiratory medications;

(C) demonstrate delivery methods of medication such as nebulizers and meter dose inhalers (MDI); and

(D) evaluate patient response to therapy before, during, and after respiratory treatments such as heart rate, blood pressure, respiration, and breath sounds.

(7) The student evaluates ethical behavioral standards and legal responsibilities in the respiratory therapy profession. The student is expected to:

(A) analyze legal and ethical scenarios as it relates to the Patient's Bill of Rights and the Health Insurance Portability and Accountability Act (HIPAA);

(B) evaluate the legal and ethical ramifications of unacceptable behavior in therapeutic practice; and

(C) describe ethical dilemmas in respiratory therapy such as advanced directives, palliative care, hospice, and end-of-life care.

(8) The student identifies academic preparation and skills necessary for employment in the field of respiratory therapy. The student is expected to:

(A) research and identify academic requirements for professional advancement such as credentials, certifications, licensure, registration, continuing education, and advanced degrees; and

(B) research and identify the path to obtain and maintain entry level licensure and credentialing.

§127.431. Leadership and Management in Nursing (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 10-12. Prerequisites: one credit in biology **. [~~and~~]** one credit in chemistry **. and at least one credit in a course from the health science career cluster** . Recommended prerequisite: **Science of Nursing** **[~~a course from the Health Science Career Cluster~~]** **.** Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) This course is designed to explore leadership and management in nursing, studying topics such as ethics, educational levels, career paths, regulatory bodies, and personal and professional leadership skills.

(4) Students are encouraged to participate in extended learning experiences such as Health Occupations Students of America (HOSA), Skills USA, career and technical student organizations, and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate verbal and non-verbal communication in a clear, concise, and effective manner; and

(B) exhibit the ability to cooperate, contribute, and collaborate as a member of a team.

(2) The student understands the different educational levels of licensed nurses and applicable careers and career pathways. The student is expected to:

(A) compare the differences between the educational requirements and roles of a licensed vocational nurse and a registered nurse;

(B) diagram the educational requirements of a registered nurse, including diploma, associate degree, bachelor's degree, master's degree, and doctoral degree;

(C) identify the different specializations of a nurse with a master's degree such as family nurse practitioner, nurse informaticist, nurse midwife, and nurse educator;

(D) differentiate the roles of the Doctor of Philosophy (PhD) and the Doctor of Nursing Practice (DNP) prepared nurse; and

(E) develop a six-year career plan in nursing.

(3) The student understands the functions of leadership in nursing. The student is expected to:

(A) illustrate or diagram the relationship and progression within the hierarchy of nursing leadership;

(B) identify critical skills and competencies for each level in the hierarchy of nursing leadership;

(C) present and examine the impact of each level of nursing in the hierarchy of leadership; and

(D) investigate and analyze different leadership styles and how they are used in different situations.

(4) The student demonstrates personal and professional leadership qualities and competencies. The student is expected to:

(A) identify different personal growth practices such as self-reflection, introspection, self-care, and journaling;

(B) describe and demonstrate intrapersonal skills such as empathy, patience, risk-taking, confidence, integrity, personal values and ethics, punctuality, and goal setting;

(C) examine personal and professional values and ethics;

(D) research and develop a plan to coach and mentor others; and

(E) evaluate decision-making processes such as delegation, problem-solving processes such as conflict management, and processes to support patient satisfaction, patient safety, and patient advocacy.

(5) The student demonstrates the appropriate use of communication techniques. The student is expected to:

(A) examine communication platforms and apply the appropriate professional response in different mediums such as telephone, email, text, electronic health records, and face to face;

(B) demonstrate professional written and verbal communication skills for individuals and teams using communication tools such as Situation Background Assessment and Recommendation (SBAR) and Acknowledge Introduce Duration Explanation and Thank you (AIDET);

(C) determine appropriate communication methods for urgent, emergent, and non-urgent situations such as team strategies and tools to enhance performance and patient safety (TeamSTEPPS); and

(D) demonstrate receiving and giving constructive criticism.

(6) The student understands the definition and application of time management. The student is expected to:

(A) demonstrate how to create an agenda that prioritizes tasks, duties, and responsibilities that must be completed, including required meetings and communications;

(B) differentiate goals that advance professional growth and responsibility and non-professional goals;

(C) identify factors that inhibit the good use of time and apply strategies that mitigate the loss of time; and

(D) demonstrate how to manage long- and short-term personal and professional schedules by creating and updating a yearly calendar.

(7) The student understands how to build and manage interdisciplinary teams and facilitate teamwork. The student is expected to:

(A) define and explain the purpose of an interdisciplinary team and the role of each member;

(B) develop a plan for creating a team through team-building exercises, culture and climate awareness, and interpersonal skills;

(C) define and apply techniques to manage personal conflict within teams; and

(D) describe the stages of team evolution such as forming, storming, norming, performing, and transforming.

(8) The student understands regulatory agencies and boards and their related requirements. The student is expected to:

(A) identify the role and responsibility of the Board of Nursing, including establishing graduation and licensure requirements;

(B) identify federal, state, and local regulatory agencies such as local hospital boards, Health and Human Services, The Joint Commission, and Center for Medicare and Medicaid Services;

(C) define and identify the nursing scope of practice;

(D) compare the difference between a certification and licensure; and

(E) compare the role of the Board of Nursing and professional nursing organizations.

§127.432. Practicum in Nursing (Two Credits), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: one credit in biology, one credit in chemistry, and at least one credit in a **Level 2 or higher course in the nursing science program of study.** **[~~course from the Health Science Career Cluster.~~]** Recommended prerequisites: Science of Nursing, Medical Terminology, and Anatomy and Physiology. Students shall be awarded two credits for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) Practicum in Nursing is designed to give students practical applications of previously studied knowledge and skills. Practicum experiences can occur in a variety of locations appropriate to the nature and level of experience.

(4) To pursue a career in the nursing industry, students should learn to reason, think critically, make decisions, solve problems, and communicate effectively. Students should recognize that quality health care depends on the ability to work well with others.

(5) The health care industry is comprised of diagnostic, therapeutic, health informatics, support services, and biotechnology research and development systems that function individually and collaboratively to provide comprehensive health care. Students recognize the employment opportunities, technology, and safety requirements of each system. Students are expected to apply the knowledge and skills necessary to pursue a health science certification or licensure through further education and employment.

(6) Professional integrity in the health care industry is dependent on acceptance of ethical and legal responsibilities. Students are expected to employ their ethical and legal responsibilities, recognize limitations, and understand the implications of their actions.

(7) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(8) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate verbal and non-verbal communication in a clear, concise, and effective manner; and

(B) demonstrate the ability to cooperate, contribute, and collaborate as a member of a team.

(2) The student applies mathematics, science, English language arts, and social sciences in nursing. The student is expected to:

(A) solve mathematical calculations appropriate to situations in a health-related environment;

(B) communicate using medical terminology;

(C) express ideas in writing and develop skills in documentation;

(D) interpret complex technical material related to the health science industry;

(E) summarize biological and chemical processes that maintain homeostasis;

(F) explain changes in body structure due to trauma and disease; and

(G) research the global impact of disease prevention and cost containment.

(3) The student models ethical behavior standards and legal responsibilities. The student is expected to:

(A) apply facility and industry standard policies and procedures, including the Health Insurance Portability and Accountability Act (HIPAA);

(B) research and present case studies related to legal and ethical issues in health care;

(C) recognize and analyze professional boundaries of patient relationships; and

(D) model safe practices, including infection control, proper body mechanics, and patient handling.

(4) The student explores the knowledge and skills of the nursing process for assessment. The student is expected to:

(A) perform and assess subjective data during a patient intake in a clinical or simulated setting by:

(i) performing a complete health history, including family and social data; and

(ii) assessing the chief complaint, history of present illness, past medical history, and a review of systems; and

(B) perform and assess objective data during a patient intake in a clinical or simulated setting by demonstrating:

(i) the skill of obtaining core vital signs;

(ii) the skill of obtaining and assessing height and weight and weight fluctuations; and

(iii) the performance of a head-to-toe physical assessment.

(5) The student explores the knowledge and skills of the nursing process for implementation or intervention. The student is expected to:

(A) demonstrate the proper use and application of medical equipment related to oxygen therapy, glucometers, pulse oximeters, catheters, incentive spirometers, mobility devices, patient handling devices, and electric hospital beds and chairs;

(B) demonstrate patient care, including care related to activities of daily living (ADL), patient positioning, patients' range of motion, basic first aid, patient transfers, and patient transport;

(C) demonstrate skills related to or acquire basic life support (BLS) certification as required by industry standards; and

(D) demonstrate the skills necessary to track nutrition and elimination such as input and output (I&O) and types of diets.

(6) The student explores the knowledge and skills of the nursing process of evaluation and re-evaluation. The student is expected to:

(A) compare normal and abnormal healthcare data;

(B) identify how to report trends and abnormal findings to appropriate personnel according to facility protocols; and

(C) explain the significance of abnormal findings.

(7) The student explores the knowledge and skills of the nursing process of documentation. The student is expected to:

(A) document objective data using medical terminology;

(B) document subjective data using medical terminology; and

(C) record documentation using various models such as Situation, Background, Assessment, and Recommendation (SBAR); Acknowledge, Introduce, Duration, Explanation, and Thank you (AIDET); and Subjective, Objective, Assessment Plan (SOAP).

(8) The student **provides** **[~~is expected to provide~~]** care for diverse populations such as persons from varying age groups and persons with physical limitations or mental health needs in clinical or simulated environment. The student is expected to:

(A) demonstrate appropriate usage of verbal and non-verbal communication techniques for providing care to persons from diverse populations; and

(B) apply appropriate techniques for assessments and care.

(9) The student is expected to provide culturally appropriate care. The student is expected to:

(A) use culturally appropriate verbal and non-verbal communication skills; and

(B) demonstrate patient interaction strategies for assessments and care.

§127.433. Medical Microbiology (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 10-12. Prerequisites: one credit in biology **, [~~and~~]** one credit in chemistry **, and at least one credit in a course from the health science career cluster. [~~Recommended prerequisite: a course from the Health Science Career Cluster.~~]** This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

(3) The Medical Microbiology course is designed to explore the microbial world, studying topics such as pathogenic and non-pathogenic microorganisms, laboratory procedures, identifying microorganisms, drug-resistant organisms, and emerging diseases.

(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(5) Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(6) Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

(7) Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(8) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that

can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(9) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(10) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate verbal and non-verbal communication in a clear, concise, and effective manner;

(B) demonstrate the ability to cooperate, contribute, and collaborate as a member of a team; and

(C) locate, evaluate, and interpret career options, opportunities, and postsecondary transitions relating to the field of microbiology.

(2) The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as microscopes, slides, streak plates, inoculating loops, Bunsen burners, striker, hot plate, petri dish, agar and other growth mediums, reactive agents, personal protective equipment (PPE), disposable pipettes, lab glassware and instruments, bacterium and other live microbial agents, enzymes, computer software and probes, incubator, and autoclave;

(E) collect quantitative data using the International System of Units (SI) and United States customary units and qualitative data as evidence;

(F) organize quantitative and qualitative data using equipment such as graphing calculator, computer software and probes, graphic organizers;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(3) The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(4) The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(5) The student knows the contributions of scientists and engineers and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists and engineers as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) or health science field in order to investigate careers.

(6) The student examines the field of microbiology in relation to medical care. The student is expected to:

(A) examine the historical development of microbiology as it relates to health care of an individual in modern medicine; and

(B) compare the roles, functions, and responsibilities of agencies governing infectious disease control.

(7) The student is expected to perform and analyze results in the microbiology laboratory. The student is expected to:

(A) classify microorganisms using a dichotomous key;

(B) prepare slides and discuss the differences between Gram positive and Gram negative bacteria such as the bacterial cell wall and the use of oxygen;

(C) identify chemical processes such as enzyme catalyst and osmotic potential of microorganisms;

(D) identify and discuss technologies used in a laboratory setting such as polymerase chain reaction (PCR), serology, enzyme-linked immunoassay (ELISA), and electrophoresis;

(E) prepare plates or active mediums to differentiate the factors required for microbial reproduction and growth;

(F) identify the normal flora microorganisms of the human body;

(G) identify and differentiate between various pathogens, including opportunistic pathogens, hospital-acquired infections, community-acquired infections, and colonizing microorganisms;

(H) isolate colonies and describe the morphology of microorganisms; and

(I) interpret and explain the role of the culture and sensitivity report provided to the clinician.

(8) The student examines the role of microorganisms in infectious diseases. The student is expected to:

(A) outline and explain the infectious disease process, including how pathogenic microorganisms affect human body systems;

(B) categorize diseases caused by bacteria, including *Rickettsia*, fungi, viruses, protozoa, arthropods, and helminths;

(C) explain and interpret the body's immune responses and defenses against infection;

(D) prepare a bacterial colony and evaluate the effects of anti-microbial agents such as narrow and broad-spectrum antibiotics;

(E) examine the environmental and social causes of the emergence and reemergence of diseases such as corona viruses, Ebola, malaria, tuberculosis, and polio;

(F) research and discuss drug *aureus*-resistant microorganisms, including carbapenem-resistant *Enterobacteriaceae*, methicillin-resistant *Staphylococcus aureus*, vancomycin-intermediate/resistant *Staphylococci*, vancomycin-resistant enterococci, and emergent antibiotic-resistant superbugs; and

(G) outline the role of governing agencies in monitoring and establishing guidelines based on the spread of infectious diseases.

(9) The student recognizes the importance of maintaining a safe environment and eliminating hazardous situations. The student is expected to:

(A) identify and apply standard laboratory precautions;

(B) identify and apply microbiological safety practices in accordance with industry standards, including the proper handling, disinfection, and disposal of biological waste and maintenance of containment levels;

(C) identify and apply appropriate personal protection equipment (PPE) and transmission-based precautions, including precautions against droplet, contact, and airborne transmission;

(D) sterilize laboratory and medical equipment and instruments in accordance with industry standards; and

(E) define and select different mechanisms of decontamination such as antiseptics, disinfection, and sterilization.

Chapter 127. Texas Essential Knowledge and Skills for Career Development and Career and Technical Education

Subchapter J. Hospitality and Tourism

§127.482. Food Science (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: one credit in biology **, [~~and~~]** one credit in chemistry **, and at least one credit in a Level 2 or higher course from the hospitality and tourism career cluster** . Recommended prerequisite: Principles of Hospitality and Tourism. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Hospitality and Tourism Career Cluster focuses on the management, marketing, and operations of restaurants and other food/beverage services, lodging, attractions, recreation events, and travel-related services.

(3) In Food Science, students examine the nature and properties of foods, food microbiology, and the principles of science in food production, processing, preparation, and preservation; use scientific methods to conduct laboratory and field investigations; and make informed decisions using critical thinking and scientific problem solving. This course provides students a foundation for further study that leads to occupations in food and beverage services; the health sciences; agriculture, food, and natural resources; and human services.

(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(5) Scientific hypotheses and theories. Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(6) Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

(7) Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(8) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(9) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(10) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by the food service business and industry. The student is expected to:

(A) apply interpersonal communication skills in the food service business and industry settings;

(B) explain and recognize the value of collaboration within the workplace;

(C) examine the importance of time management to succeed in the workforce;

(D) identify work ethics and professionalism in a job setting;

(E) describe problem-solving and critical-thinking skills used in the workplace; and

(F) explore careers and professions in food science.

(2) The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, metric rulers, electronic balances, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, and models, diagrams, or samples of biological specimens or structures, vacuum sealer, oven, cook top, cookware, bakeware, cutlery, and measuring cups and spoons;

(E) collect quantitative data using the International System of Units (SI) and United States customary units and qualitative data as evidence;

(F) organize quantitative and qualitative data using lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(3) The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(4) The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(5) The student knows the contributions of scientists and engineers and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists and engineers as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics or food science field.

(6) The student analyzes household and commercial sustainability and regulatory practices in food production. The student is expected to:

(A) research and investigate resource use, sustainability, and conservation in food production such as with water, land, and oceans;

(B) analyze the effect of food on the decomposition cycle, including composting, recycling, and disposal; and

(C) demonstrate appropriate methods for sorting and disposing of food waste, including fats and oils, and packaging waste from food production.

(7) The student analyzes the role of acids and bases in food science. The student is expected to:

(A) evaluate physical and chemical properties of acids and bases; and

(B) analyze the relationship of pH to the properties, safety, and freshness of food.

(8) The student evaluates the principles of microbiology and food safety practices. The student is expected to:

(A) investigate the properties of microorganisms that cause food spoilage;

(B) compare food intoxication and food infection;

(C) examine methods to destroy or inactivate harmful pathogens in foods;

(D) compare beneficial and harmful microorganisms, including lactic acid bacteria, acetic acid bacteria, various baking and brewing yeasts, *E. coli*, *Staphylococcus*, *Clostridium botulinum*, *Clostridium perfringens*, *Salmonella*, *Listeria*, and *Shigella*;

(E) analyze sanitary food-handling practices such as personal hygiene or equipment sanitation; and

(F) prepare for a state or national food manager sanitation certification or alternative credential within the field of food science technology.

(9) The student examines the chemical properties of food. The student is expected to:

(A) describe acids, bases, salts, carbohydrates, lipids, proteins and other elements, compounds, and mixtures related to food science;

(B) compare heterogeneous and homogeneous mixtures;

(C) analyze chemical and physical changes in food; and

(D) use chemical symbols, formulas, and equations in food science such as oxidation of sugars in a cut apple or fermentation in the production of yogurt.

(10) The student analyzes solutions, colloids, solids, gels, foams, and emulsions in food science. The student is expected to:

(A) identify the solvent and solute in various solutions such as brines;

(B) compare unsaturated, saturated, and supersaturated solutions, including their effects on boiling and freezing points in food preparation such as when making candy or ice cream;

(C) calculate the concentration of a solution using mass percent such as the concentration of sugar needed for crystallization;

(D) describe the properties of colloidal dispersions such as gelatin, mayonnaise, or milk;

(E) differentiate between and give examples of temporary, semi-permanent, and permanent emulsions;

(F) investigate the relationships between the three parts of a permanent emulsion; and

(G) create temporary, semi-permanent, and permanent food emulsions.

(11) The student analyzes the functions of enzymes in food science. The student is expected to:

(A) describe the role of enzymes as catalysts in chemical reactions of food, including cheese-making, the enzymatic tenderization of meat, and oxidation of sugars in fruit;

(B) explain the relationship between an enzyme and a substrate;

(C) analyze the functions of enzymes in digestion, including the factors that influence enzyme activity, and relate enzymatic activity in digestion to dietary restrictions; and

(D) analyze enzyme reactions in food preparation, including cheese-making, the enzymatic tenderization of meat, and oxidation of sugars in fruit.

(12) The student evaluates the role of fermentation in food science. The student is expected to:

(A) analyze modern and historical reasons food is fermented;

(B) describe the conditions under which bacterial fermentation of food occurs and use chemical equations to describe the products of fermentation; and

(C) prepare various fermented food products.

(13) The student assesses the reaction of leavening agents in baked products. The student is expected to:

(A) describe the physical and chemical changes that occur in leavening;

(B) identify various leavening agents and describe their functions in food production;

(C) use chemical equations to describe how acids act as leavening agents;

(D) conduct laboratory experiments with various types and amounts of leavening agents to compare the doughs and batters produced; and

(E) create baked products using various leavening agents.

(14) The student explores the roles of food additives. The student is expected to:

(A) evaluate the various types of food additives such as incidental, intentional, natural, and artificial;

(B) investigate the various functions of food additives such as preserving food, increasing nutritive value, and enhancing sensory characteristics; and

(C) research local, state, national, and international agencies involved in regulating food additives.

(15) The student analyzes the effects of heat energy transfer in food production. The student is expected to:

(A) analyze the relationship between molecular motion and temperature;

(B) compare heat transfer processes, including conduction, convection, and radiation;

(C) investigate the role of phase changes in food production, including crystallization, coagulation, and reduction; and

(D) demonstrate rates of reaction using various temperatures and describe the effects of temperature on the characteristics of food products.

(16) The student evaluates the properties of carbohydrates in food and their effects on food production. The student is expected to:

(A) identify the physical properties and chemical structures of simple and complex carbohydrates;

(B) describe the functions of carbohydrates such as caramelization, crystallization, and thickening agents in food production;

(C) describe the processes of gelatinization and retrogradation in food production; and

(D) create food products using simple and complex carbohydrates.

(17) The student evaluates the properties of fats in food and their effects on food production. The student is expected to:

(A) identify the physical properties and chemical structures of saturated and unsaturated fats;

(B) describe the functions of different types of fats in food production;

(C) demonstrate methods for controlling fat oxidation;

(D) analyze the effects of temperature on fats in food preparation;

(E) conduct laboratory experiments using the scientific processes to explore the functions of fats in food production; and

(F) create food products using saturated and unsaturated fats.

(18) The student evaluates the properties of proteins and their effects on food production. The student is expected to:

(A) identify the physical properties and chemical structures of proteins;

(B) explain the processes of protein denaturation, coagulation, and syneresis;

(C) describe the functions and uses of proteins such as in emulsions, foams, and gluten formation;

(D) analyze the effects of moisture and temperature on protein in food production such as moist and dry heat methods for preparation; and

(E) create food products using protein.

(19) The student evaluates the properties of vitamins and minerals and their interrelationships in food production. The student is expected to compare the effects of food production on water- and fat-soluble vitamins and minerals.

(20) The student evaluates the properties of water and their effects on food production. The student is expected to:

(A) identify the properties of water, including as a solvent or medium, and its effects on food production; and

(B) compare the effects of hard and soft water on food production.

(21) The student explains nutritional aspects of food production. The student is expected to:

(A) describe how variations in human digestion and metabolism affect dietary modifications;

(B) identify common and special dietary modifications such as for food allergies, intolerances, or medical conditions;

(C) develop and modify recipes for dietary differences such as allergies and intolerances or for personal health preferences such as low-fat or sugar-free; and

(D) plan and create a dining experience using the most recent USDA dietary guidelines.

(22) The student analyzes processes that manage bacteria to safe levels during food production. The student is expected to investigate processes that manage food bacteria such as dehydration, pasteurization, and food irradiation.

(23) The student examines packaging and labeling guidelines. The student is expected to:

(A) research and evaluate federal food packaging regulations, including the information required on a food label;

(B) compare global food packaging regulations to those of the United States; and

(C) analyze the effectiveness of commercial food packaging for specific foods.

(24) The student analyzes food preservation processes. The student is expected to:

(A) describe the benefits of food preservation;

(B) compare various methods of household and commercial dehydration, canning, and freezing; and

(C) create a food product using a selected preservation method.

Chapter 127. Texas Essential Knowledge and Skills for Career Development and Career and Technical Education

Subchapter M. Law and Public Service

§127.651. Implementation of Texas Essential Knowledge and Skills for Law and Public Service, Adopted 2021.

(a) The provisions of this subchapter shall be implemented by school districts beginning with the 2022-2023 school year.

(b) No later than August 31, 2022, the commissioner of education shall determine whether instructional materials funding has been made available to Texas public schools for materials that cover the essential knowledge and skills for career and technical education as adopted in §127.652 of this subchapter.

(c) If the commissioner makes the determination that instructional materials funding has been made available under subsection (b) of this section, §127.652 of this subchapter shall be implemented beginning with the 2022-2023 school year and apply to the 2022-2023 and subsequent school years.

(d) If the commissioner does not make the determination that instructional materials funding has been made available under subsection (b) of this section, the commissioner shall determine no later than August 31 of each subsequent school year whether instructional materials funding has been made available. If the commissioner determines that instructional materials funding has been made available, the commissioner shall notify the State Board of Education and school districts that §127.652 of this subchapter shall be implemented for the following school year.

§127.652. Forensic Science (One Credit), Adopted 2021.

(a) General requirements. The course is recommended for students in Grades 11 and 12. Prerequisites: one credit in biology **, [~~and~~]** one credit in chemistry **, and at least one credit in a Level 2 or higher course from the law and public safety career cluster** . This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Law and Public Service Career Cluster focuses on planning, managing, and providing legal services, public safety, protective services, and homeland security, including professional and technical support services.

(3) Forensic Science is a survey course that introduces students to the application of science to law. Students learn terminology and procedures related to the collection and examination of physical evidence using scientific processes performed in a field or laboratory setting. Students also learn the history and the legal aspects of forensic science.

(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(5) Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(6) Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

(7) Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(8) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(9) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(10) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to demonstrate professional standards/employability skills such as demonstrating good attendance, punctuality, and ethical conduct; meeting deadlines, and working toward personal and team goals.

(2) The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools and equipment such as scientific calculators, computers, internet access, digital cameras, video recording devices, meter sticks, metric rulers, measuring

tapes, digital range finders, protractors, calipers, light microscopes up to 100x magnification, hand lenses, stereoscopes, digital scales, dissection equipment, standard laboratory glassware, appropriate personal protective equipment (PPE), an adequate supply of consumable chemicals, biological specimens, prepared evidence slides and samples, evidence packaging and tamper evident tape, evidence tents, crime scene tape, L-rulers, American Board of Forensic Odontology (ABFO) scales, alternate light sources (ALS) and ALS protective goggles, blood specimens, blood presumptive tests, glass samples of various chemical composition, human and non-human bones, fingerprint brushes and powders, lifting tapes and cards, ten-print cards and ink pads, swabs with containers, disposable gloves, and relevant and necessary kits;

(E) collect quantitative data with accuracy and precision using the International System of Units (SI) and United States customary units and qualitative data as evidence;

(F) organize quantitative and qualitative data using appropriate methods of communication such as reports, graphs, tables, or charts;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(3) The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(4) The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(5) The student knows the contributions of scientists and engineers and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists and engineers as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field.

(6) The student explores the history of forensic science. The student is expected to:

(A) analyze the historical development and current advancements of different forensic science disciplines such as forensic biology, anthropology/odontology, forensic chemistry, trace evidence, ballistics, fingerprints, digital forensics, and questioned documents; and

(B) explain significant historical and modern contributions to the development and advancement of forensic science made by contributors such as Edmond Locard, Mathieu Orfila, Francis Galton, Edwin Henry, and Alec Jeffreys.

(7) The student analyzes legal aspects within forensic science. The student is expected to:

(A) summarize the ethical standards required of a forensic science professional;

(B) identify and explain knowledge of terminology and procedures employed in the criminal justice system as they pertain to the chain of custody procedure for evidence;

(C) identify and explain knowledge of terminology and procedures employed in the criminal justice system as they pertain to expert witness testimony;

(D) research and discuss the effect of biases such as confirmation bias and framing cognitive bias on evidence collection, forensic analysis, and expert testimony; and

(E) compare the admissibility of expert witness testimony in terms of the Frye Standard and the Daubert Standard under federal rules of evidence.

(8) The student explores career options within forensic science. The student is expected to:

(A) explore and describe discipline-specific requirements for careers in forensic science, including collegiate course requirements, licensure, certifications, and physical and mental capabilities;

(B) differentiate the roles and responsibilities of professionals in the criminal justice system, including forensic scientists, crime scene investigators, criminologists, court systems personnel, and medicolegal death investigations; and

(C) differentiate the functions of various forensic science disciplines such as forensic biology, forensic chemistry, trace evidence, ballistics, fingerprints, digital forensics, and questioned documents.

(9) The student recognizes the procedures of crime scene investigation while maintaining scene integrity. The student is expected to:

(A) explain the roles and tasks needed to complete a crime scene examination, which may require collaboration with outside experts and agencies, and demonstrate the ability to work as a member of a crime scene team;

(B) develop a detailed, technical written record based on observations and activities, documenting the crime scene examination;

(C) discuss the elements of criminal law that guide search and seizure of persons, property, and evidence;

(D) conduct a primary and secondary systematic search of a simulated crime scene for physical evidence utilizing search patterns such as spiral, line, grid, and zone;

(E) document a crime scene using photographic or audiovisual equipment;

(F) generate a physical or digital crime scene sketch, including coordinates or measurements from fixed points, compass directions, scale of proportion, legend-key, heading, and title block; and

(G) demonstrate proper techniques for collecting, packaging, and preserving physical evidence found at a crime scene while maintaining documentation, including chain of custody.

(10) The student analyzes fingerprint evidence in forensic science. The student is expected to:

(A) compare the three major fingerprint patterns of arches, loops, and whorls;

(B) identify the minutiae of fingerprints, including bifurcations, ending ridges, dots, short ridges, and enclosures/islands;

(C) distinguish between patent, plastic, and latent impressions;

(D) perform procedures for developing and lifting latent prints on nonporous surfaces using cyanoacrylate and fingerprint powders;

(E) perform procedures for developing latent prints using chemical processes on porous and adhesive surfaces with chemicals such as ninhydrin and crystal violet and documenting the results via photography; and

(F) explain the Integrated Automated Fingerprint Identification System (IAFIS) and describe the implications of Next Generation Identification (NGI) systems.

(11) The student collects and analyzes impression evidence in forensic science. The student is expected to:

(A) analyze the class and individual characteristics of tool mark impressions and the recovery and documentation of surface characteristics such as wood or metal;

(B) analyze the class and individual characteristics of footwear impressions and the recovery and documentation of surface characteristics such as soil or organic plant material;

(C) analyze the class and individual characteristics of tire tread impressions and the recovery documentation of surface characteristics such as soil or organic plant material; and

(D) compare impression evidence collected at a simulated crime scene with the known impression.

(12) The student recognizes the methods to process and analyze hair and fibers found in a crime scene. The student is expected to:

(A) demonstrate how to collect hair and fiber evidence at a simulated crime scene;

(B) perform the analysis of hair and fiber evidence using **forensic science** methods such as microscopy and flame testing;

(C) compare the microscopic characteristics of human hair and non-human hair, including medulla, pigment distribution, and scales;

(D) describe and illustrate the different microscopic characteristics used to determine the origin of a human hair sample; and

(E) differentiate between natural and synthetic fibers.

(13) The student recognizes the methods to process and analyze glass evidence. The student is expected to:

(A) demonstrate how to collect and preserve glass evidence;

(B) compare the composition of various types of glass such as soda lime, borosilicate, leaded, and tempered;

(C) determine the direction of a projectile by examining glass fractures; and

(D) define refractive index and explain how it is used in forensic glass analysis.

(14) The student explores principles of questioned document analysis in the physical and digital form. The student is expected to:

(A) research and explain different types of examinations performed on digital and physical evidence in a forensic laboratory such as digital data recovery, counterfeiting, ink, and paper analysis;

(B) investigate and describe the security features incorporated in U.S. and foreign currency to prevent counterfeiting; and

(C) perform handwriting comparisons of an unknown sample with exemplars by analyzing characteristics such as letter, line, and formatting.

(15) The student evaluates firearms and ballistics evidence. The student is expected to:

(A) describe the mechanism of modern firearms such as long guns and handguns;

(B) identify the components and characteristics of bullet and cartridge cases;

(C) describe the composition of and method of analysis for gunshot residue and primer residue;

(D) conduct and calculate trajectory analysis of bullet strikes within a simulated crime scene; and

(E) identify and recognize the type of information available through the National Integrated Ballistics Information Network.

(16) The student identifies controlled and illicit substances. The student is expected to:

(A) differentiate between toxicological analysis and controlled substance analysis as they relate to the method of collection and impact on the body;

(B) classify controlled substances using the schedules under the Controlled Substances Act; and

(C) identify unknown substances using presumptive and confirmatory procedures such as microchemical/color indicating reagent field tests, microscopy, chromatography, and spectrophotometry.

(17) The student explores toxicology in forensic science. The student is expected to:

(A) explain the absorption, distribution, metabolization, and elimination of toxins such as alcohol, prescription drugs, controlled substances, and carbon monoxide through the human body;

(B) describe presumptive and confirmatory laboratory procedures as they relate to toxicological analysis such as head space analysis, solid-phase extractions, gas chromatography-mass spectrometry (GC/MS), color tests, and immunoassays;

(C) interpret results from presumptive and confirmatory laboratory procedures, including GC/MS and their implications; and

(D) explain the precautions necessary in the forensic laboratory for proper preservation of biological samples.

(18) The student analyzes blood spatter at a simulated crime scene. The student is expected to:

(A) analyze blood stain patterns based on surface type and appearance such as size, shape, distribution and location in order to determine the mechanism by which the patterns are created;

(B) explain the methods of chemically enhancing latent blood patterns using reagents such as Blue Star or Amido Black; and

(C) conduct and interpret blood presumptive tests for various biologicals such as phenolphthalein and tetramethylbenzidine (TMB).

(19) The student analyzes the foundations and methodologies surrounding the processing of biological evidence for the purpose of identification. The student is expected to:

(A) identify different types of biological samples and practice proper collection and preservation techniques;

(B) identify the red blood cell antigens and antibodies as they relate to human blood types;

(C) describe the structure of a deoxyribonucleic acid (DNA) molecule and its function;

(D) explain the analytical procedure for generating a DNA profile, including extraction, quantification, amplification, and capillary electrophoresis;

(E) explain the different methodologies surrounding the different types of DNA analysis such as short tandem repeats (STRs), Y-STRs, mitochondrial DNA, and single nucleotide polymorphisms (SNPs);

(F) interpret the components of an electropherogram; and

(G) explore the databasing systems associated with DNA such as Combined DNA Index System (CODIS) and ancestry-based databasing systems.

(20) The student explores the principles surrounding medicolegal death investigations. The student is expected to:

(A) explain the principles of rigor, algor, and livor mortis and how they apply to deceased persons;

(B) differentiate between the types of wound patterns such as lacerations and blunt force trauma resulting from stabbings, bludgeoning, gunshots, and strangulations;

(C) determine cause and manner of death from an autopsy report obtained through resources such as case studies, simulated autopsies, and dissections; and

(D) determine the approximate time of death using entomology.

(21) The student explores principles of anthropology and odontology relevant to forensic science. The student is expected to:

(A) identify the major bones of the human skeletal system;

(B) compare composition and structure of human and non-human bones;

(C) describe the collection and preservation methods for bone evidence;

(D) explain the characteristics of the human skeletal system indicative of specific biological sex and approximate range of age and height; and

(E) explain how human remains are identified through dental records such as dentures, x-rays, and implants.

Chapter 127. Texas Essential Knowledge and Skills for Career Development and Career and Technical Education

Subchapter O. Science, Technology, Engineering, and Mathematics

§127.778. Principles of Bioscience (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 9 and 10. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services such as laboratory and testing services and research and development services.

(3) Principles of Bioscience provides an overview of biotechnology, bioengineering, and related fields. Topics related to genetics, proteins, and nucleic acids reinforce the applications of Biology content. Students will further study the increasingly important agricultural, environmental, economic, and political roles of bioenergy and biological remediation; the roles of nanoscience and nanotechnology in biotechnology medical research; and future trends in biological science and biotechnology.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession;

(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome;

(C) present written and oral communication in a clear, concise, and effective manner;

(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results; and

(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed.

(2) The student explores biotechnology career opportunities. The student is expected to:

(A) determine interests in the field of biotechnology through explorations such as career assessments, interactions with biotechnology professionals, media, and literature;

(B) identify career options in the field of biotechnology;

(C) identify reliable sources of career information;

(D) research and communicate interests, knowledge, educational level, abilities, and skills needed in a biotechnology-related occupation;

(E) identify conventional and non-conventional career opportunities that match interests and aptitudes;

(F) research applications of biotechnology in medicine, the environment, and settings such as pharmaceutical, agricultural, and industrial;

(G) use technology to research biotechnology topics, including identifying and selecting appropriate scholarly references; and

(H) analyze and discuss professional publications such as academic and peer-reviewed journals and technical reports.

(3) The student evaluates ethical and legal issues in biotechnology. The student is expected to:

(A) identify current ethical and legal issues;

(B) describe the history of biotechnology and related ethical and legal issues;

(C) discuss legal and technology issues for at least two biotechnology-related areas; and

(D) analyze examples of biotechnology views supported by objective and subjective sources such as scientific data, economic data, and sociocultural contexts.

(4) The student examines federal, state, local, and industry regulations as applied to biotechnological processes through researching credible sources. The student is expected to:

(A) identify local, state, and federal agencies responsible for regulating the biotechnology industry such as the U.S. Department of Agriculture (USDA), the Environmental Protection Agency (EPA), the U.S. Food and Drug Administration (FDA), and the Centers for Disease Control and Prevention (CDC);

(B) identify professional organizations participating in the development of biotechnology policies;

(C) identify and define terms related to biotechnology regulations such as Good Laboratory Practices (GLP), Good Manufacturing Practices (GMP), and Globally Harmonized System (GHS); and

(D) outline the methods and procedures used in biotechnology laboratories to follow local, state, and federal regulations such as those in the agricultural and health areas.

(5) The student demonstrates knowledge of the business climate for biotechnology industry sectors in the current market. The student is expected to:

(A) identify professional publications;

(B) identify the various biotechnology industry sectors;

(C) investigate and report on career opportunities in the biotechnology industry sectors; and

(D) identify professional organizations such as those at the local, state, and national levels.

(6) The student researches and exhibits employability skills that support a career in the biotechnology industry. The student is expected to:

(A) demonstrate verbal, non-verbal, written, and electronic communication skills;

(B) demonstrate skills used to secure and maintain employment;

(C) demonstrate appropriate workplace etiquette;

(D) display productive work habits and attitudes; and

(E) identify appropriate safety equipment and practices as outlined in Texas Education Agency-approved and industry-approved safety standards such as the use of personal protective equipment (PPE) and safety data sheets (SDS).

(7) The student investigates how biotechnology impacts the origins of waste and resource recovery. The student is expected to:

(A) identify biotechnology manufacturing processes and their end products, including waste and marketable products;

(B) explore the impacts of waste on biotic and abiotic factors in the environment such as effects on biological life cycles and pollution from nonbiodegradable single-use materials and microplastics;

(C) analyze the results of manufacturing refuse;

(D) explain the negative impacts of waste with respect to the individual, society, and the global population;

(E) investigate solutions to waste through bioremediation; and

(F) investigate evidence supporting waste management through regulations, public policy, and technology development.

(8) The student examines the relationship of biotechnology to the development of commercial products. The student is expected to:

(A) identify applications of agricultural biotechnology such as selective breeding of livestock and plants, aquaculture, horticultural products, and genetically modified organisms;

(B) identify applications of industrial biotechnology such as fermented food and beverages, genetically engineered proteins for industry, biocatalysts, bio polymers, biosensors, bioremediation, and biofuels;

(C) identify applications of medical and pharmaceutical biotechnology such as genetically modified cells, antibodies, vaccine and gene therapy, genetic testing for human disease/disorders, three-dimensional bio-printing, and medicines from plants, animals, fungi, and bacteria;

(D) identify applications of research and development in biotechnology such as deoxyribonucleic acid (DNA) and protein synthesis and sequencing, genetic testing and screening, DNA identification, RNAi, siRNA, miRNA, the CRISPR/Cas9 system, and synthetic biology;

(E) identify the applications of biotechnology in the fields of forensics, law enforcement, nanotechnology, and bioinformatics;

(F) research ethical considerations, laws, and regulations for biotechnological applications such as bioinformatics, genetic engineering, and nanotechnology; and

(G) identify the function of laboratory equipment, including a microscope, thermocycler, pH meter, hot plate stirrer, electronic balance, autoclave, centrifuge, transilluminator, micropipette, incubator, electrophoresis unit, vortex mixer, water bath, laboratory glassware, biosafety cabinet, and chemical fume hood.

§127.779. Biotechnology I (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: one credit in biology. Recommended prerequisites: Principles of Bioscience and one credit in chemistry. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services such as laboratory and testing services and research and development services.

(3) In Biotechnology I, students will apply advanced academic knowledge and skills to the emerging fields of biotechnology such as agricultural, medical, regulatory, and forensics. Students will have the opportunity to use sophisticated laboratory equipment, perform statistical analysis, and practice quality-control techniques. Students will conduct laboratory and field investigations and make informed decisions using critical thinking, scientific problem solving, and the engineering design process. Students in Biotechnology I will study a variety of topics that include structures and functions of cells, nucleic acids, proteins, and genetics.

(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(5) Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(6) Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models

(7) Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(8) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(9) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(10) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession;

(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome;

(C) present written and oral communication in a clear, concise, and effective manner;

(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results; and

(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed.

(2) The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as microscopes, thermocyclers, pH meters, hot plate stirrers, glass bulb thermometers, timing devices, electronic balances, vortex mixers, autoclaves, micropipettes, centrifuges, gel and capillary electrophoresis units, cameras, data collection probes, spectrophotometers, transilluminators, incubators, water baths, laboratory glassware, biosafety cabinets, and chemical fume hoods;

(E) collect quantitative data using the International System of Units (SI) and United States customary units and qualitative data as evidence;

(F) organize quantitative and qualitative data using laboratory notebooks, written lab reports, graphs, charts, tables, digital tools, diagrams, scientific drawings, and student-prepared models;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(3) The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(4) The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(5) The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists and engineers as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a STEM field.

(6) The student explores the emerging field of biotechnology. The student is expected to:

(A) define biotechnology and provide examples of biotechnology products such as recombinant proteins, fermented foods, biopharmaceuticals, and genetically modified foods;

(B) compare applications of bioinformatics such as deoxyribonucleic acid (DNA) barcoding, sequencing, National Center for Biotechnology Information (NCBI) tools, ClinVar, Genemonon Mastermind, genetic testing, phylogenetic relationships, and the use of online databases;

(C) research and identify career opportunities in genetics, bioinformatics, and in fields such as molecular, forensic, medical, regulatory, and agricultural biotechnology;

(D) identify significant contributions of diverse scientists to biotechnology and explain their impact on society;

(E) define bioethics and evaluate the applications of bioethics;

(F) evaluate different points of view about issues and current events in biotechnology;

(G) identify applications in agricultural biotechnology such as genetically modified organisms (GMOs), plant propagation from tissue culturing, and aquaculture hydroponics;

(H) identify applications in medical biotechnology such as vaccines production, stem cells therapy, gene therapy, pharmaceutical production, pharmacogenetics, genomics, synthetic biology, and personalized medicine;

(I) identify applications in forensic biotechnology such as capillary electrophoresis, real-time polymerase chain reaction, DNA fingerprinting, restriction fragment length polymorphisms (RFLP) analysis, toxicology, and serology; and

(J) identify solutions to waste through bioremediation and non-biotechnological standard solutions such as landfills, incineration, absorbent materials, and catalytic materials.

(7) The student summarizes biotechnology laboratory procedures and their applications in the biotechnology industry. The student is expected to:

(A) identify the major sectors of the biotechnology industry such as medical and pharmaceutical, agricultural, industrial, forensic, and research and development;

(B) identify the biotechnology laboratory procedures used in each sector such as selective breeding, genetic engineering, DNA analysis, and protein analysis; and

(C) compare and contrast the different applications used in biotechnology laboratory procedures of each sector.

(8) The student understands the role of genetics in the biotechnology industry. The student is expected to:

(A) explain terms related to molecular biology, including nucleic acids, nitrogen bases, nucleotides, mRNA, rRNA, tRNA, ribosomes, amino acids, transcription, translation, polymerase, and protein synthesis;

(B) compare and contrast the structures and functions of DNA and ribonucleic acid (RNA), including nitrogen bases, nucleotides, the helical nature of DNA, and hydrogen bonding between purines and pyrimidines;

(C) distinguish between nuclear and mitochondrial DNA and their gamete sources;

(D) describe the DNA replication process in eukaryotic and prokaryotic cells, including leading and lagging strands and Okazaki fragments;

(E) illustrate the process of protein synthesis, including ribosomal subunits and the role of tRNA;

(F) describe the structures and functions of proteins, including three-dimensional folding, enzymes, and antibodies;

(G) explain the molecular structures of genes, including enhancers, promoters, exons, introns, and coding regions;

(H) describe the different types of mutations, including inversions, deletions, duplications, and substitutions;

(I) explain the effects of mutation types on phenotype and gene function; and

(J) describe unique elements of the molecular structure of a chromosome such as short tandem repeats (STR), transposons, and methylation and acetylation of DNA.

(9) The student analyzes the importance of recombinant DNA technology and genetic engineering. The student is expected to:

(A) describe the fundamental steps in recombinant DNA technology;

(B) explain how recombinant DNA technology such as nuclear transfer cloning is used to clone genes and create recombinant proteins;

(C) explain the role of tissue cultures in genetic modification procedures;

(D) describe plant- and animal-tissue culture procedures;

(E) compare and contrast growing conditions for plant and animal tissue cultures;

(F) explain the role of restriction enzymes; and

(G) distinguish between vectors commonly used in biotechnology for DNA insertion, including plasmids, adenoviruses, retroviruses, and bacteriophages.

(10) The student examines federal, state, local, and industry regulations as related to biotechnology. The student is expected to:

(A) discuss the relationship between the local, state, and federal agencies responsible for regulation of the biotechnology industry such as the U.S. Department of Agriculture (USDA), the Environmental Protection Agency (EPA), the U.S. Food and Drug Administration (FDA), and the Centers for Disease Control and Prevention (CDC); and

(B) analyze policies and procedures used in the biotechnology industry such as quality assurance, standard operating procedures (SOPs), Good Manufacturing Practices (GMPs), and International Organization for Standardization (ISO) quality systems.

(11) The student performs biotechnology laboratory procedures. The student is expected to:

(A) measure volumes and weights to industry standards with accuracy and precision;

(B) analyze data and perform calculations and statistical analysis as it relates to biotechnology laboratory experiments;

(C) demonstrate proficiency in pipetting techniques;

(D) identify microorganisms using staining methods such as the Gram stain, methylene-blue stain, and acid-fast staining;

(E) prepare a restriction digest, isolate nucleic acids, and evaluate results using techniques such as gel and capillary electrophoresis, Northern blot analysis, and Southern blot analysis;

(F) explain the importance of media components to the outcome of cultures;

(G) isolate, maintain, and store microbial cultures safely;

(H) prepare seed inoculum; and

(I) perform plating techniques such as streak plating, spread plating, and the Kirby-Bauer method.

(12) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:

(A) demonstrate aseptic techniques for establishing and maintaining a sterile work area;

(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions;

(C) calculate and prepare a dilution series; and

(D) determine optimum conditions of reagents for experimentation.

(13) The student conducts quality-control analysis while performing biotechnology laboratory procedures. The student is expected to:

(A) perform validation testing on laboratory reagents and equipment; and

(B) analyze data and perform calculations and statistical analysis on results of quality-control samples.

§127.780. Biotechnology II (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: [~~**Biotechnology I and**~~] one credit in chemistry **and Biotechnology I** . **This course satisfies a high school science graduation requirement.** Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services such as laboratory and testing services and research and development services.

(3) Biotechnology II has the components of any rigorous scientific or bioengineering program of study. This course applies the standard skills mastered in Biotechnology I and includes additional skills related to assay design, protein analysis, applications of genetic engineering, and quality management. After taking this course, students should be prepared for entry-level lab technician jobs.

(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(5) Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(6) Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

(7) Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(8) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(9) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(10) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession;

(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome;

(C) present written and oral communication in a clear, concise, and effective manner;

(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results; and

(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed.

(2) The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as microscopes, thermocyclers, pH meters, hot plate stirrers, glass bulb thermometers, timing devices, electronic balances, vortex mixers, autoclaves, micropipettes, centrifuges, gel and capillary electrophoresis units, cameras, data collection probes, spectrophotometers, transilluminators, incubators, water baths, laboratory glassware, biosafety cabinets, and chemical fume hoods;

(E) collect quantitative data using the International System of Units (SI) and United States customary units and qualitative data as evidence;

(F) organize quantitative and qualitative data using laboratory notebooks, written lab reports, graphs, charts, tables, digital tools, diagrams, scientific drawings, and student-prepared models;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(3) The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(4) The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(5) The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists and engineers as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a STEM field.

(6) The student prepares for an entry-level career in biotechnology. The student is expected to:

(A) research and identify career opportunities in genetics, bioinformatics, and fields such as molecular, forensic, medical, regulatory, and agricultural biotechnology;

(B) identify the significance of recent advances in molecular, forensic, medical, regulatory, and agricultural biotechnology;

(C) discuss current bioethical issues related to the field of biotechnology;

(D) create a job-specific resume; and

(E) develop a career plan.

(7) The student analyzes academic and professional journals and technical reports. The student is expected to:

(A) identify the scientific methodology used by a researcher;

(B) examine a prescribed research design and identify dependent and independent variables;

(C) evaluate a prescribed protocol to determine the purpose for each of the procedures performed; and

(D) interpret data and evaluate conclusions.

(8) The student explores assay design in the field of biotechnology. The student is expected to:

(A) define assay requirements and optimizations;

(B) perform statistical analysis on assay design and experimental data such as linearity, system sustainability, limit of detection, and R2 values;

(C) determine an unknown protein concentration using a standard curve and technique such as a Bradford assay; and

(D) evaluate enzyme kinetics using a colorimetric assay.

(9) The student explores applications related to protein expression in the field of biotechnology. The student is expected to:

(A) describe the fundamental steps in recombinant deoxyribonucleic acid (DNA) technology;

(B) produce a recombinant protein such as green fluorescent protein (GFP);

(C) analyze proteins using techniques such as enzyme-linked immunosorbent assay (ELISA), spectrophotometry, and sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE); and

(D) isolate a specific protein from a biological sample using techniques such as chromatography and Western blot analysis.

(10) The student explores applications of recombinant DNA technology and genetic engineering. The student is expected to:

(A) prepare and maintain tissue cultures commonly used in genetic modification procedures;

(B) evaluate the effects of changes to growing conditions such as pH, temperature, and growth media;

(C) evaluate the results of a bacterial transformation using a restriction enzyme digest and Southern blot analysis;

(D) compare and contrast vectors commonly used in biotechnology applications, including plasmids, adenoviruses, retroviruses, and bacteriophages;

(E) explain the steps and components of the polymerase chain reaction (PCR); and

(F) explain applications of CRISPR/Cas9 technology in gene editing and diagnostics.

(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:

(A) demonstrate aseptic techniques for establishing and maintaining a sterile work area;

(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions;

(C) calculate and prepare a dilution series;

(D) determine acceptability and optimum conditions of reagents for experimentation; and

(E) prepare multi-component solutions of given molarity or concentration and volume.

(12) The student investigates the role of quality in the biotechnology industry, The student is expected to:

(A) describe the product pipeline in the biotechnology industry;

(B) describe the importance of quality assurance and quality control;

(C) explain the importance of documentation to quality assurance and quality control;

(D) describe the importance of corrective and preventive action (CAPA);

(E) describe Quality Management Systems (QMS) components, including inspection, audit, surveillance, and prevention;

(F) describe Good Manufacturing Practices (GMP), Good Clinical Practices (GCP), Good Documentation Practices (GDP), Good Lab Practices (GLP), and International Organization for Standardization (ISO);

(G) perform validation testing on laboratory reagents and equipment;

(H) analyze data and perform calculations and statistical analysis on results of quality-control samples such as standard deviation and percent error; and

(I) apply and create industry protocols such as laboratory method protocols, standard operating procedures (SOPs), and validation forms.

§127.781. Principles of Applied Engineering (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 9 and 10. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.

(3) Principles of Applied Engineering provides an overview of the various fields of science, technology, engineering, and mathematics and their interrelationships. Students develop engineering communication skills, which include computer graphics, modeling, and presentations, by using a variety of computer hardware and software applications to complete assignments and projects. Upon completing this course, students will have an understanding of the various fields of engineering and be able to make informed career decisions.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate knowledge of how to dress, speak, and conduct oneself in a manner appropriate for the profession;

(B) cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome;

(C) present written and oral communication in a clear, concise, and effective manner;

(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results; and

(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks.

(2) The student investigates the components of engineering and technology systems. The student is expected to:

(A) investigate and report on the history of engineering disciplines, including chemical, civil, electrical, and mechanical engineering;

(B) identify the inputs, processes, and outputs associated with technological systems;

(C) describe the difference between open and closed systems;

(D) describe how technological systems interact to achieve common goals;

(E) compare engineering, science, and technology career paths, including entry-level employment, military service, apprenticeships, community and technical colleges, and universities;

(F) conduct and present research on emerging and innovative technology; and

(G) demonstrate proficiency of the engineering design process.

(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:

(A) use clear and concise written, verbal, and visual communication techniques;

(B) maintain a design and computation engineering notebook;

(C) develop and present ideas using sketching and computer-aided design and drafting (CADD);

(D) draw conclusions using industry-standard visualization techniques and media;

(E) maintain a paper or digital portfolio using the engineering documentation process; and

(F) use collaborative tools such as desktop or web-based applications to share and develop information.

(4) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:

(A) master relevant safety tests;

(B) follow lab safety guidelines as prescribed by instructor in compliance with local, state, and federal regulations;

(C) identify industry safety terminology related to the personal work environment such as Occupational Safety and Health Administration (OSHA), American Society of Mechanical Engineers (ASME), and personal protective equipment (PPE);

(D) recognize the classification of hazardous materials and wastes;

(E) describe appropriate ways to dispose of hazardous materials and wastes;

(F) maintain, safely handle, and properly store laboratory equipment;

(G) describe the implications of negligent or improper maintenance; and

(H) demonstrate the use of precision measuring instruments.

(5) The student describes the factors that affect the progression of technology and analyzes the potential intended and unintended consequences of technological advances. The student is expected to:

(A) describe how technology has affected individuals, societies, cultures, economies, and environments;

(B) describe how the development and use of technology influenced past events;

(C) describe how and why technology progresses; and

(D) predict possible changes caused by the advances of technology.

(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:

(A) identify and describe an engineering design process needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project;

(B) identify the chemical, mechanical, and physical properties of engineering materials and identify testing methods associated with the materials;

(C) use problem-solving techniques to develop technological solutions such as product, process, or system;

(D) use consistent units for all measurements and computations; and

(E) assess the risks and benefits of a design solution.

(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:

(A) describe applications of robotics, process control, and automation systems;

(B) apply design concepts to problems in robotics, process control, and automation systems;

(C) identify fields and career opportunities related to robotics, process control, and automation systems; and

(D) identify emerging trends in robotics, process control, and automation systems.

(8) The student understands the opportunities and careers in fields related to electrical and mechanical systems. The student is expected to:

(A) describe the applications of electrical and mechanical systems;

(B) describe career opportunities in electrical and mechanical systems;

(C) identify emerging trends in electrical and mechanical systems; and

(D) describe and apply basic electronic theory.

(9) The student collaborates as a team member while completing a comprehensive project. The student is expected to:

(A) apply the design process, including decision matrices, as a team participant;

(B) perform different roles within the project as a team member;

(C) formulate decisions using collaborative strategies such as decision and design matrices and conflict resolution;

(D) maintain an engineering notebook for the project;

(E) develop and test the model for the project; and

(F) demonstrate communication skills by preparing and presenting the project, including building consensus setback resolution and decision matrices.

(10) The student demonstrates a knowledge of drafting by completing a series of drawings that can be published by various media. The student is expected to:

(A) set up, create, and modify drawings;

(B) store and retrieve geometry;

(C) demonstrate and use appropriate line types in engineering drawings;

(D) draw two-dimensional, single-view objects;

(E) create multi-view working drawings using orthographic projection;

(F) dimension objects using current American National Standards Institute (ANSI) standards;

(G) draw single-line two-dimensional pictorial representations; and

(H) create working drawings that include section views.

(11) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:

(A) identify and define an engineering problem;

(B) formulate goals, objectives, and requirements to solve an engineering problem;

(C) determine the design parameters such as materials, personnel, resources, funding, manufacturability, feasibility, and time associated with an engineering problem;

(D) establish and evaluate potential constraints, including health, safety, social, environmental, ethical, political, regulatory, and legal, pertaining to a problem;

(E) identify or create alternative solutions to a problem using a variety of techniques such as brainstorming, reverse engineering, and researching engineered and natural solutions;

(F) test and evaluate proposed solutions using **engineering** methods such as creating models, prototypes, mock-ups, or simulations or performing critical design review, statistical analysis, or experiments;

(G) apply structured techniques such as a decision tree, design matrix, or cost-benefit analysis to select and justify a preferred solution to a problem;

(H) predict performance, failure modes, and reliability of a design solution; and

(I) prepare a project report that clearly documents the designs, decisions, and activities during each phase of the engineering design process.

§127.782. Engineering Science (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 10-12. Prerequisites: Algebra I **, [~~and~~]** one credit in biology **, and at least one credit in a course from the science, technology, engineering, and mathematics career cluster** . Recommended prerequisite**s**: Geometry, Integrated Physics and Chemistry (IPC), one credit in chemistry, or one credit in physics. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.

(3) Engineering Science is an engineering course designed to expose students to some of the major concepts and technologies that they will encounter in a postsecondary program of study in any engineering domain. Students will have an opportunity to investigate engineering and high-tech careers. In Engineering Science, students will employ science, technology, engineering, and mathematical concepts in the solution of real-world challenge situations. Students will develop problem-solving skills and apply their knowledge of research and design to create solutions to various challenges. Students will also learn how to document their work and communicate their solutions to their peers and members of the professional community.

(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(5) Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(6) Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

(7) Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(8) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(9) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(10) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession;

(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome;

(C) present written and oral communication in a clear, concise, and effective manner;

(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results; and

(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed.

(2) The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as dial caliper, micrometer, protractor, compass, scale rulers, multimeter, and circuit components;

(E) collect quantitative data using the International System of Units (SI) and United States customary units and qualitative data as evidence;

(F) organize quantitative and qualitative data using spreadsheets, engineering notebooks, graphs, and charts;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(3) The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(4) The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(5) The student knows the contributions of scientists and engineers and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists and engineers as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a STEM field.

(6) The student investigates engineering-related fields and career opportunities. The student is expected to:

(A) differentiate between engineering and engineering technology;

(B) compare the roles or job descriptions for career opportunities in the fields of pure science, engineering, and engineering technology;

(C) identify and differentiate between the different engineering disciplines; and

(D) demonstrate appropriate oral, written, and visual forms of technical communication.

(7) The student demonstrates an understanding of design problems and works individually and as a member of a team to solve design problems. The student is expected to:

(A) solve design problems individually and in a team;

(B) create solutions to existing problems using a design process;

(C) use a design brief to identify problem specifications and establish project constraints;

(D) use communication to achieve a desired goal within a team; and

(E) work as a member of a team to conduct research to develop a knowledge base, stimulate creative ideas, and make informed decisions.

(8) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:

(A) explain the purpose and operation of components, including gears, sprockets, pulley systems, and simple machines;

(B) explain how components, including gears, sprockets, pulley systems, and simple machines, make up mechanisms;

(C) distinguish between the six simple machines and their attributes and components;

(D) measure forces and distances related to a mechanism;

(E) calculate work and power in mechanical systems;

(F) determine experimentally the efficiency of mechanical systems; and

(G) calculate mechanical advantage and drive ratios of mechanisms.

(9) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:

(A) identify and categorize energy sources as nonrenewable, renewable, or inexhaustible;

(B) define and calculate work and power in electrical systems;

(C) calculate and explain how power in a system converts energy from electrical to mechanical; and

(D) define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law.

(10) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships between material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:

(A) explain the purpose of energy management;

(B) evaluate system energy requirements in order to select the proper energy source;

(C) explain and design how multiple energy sources can be combined to convert energy into useful forms;

(D) describe how hydrogen fuel cells create electricity and heat and how solar cells create electricity;

(E) measure and analyze how thermal energy is transferred via convection, conduction, and radiation;

(F) analyze how thermal energy transfer is affected by conduction, thermal resistance values, convection, and radiation; and

(G) calculate resistance, efficiency, and power transfer in power transmission and distribution applications for various material properties.

(11) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:

(A) illustrate, calculate, and experimentally measure all forces acting upon a given body;

(B) locate the centroid of structural members mathematically or experimentally;

(C) calculate moment of inertia of structural members;

(D) define and calculate static equilibrium;

(E) differentiate between scalar and vector quantities;

(F) identify properties of a vector, including magnitude and direction;

(G) calculate the X and Y components given a vector;

(H) calculate moment forces given a specified axis;

(I) calculate unknown forces using equations of equilibrium; and

(J) calculate external and internal forces in a statically determinate truss using translational and rotational equilibrium equations.

(12) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:

(A) conduct investigative non-destructive material property tests on selected common household products;

(B) calculate and measure the weight, volume, mass, density, and surface area of selected common household products; and

(C) identify the manufacturing processes used to create selected common household products.

(13) The student uses material testing to determine a product's function and performance. The student is expected to:

(A) use a design process and mathematical formulas to solve and document design problems;

(B) obtain measurements of material samples such as length, width, height, and mass;

(C) use material testing to determine a product's reliability, safety, and predictability in function;

(D) identify and calculate test sample material properties using a stress-strain curve; and

(E) identify and compare measurements and calculations of sample material properties such as elastic range, proportional limit, modulus of elasticity, elastic limit, resilience, yield point, plastic deformation, ultimate strength, failure, and ductility using stress-strain data points.

(14) The student understands that control systems are designed to provide consentient process control and reliability and uses computer software to create flowcharts and control system operating programs. The student is expected to:

(A) create detailed flowcharts using a computer software application;

(B) create control system operating programs using computer software;

(C) create system control programs that use flowchart logic;

(D) select appropriate input and output devices based on the need of a technological system; and

(E) judge between open- and closed-loop systems in order to select the most appropriate system for a given technological problem.

(15) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:

(A) identify and explain basic components and functions of fluid power devices;

(B) differentiate between pneumatic and hydraulic systems and between hydrodynamic and hydrostatic systems;

(C) use Pascal's Law to calculate values in a fluid power system;

(D) distinguish between gauge pressure and absolute pressure and between temperature and absolute temperature;

(E) calculate values in a pneumatic system using the ideal gas laws; and

(F) calculate and experiment with flow rate, flow velocity, and mechanical advantage in a hydraulic system model.

(16) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:

(A) calculate and test the theoretical probability that an event will occur;

(B) calculate the experimental frequency distribution of an event occurring;

(C) apply the Bernoulli process to events that only have two distinct possible outcomes;

(D) apply AND, OR, and NOT logic to solve complex probability scenarios;

(E) apply Bayes's theorem to calculate the probability of multiple events occurring;

(F) calculate the central tendencies of a data array, including mean, median, and mode;

(G) calculate data variations, including range, standard deviation, and variance; and

(H) create and explain a histogram to illustrate frequency distribution.

(17) The student demonstrates an understanding of kinematics in one and two dimensions and applies the concepts to real-world engineering design problems. The student is expected to:

(A) calculate distance, displacement, speed, velocity, and acceleration from data;

(B) calculate experimentally the acceleration due to gravity given data from a free-fall device;

(C) calculate the X and Y components of an object in projectile motion; and

(D) determine and test the angle needed to launch a projectile a specific range given the projectile's initial velocity.

§127.785. Engineering Design and Problem Solving (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Algebra I **, [~~and~~]** Geometry **, and at least one credit in a Level 2 or higher course in the science, technology, engineering, and mathematics career cluster** . **[~~Recommended prerequisites: two credits from the Science, Technology, Engineering, and Mathematics (STEM) Career Cluster.~~]** This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The STEM Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.

(3) The Engineering Design and Problem Solving course is the creative process of solving problems by identifying needs and then devising solutions. The solution may be a product, technique, structure, or process depending on the problem. Science aims to understand the natural world, while engineering seeks to shape this world to meet human needs and wants. Engineering design takes into consideration limiting factors or "design under constraint." Various engineering disciplines address a broad spectrum of design problems using specific concepts from the sciences and mathematics to derive a solution. The design process and problem solving are inherent to all engineering disciplines.

(4) Engineering Design and Problem Solving reinforces and integrates skills learned in previous mathematics and science courses. This course emphasizes solving problems, moving from well-defined toward more open-ended, with real-world application. Students will apply critical-thinking skills to justify a solution from multiple design options. Additionally, the course promotes interest in and understanding of career opportunities in engineering.

(5) This course is intended to stimulate students' ingenuity, intellectual talents, and practical skills in devising solutions to engineering design problems. Students use the engineering design process cycle to investigate, design, plan, create, and evaluate solutions. At the same time, this course fosters awareness of the social and ethical implications of technological development.

(6) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(7) Scientific hypotheses and theories. Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(8) Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

(9) Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(10) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(11) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(12) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession;

(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome;

(C) present written and oral communication in a clear, concise, and effective manner;

(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results; and

(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed.

(2) The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as dial caliper, micrometer, protractor, compass, scale rulers, multimeter, and circuit components;

(E) collect quantitative data using the International System of Units (SI) and United States customary units and qualitative data as evidence;

(F) organize quantitative and qualitative data using spreadsheets, engineering notebooks, graphs, and charts;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(3) The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(4) The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(5) The student knows the contributions of scientists and engineers and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists and engineers as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a STEM field.

(6) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:

(A) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials; and

(B) draw inferences based on data related to promotional materials for products and services.

(7) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:

(A) select appropriate mathematical models to develop solutions to engineering design problems;

(B) integrate advanced mathematics and science skills as necessary to develop solutions to engineering design problems;

(C) judge the reasonableness of mathematical models and solutions;

(D) investigate and apply relevant chemical, mechanical, biological, electrical, and physical properties of materials to engineering design problems;

(E) identify the inputs, processes, outputs, control, and feedback associated with open and closed systems;

(F) describe the difference between open-loop and closed-loop control systems;

(G) evaluate different measurement tools such as dial caliper, micrometer, protractor, compass, scale rulers, and multimeter, make measurements with accuracy and precision, and specify tolerances; and

(H) use conversions between measurement systems to solve real-world problems.

(8) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:

(A) communicate visually by sketching and creating technical drawings using established engineering graphic tools, techniques, and standards;

(B) read and comprehend technical documents, including specifications and procedures;

(C) prepare written documents such as memorandums, emails, design proposals, procedural directions, letters, and technical reports using the formatting and terminology conventions of technical documentation;

(D) organize information for visual display and analysis using appropriate formats for various audiences, including technical drawings, graphs, and tables such as file conversion and appropriate file types, in order to collaborate with a wider audience;

(E) evaluate the quality and relevance of sources and cite appropriately; and

(F) defend a design solution in a presentation.

(9) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:

(A) identify and describe career options, working conditions, earnings, and educational requirements of various engineering disciplines such as those listed by the Texas Board of Professional Engineers;

(B) recognize that engineers are guided by established codes emphasizing high ethical standards;

(C) explore the differences, similarities, and interactions between engineers, scientists, and mathematicians;

(D) describe how technology has evolved in the field of engineering and consider how it will continue to be a useful tool in solving engineering problems;

(E) discuss the history and importance of engineering innovation on the U.S. economy and quality of life; and

(F) describe the importance of patents and the protection of intellectual property rights.

(10) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:

(A) identify and define an engineering problem;

(B) formulate goals, objectives, and requirements to solve an engineering problem;

(C) determine the design parameters associated with an engineering problem such as materials, personnel, resources, funding, manufacturability, feasibility, and time;

(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal;

(E) identify or create alternative solutions to a problem using a variety of techniques such as brainstorming, reverse engineering, and researching engineered and natural solutions;

(F) test and evaluate proposed solutions using methods such as creating models, prototypes, mock-ups, or simulations or performing critical design review, statistical analysis, or experiments;

(G) apply structured techniques to select and justify a preferred solution to a problem such as a decision tree, design matrix, or cost-benefit analysis;

(H) predict performance, failure modes, and reliability of a design solution; and

(I) prepare a project report that clearly documents the designs, decisions, and activities during each phase of the engineering design process.

(11) The student manages an engineering design project. The student is expected to:

(A) participate in the design and implementation of a real-world or simulated engineering project using project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project;

(B) develop a plan and project schedule for completion of a project;

(C) work in teams and share responsibilities, acknowledging, encouraging, and valuing contributions of all team members;

(D) compare and contrast the roles of a team leader and other team member responsibilities;

(E) identify and manage the resources needed to complete a project;

(F) use a budget to determine effective strategies to meet cost constraints;

(G) create a risk assessment for an engineering design project;

(H) analyze and critique the results of an engineering design project; and

(I) maintain an engineering notebook that chronicles work such as ideas, concepts, inventions, sketches, and experiments.

§127.786. Introduction to Computer-Aided Design and Drafting (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 9-12. Recommended Prerequisite: Principles of Applied Engineering, Principles of Architecture and Design, or Principles of Manufacturing. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.

(3) Introduction to Computer-Aided Design and Drafting (CADD) allows students to acquire knowledge and skills needed to use design software, including an introduction to CADD equipment and software selection and interfaces. Students gain skills in setting up a CADD workstation; upgrading a computer to run advanced CADD software; working with storage devices; storing, retrieving, backing-up, and sharing databases, file servers, and local area networks (LANs); and transferring drawing files over the internet.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) describe the roles, responsibilities, and dynamics of a team as applied in appropriate industry fields;

(B) explain employers' work expectations;

(C) use effective and accurate architectural or engineering vocabulary throughout design and drafting process;

(D) demonstrate knowledge of the concepts and skills related to health in the workplace; and

(E) demonstrate safety in the workplace as specified by appropriate governmental regulations.

(2) The student demonstrates knowledge of the CADD software. The student is expected to:

(A) describe computer-aided design, drafting, and CADD applications;

(B) demonstrate how to start and exit CADD software without corrupting files;

(C) use draw files;

(D) save, close, and open saved files;

(E) determine and specify drawing units and limits;

(F) describe and use the Cartesian coordinate system;

(G) use drawing snap and grid functions; and

(H) demonstrate the use of dynamic input and the command line.

(3) The student demonstrates the use of CADD tools for basic drawing and plotting. The student is expected to:

(A) draw objects using the line tool;

(B) draw circles, arcs, ellipses, and elliptical arcs;

(C) draw polylines, rectangles, donuts, and filled circles;

(D) draw true spline curves;

(E) create drawing templates;

(F) describe basic line conventions;

(G) create and manage layers;

(H) draw objects on separate layers;

(I) print and plot drawings;

(J) demonstrate organizational skills to influence the sequential process when creating drawings;

(K) construct geometric figures of lines, splines, circles, and arcs;

(L) create and edit text using appropriate style and size to annotate drawings;

(M) use control accuracy enhancement tools for entity positioning methods such as snap and xyz;

(N) use editing commands;

(O) use viewing commands to perform zooming and panning;

(P) plot drawings on media using layout and scale;

(Q) use query commands to interrogate database for entity characteristics, distance, area, and status;

(R) move, stretch, and offset objects;

(S) create a radius between objects;

(T) trim and extend objects;

(U) break and join objects;

(V) change object properties; and

(W) create hatching and manipulate properties such as calculating the area of an enclosed shape.

(4) The student demonstrates the use of CADD tools display and viewpoints. The student is expected to:

(A) create multiple viewpoints in the drawing window;

(B) select appropriate object snaps for various drawing tasks;

(C) create orthographic drawings;

(D) analyze challenges and identify solutions for design problems;

(E) investigate the use of space, scale, and environmental features to create three-dimensional form or the illusion of depth and form;

(F) prepare multi-view scaled drawings;

(G) select proper drawing scale, views, and layout;

(H) create drawings containing horizontal and vertical surfaces;

(I) create drawings containing circles and arcs;

(J) create removed details and conventional breaks using sectional drawing techniques;

(K) create assembly drawings;

(L) create detail drawings; and

(M) create technical drawings and title blocks associated with the different CAD drawings.

(5) The student demonstrates the use of software tools to properly create text within a CADD drawing. The student is expected to:

(A) use proper text standards for technical drawings;

(B) calculate drawing scale and text height using a scale ratio;

(C) apply text styles to enhance readability of drawings;

(D) demonstrate the use of tools to create multi-line text objects and single-line text;

(E) edit existing text; and

(F) create, insert, and modify tables.

(6) The student demonstrates the use of CADD editing tools within drawings. The student is expected to:

(A) draw chamfers and fillets;

(B) use editing tools to modify existing drawings;

(C) edit polylines and splines;

(D) move and copy objects;

(E) create mirror images and align objects; and

(F) scale and array objects.

(7) The student demonstrates the use of grips in drawings. The student is expected to:

(A) apply grips to stretch, move, rotate, scale, mirror, and copy objects;

(B) demonstrate the use of Quick Properties and the Properties palette to access CADD tools; and

(C) create selections by using the Quick Select dialog box.

(8) The student demonstrates the use of scale and dimension standards and practices. The student is expected to:

(A) apply standard dimensioning rules;

(B) draw scales and dimensions;

(C) create, edit, and manage dimension styles;

(D) add linear and angular dimensions to a drawing;

(E) draw datum and chain dimensions;

(F) dimension circles and arcs;

(G) control the appearance of existing dimensions and dimension text; and

(H) change dimension line spacing and alignment.

(9) The student creates and demonstrates standard blocks using tool palettes. The student is expected to:

(A) create and save text information blocks;

(B) insert blocks into a drawing;

(C) edit and update a block in a drawing;

(D) create blocks as a drawing file;

(E) construct and use a symbol library of blocks; and

(F) purge unused items from a drawing.

(10) The student prepares surface developments. The student is expected to:

(A) prepare developments of prisms, cylinders, cones, and pyramids;

(B) prepare developments of a transition piece; and

(C) prepare drawings involving intersecting pieces.

(11) The student designs and prepares basic architectural drawings. The student is expected to:

(A) solve design problems to gain new perspectives;

(B) apply critical-thinking and problem-solving skills to develop creative solutions for design problems;

(C) draw a site plan;

(D) draw a floor plan;

(E) draw interior and exterior elevations;

(F) draw a roof plan;

(G) prepare door and window schedules;

(H) draw wall sections;

(I) draw a plot plan; and

(J) draw an electrical and reflected ceiling plan.

(12) The student designs and prepares a technical drawing. The student is expected to:

(A) draw individual parts;

(B) draw the closed assembly drawings per the parts; and

(C) draw and explode the assembly with the parts list.

§127.787. Intermediate Computer-Aided Design and Drafting (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: Architectural Design I, Introduction to Computer-Aided Design and Drafting, or Engineering Design and Presentation I. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Science, Technology, Engineering, and Science (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.

(3) In Intermediate Computer-Aided Design and Drafting (CADD), students develop practices and techniques used in computer-aided drafting, emphasizing the development and use of prototype drawings, construction of pictorial drawings, construction of three-dimensional drawings, interfacing two-dimensional and three-dimensional environments, and extracting data. Basic rendering techniques will also be developed. Emphasis is placed on drawing set-up; creating and modifying geometry; storing and retrieving predefined shapes; placing, rotating, and scaling objects; adding text and dimensions; using layers and coordinating systems, as well as using input and output devices.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) describe the roles, responsibilities, and dynamics of a team as applied in appropriate industry fields;

(B) explain employers' work expectations;

(C) demonstrate knowledge of the concepts and skills related to health and safety in the workplace as specified by appropriate governmental regulations;

(D) evaluate and justify decisions based on ethical reasoning;

(E) evaluate alternative responses to workplace situations based on personal, professional, ethical, and legal responsibilities and employer policies;

(F) identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace;

(G) interpret and explain written organizational policies and procedures; and

(H) demonstrate personal responsibility, ethics, and integrity, including respect for intellectual property, when accessing information and creating design projects.

(2) The student demonstrates an understanding of CADD terminology, tools, and symbols. The student is expected to:

(A) apply the Cartesian Coordinate Systems to illustrate the application of Z coordinates;

(B) describe the CADD menu structure;

(C) differentiate between type-in commands, icons, and pulldown menus;

(D) manipulate the standard draw commands;

(E) demonstrate modifying commands;

(F) explain the various modes of viewing drawings; and

(G) define and modify dimension styles.

(3) The student produces hand sketches to organize ideas and communicate design ideas. The student is expected to:

(A) demonstrate the use of graphic descriptions;

(B) develop skill in sketching or mark making to plan, execute, and construct two-dimensional images and three-dimensional models;

(C) demonstrate methods of projection; and

(D) use proper drafting techniques to convert sketches into an electronic drawing using CADD.

(4) The student demonstrates an understanding of commands in a CADD system. The student is expected to:

(A) operate CADD software;

(B) demonstrate draw commands;

(C) modify drawn objects in CADD software;

(D) create two-dimensional and three-dimensional objects;

(E) convert two-dimensional drawings to three-dimensional drawings;

(F) convert three-dimensional drawings to two-dimensional drawings;

(G) prepare text blocks in CADD software;

(H) manipulate an external reference or file;

(I) import files of different formats into CADD;

(J) demonstrate the plot command in print or plot drawings; and

(K) import and export data using attributes.

(5) The student preforms computer-aided drafting functions. The student is expected to:

(A) create text styles, text justification, and multi-line text;

(B) create and use multi-leaders;

(C) edit dimensions;

(D) work with dimension styles;

(E) crosshatch objects;

(F) isolate and hide objects;

(G) use selection set methods;

(H) use rectangular, polar, and path arrays;

(I) use rotation reference angles;

(J) use elements of creativity and organizational principles to create visually coherent viewports and layouts;

(K) create and manage layers and properties;

(L) use page setup for plotting;

(M) create, insert, and edit reusable content such as symbols and blocks;

(N) use specific line types using the Standard Alphabet of Lines;

(O) create fills and gradients; and

(P) edit hatch patterns and fills.

(6) The student creates drawings using the CADD software. The student is expected to:

(A) translate hand sketches into CADD software;

(B) create projected mechanical drawings;

(C) create drawings with external references;

(D) complete a three-dimensional parametric model;

(E) organize a complex assembly, including an animated exploded assembly;

(F) compare various methods of drawing solids;

(G) construct a composite drawing using multiple drawings;

(H) justify correct drawing methods;

(I) draw lines, arcs, and circles to represent plans or mechanical assemblies;

(J) create text styles, text justification, and multi-line text;

(K) create and use multi-leaders;

(L) edit dimensions, including dimension styles;

(M) isolate and hide objects;

(N) use selection set methods;

(O) use elements of creativity and organizational principles to create visually coherent viewports and layouts;

(P) create and manage layers;

(Q) use page setup for plotting; and

(R) prepare multi-view drawings, including sectional and auxiliary views.

(7) The student creates electrical drawings. The student is expected to:

(A) prepare schematic drawings;

(B) prepare printed circuit board assembly drawing packages;

(C) prepare connection drawings;

(D) prepare interconnection drawings;

(E) prepare wiring drawings;

(F) prepare cable drawings and/or harness drawings;

(G) prepare component drawings; and

(H) prepare logic diagrams.

(8) The student creates mechanical drawings. The student is expected to:

(A) prepare fastener, cam, gear, spring, and bearing drawings;

(B) prepare detail drawings;

(C) prepare surface developments;

(D) prepare welding drawings;

(E) prepare bearing drawings;

(F) prepare casting drawings;

(G) prepare forging drawings;

(H) prepare tool drawings;

(I) prepare molding diagrams;

(J) prepare stamping drawings;

(K) prepare numerical-control drawings;

(L) modify drawings to include material specifications and parts list; and

(M) identify geometric tolerances and dimensioning of specific machined surfaces.

(9) The student prepares CADD project designs. The student is expected to:

(A) develop a floor plan depicting all elements of the building, including BIM (building information modeling);

(B) render a site plan that depicts all elements of the site;

(C) render exterior and interior elevations;

(D) draw a specified roof type within a plan;

(E) prepare door and window schedules;

(F) draw a wall and building section;

(G) draw an overall site plan;

(H) draw a building plot plan;

(I) review and revise plans throughout the design process to refine and achieve design objective;

(J) demonstrate flexibility and adaptability throughout the design process; and

(K) define a basic project materials list.

§127.788. Fundamentals of Computer Science (One Credit), Adopted 2021.

(a) General requirements. Students shall be awarded one credit for successful completion of this course. This course is recommended for students in Grades 7-12.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services such as laboratory and testing services and research and development services.

(3) Fundamentals of Computer Science is intended as a first course for those students just beginning the study of computer science. Students will learn about the computing tools that are used every day. Students will foster their creativity and innovation through opportunities to design, implement, and present solutions to real-world problems. Students will collaborate and use computer science concepts to access, analyze, and evaluate information needed to solve problems. Students will learn computational thinking, problem-solving, and reasoning skills that are the foundation of computer science. By using computer science knowledge and skills that support the work of individuals and groups in solving problems, students will select the technology appropriate for the task, synthesize knowledge, create solutions, and evaluate the results. Students will learn digital citizenship by researching current laws, regulations, and best practices and by practicing integrity and respect. Students will gain an understanding of the principles of computer science through the study of technology operations and concepts.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) Employability. The student identifies various employment opportunities in the computer science field. The student is expected to:

(A) identify job opportunities and accompanying job duties and tasks;

(B) examine the role of certifications, resumes, and portfolios in the computer science profession;

(C) employ effective technical reading and writing skills;

(D) employ effective verbal and non-verbal communication skills;

(E) solve problems and think critically;

(F) demonstrate leadership skills and function effectively as a team member;

(G) demonstrate an understanding of legal and ethical responsibilities in relation to the field of computer science;

(H) demonstrate planning and time-management skills; and

(I) compare university computer science programs.

(2) Creativity and innovation. The student develops products and generates new knowledge, understanding, and skills. The student is expected to:

(A) investigate and explore various career opportunities within the computer science field and report findings through various media;

(B) create algorithms for the solution of various problems;

(C) discuss methods and create and publish web pages using a web-based language such as HTML, Java Script, or XML; and

(D) use generally accepted design standards for spacing, fonts, and color schemes to create functional user interfaces, including static and interactive screens.

(3) Communication and collaboration. The student communicates and collaborates with peers to contribute to his or her own learning and the learning of others. The student is expected to:

(A) seek and respond to advice or feedback from peers, educators, or professionals when evaluating problem solutions;

(B) debug and solve problems using reference materials and effective strategies; and

(C) publish information in a variety of ways such as print, monitor display, web pages, or video.

(4) Critical thinking, problem solving, and decision making. The student uses appropriate strategies to analyze problems and design algorithms. The student is expected to:

(A) demonstrate the ability to insert external standalone objects such as scripts or widgets into web pages;

(B) demonstrate understanding of binary representation of data in computer systems, perform conversions between decimal and binary number systems, and count in binary number systems;

(C) identify a problem's description, purpose, and goals;

(D) demonstrate coding proficiency in a programming language by developing solutions that create stories, games, and animations;

(E) identify and use the appropriate data type to properly represent the data in a program problem solution;

(F) demonstrate an understanding of and use variables within a programmed story, game, or animation;

(G) demonstrate proficiency in the use of arithmetic operators to create mathematical expressions, including addition, subtraction, multiplication, real division, integer division, and modulus division;

(H) demonstrate an understanding of and use sequence within a programmed story, game, or animation;

(I) demonstrate an understanding of and use conditional statements within a programmed story, game, or animation;

(J) demonstrate an understanding of and use iteration within a programmed story, game, or animation;

(K) use random numbers within a programmed story, game, or animation; and

(L) test program solutions by investigating intended outcomes.

(5) Digital citizenship. The student explores and understands safety, legal, cultural, and societal issues relating to the use of technology and information. The student is expected to:

(A) discuss privacy and copyright laws/issues and model ethical acquisition of digital information by citing sources using established methods;

(B) compare various non-copyright asset sharing options such as open source, freeware, and public domain;

(C) demonstrate proper digital etiquette and knowledge of acceptable use policies when using networks;

(D) discuss the value of strong passwords and virus detection/prevention for privacy and security;

(E) discuss the impact of computing and computing-related advancements on society; and

(F) discuss how electronic media can affect reliability of information.

(6) Technology operations and concepts. The student understands technology concepts, systems, and operations as they apply to computer science. The student is expected to:

(A) demonstrate knowledge of the basic computer components, including a central processing unit (CPU), storage, and input/output devices;

(B) use system tools, including appropriate file management;

(C) demonstrate knowledge of different operating systems;

(D) describe the differences between an application and an operating system; and

(E) use various input, processing, output, and primary/secondary storage devices.

§127.789. Computer Science I (One Credit), Adopted 2021.

(a) General requirements. Students shall be awarded one credit for successful completion of this course. Required corequisite: Algebra I. This course is recommended for students in Grades 8-12.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services such as laboratory and testing services and research and development services.

(3) Computer Science I will foster students' creativity and innovation by presenting opportunities to design, implement, and present meaningful programs through a variety of media. Students will collaborate with one another, their instructor, and various electronic communities to solve the problems presented throughout the course. Through computational thinking and data analysis, students will identify task requirements, plan search strategies, and use computer science concepts to access, analyze, and evaluate information needed to solve problems. By using computer science knowledge and skills that support the work of individuals and groups in solving problems, students will select the technology appropriate for the task, synthesize knowledge, create solutions, and evaluate the results. Students will learn digital citizenship by researching current laws, regulations, and best practices and by practicing integrity and respect. Students will gain an understanding of the principles of computer science through the study of technology operations, systems, and concepts.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) Employability. The student identifies various employment opportunities in the computer science field. The student is expected to:

(A) identify job opportunities and accompanying job duties and tasks;

(B) examine the role of certifications, resumes, and portfolios in the computer science profession;

(C) employ effective technical reading and writing skills;

(D) employ effective verbal and non-verbal communication skills;

(E) solve problems and think critically;

(F) demonstrate leadership skills and function effectively as a team member;

(G) demonstrate an understanding of legal and ethical responsibilities in relation to the field of computer science;

(H) demonstrate planning and time-management skills; and

(I) compare university computer science programs.

(2) Communication and collaboration. The student communicates and collaborates with peers to contribute to his or her own learning and the learning of others. The student is expected to:

(A) participate in learning communities as a learner, initiator, contributor, and teacher/mentor; and

(B) seek and respond to advice from peers, educators, or professionals when evaluating quality and accuracy of the student's product.

(3) Programming style and presentation. The student utilizes proper programming style and develops appropriate visual presentation of data, input, and output. The student is expected to:

(A) create and properly label and display output;

(B) create interactive input interfaces, with relevant user prompts, to acquire data from a user such as console displays or Graphical User Interfaces (GUIs);

(C) write programs with proper programming style to enhance the readability and functionality of a code by using descriptive identifiers, internal comments, white space, spacing, indentation, and a standardized program style;

(D) format data displays using standard formatting styles; and

(E) display simple vector graphics using lines, circles, and rectangles.

(4) Critical thinking, problem solving, and decision making. The student uses appropriate strategies to analyze problems and design algorithms. The student is expected to:

(A) use program design problem-solving strategies to create program solutions;

(B) create a high-level program plan using a visual tool such as a flow chart or graphic organizer;

(C) identify the tasks and subtasks needed to solve a problem;

(D) identify the data types and objects needed to solve a problem;

(E) identify reusable components from existing code;

(F) design a solution to a problem;

(G) code a solution from a program design;

(H) identify error types, including syntax, lexical, run time, and logic;

(I) test program solutions with valid and invalid test data and analyze resulting behavior;

(J) debug and solve problems using error messages, reference materials, language documentation, and effective strategies;

(K) explore common algorithms such as finding greatest common divisor, finding the biggest number out of three, finding primes, making change, and finding the average;

(L) create program solutions that address basic error handling such as preventing division by zero and type mismatch;

(M) select the most appropriate construct for a defined problem;

(N) create program solutions by using the arithmetic operators to create mathematical expressions, including addition, subtraction, multiplication, real division, integer division, and modulus division;

(O) create program solutions to problems using available mathematics library functions or operators, including absolute value, round, power, square, and square root;

(P) develop program solutions that use assignment;

(Q) develop sequential algorithms to solve non-branching and non-iterative problems;

(R) develop algorithms to decision-making problems using branching control statements;

(S) develop iterative algorithms and code programs to solve practical problems;

(T) demonstrate proficiency in the use of the relational operators;

(U) demonstrate proficiency in the use of the logical operators; and

(V) generate and use random numbers.

(5) Digital citizenship. The student explores and understands safety, legal, cultural, and societal issues relating to the use of technology and information. The student is expected to:

(A) discuss intellectual property, privacy, sharing of information, copyright laws, and software licensing agreements;

(B) model ethical acquisition and use of digital information;

(C) demonstrate proper digital etiquette, responsible use of software, and knowledge of acceptable use policies;

(D) investigate measures, including strong passwords, pass phrases, and other methods of authentication, as well as virus detection/prevention for privacy and security; and

(E) investigate computing and computing-related advancements and the social and ethical ramifications of computer usage.

(6) Technology operations, systems, and concepts. The student understands technology concepts, systems, and operations as they apply to computer science. The student is expected to:

(A) demonstrate knowledge of major hardware components, including primary and secondary memory, a central processing unit (CPU), and peripherals;

(B) differentiate between current programming languages, discuss the general purpose for each language, and demonstrate knowledge of specific programming terminology and concepts and types of software development applications;

(C) differentiate between a high-level compiled language and an interpreted language;

(D) identify and use concepts of object-oriented design;

(E) differentiate between local and global scope access variable declarations;

(F) encapsulate data and associated subroutines into an abstract data type;

(G) create subroutines that do not return values with and without the use of arguments and parameters;

(H) create subroutines that return typed values with and without the use of arguments and parameters;

(I) create calls to processes passing arguments that match parameters by number, type, and position;

(J) compare data elements using logical and relational operators;

(K) identify and convert binary representation of numeric and nonnumeric data in computer systems using American Standard Code for Information Interchange (ASCII) or Unicode;

(L) identify finite limits of numeric data such as integer wrap around and floating point precision;

(M) perform numerical conversions between the decimal and binary number systems and count in the binary number system;

(N) choose, identify, and use the appropriate data types for integer, real, and Boolean data when writing program solutions;

(O) analyze the concept of a variable, including primitives and objects;

(P) represent and manipulate text data, including concatenation and other string functions;

(Q) identify and use the structured data type of one-dimensional arrays to traverse, search, and modify data;

(R) choose, identify, and use the appropriate data type or structure to properly represent the data in a program problem solution; and

(S) compare strongly typed and un-typed programming languages.

§127.790. Computer Science II (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 10-12. Prerequisites: Algebra I and Computer Science I or AP Computer Science Principles. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services such as laboratory and testing services and research and development services.

(3) Computer Science II will foster students' creativity and innovation by presenting opportunities to design, implement, and present meaningful programs through a variety of media. Students will collaborate with one another, their instructor, and various electronic communities to solve the problems presented throughout the course. Through computational thinking and data analysis, students will identify task requirements, plan search strategies, and use computer science concepts to access, analyze, and evaluate information needed to solve problems. By using computer science knowledge and skills that support the work of individuals and groups in solving problems, students will select the technology appropriate for the task, synthesize knowledge, create solutions, and evaluate the results. Students will gain an understanding of computer science through the study of technology operations, systems, and concepts.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) Employability. The student identifies various employment opportunities in the computer science field. The student is expected to:

(A) identify job opportunities and accompanying job duties and tasks;

(B) examine the role of certifications, resumes, and portfolios in the computer science profession;

(C) employ effective technical reading and writing skills;

(D) employ effective verbal and non-verbal communication skills;

(E) solve problems and think critically;

(F) demonstrate leadership skills and function effectively as a team member;

(G) identify legal and ethical responsibilities in relation to the field of computer science;

(H) demonstrate planning and time-management skills; and

(I) compare university computer science programs.

(2) Creativity and innovation. The student develops products and generates new understandings by extending existing knowledge. The student is expected to:

(A) use program design problem-solving strategies to create program solutions;

(B) read, analyze, and modify programs and their accompanying documentation such as an application programming interface (API), internal code comments, external documentation, or readme files;

(C) follow a systematic problem-solving process of identifying the purpose and goals, the data types and objects needed, and the subtasks to be performed;

(D) compare design methodologies and implementation techniques such as top-down, bottom-up, and black box;

(E) trace a program, including inheritance and black box programming;

(F) choose, identify, and use the appropriate abstract data type, advanced data structure, and supporting algorithms to properly represent the data in a program problem solution; and

(G) use object-oriented programming development methodology, data abstraction, encapsulation with information hiding, inheritance, and procedural abstraction in program development and testing.

(3) Communication and collaboration. The student communicates and collaborates with peers to contribute to his or her own learning and the learning of others. The student is expected to:

(A) use the principles of software development to work in software design teams;

(B) break a problem statement into specific solution requirements;

(C) create a program development plan;

(D) code part of a solution from a program development plan while a partner codes the remaining part;

(E) collaborate with a team to test a solution, including boundary and standard cases; and

(F) develop presentations to report the solution findings.

(4) Data literacy and management. The student locates, analyzes, processes, and organizes data. The student is expected to:

(A) utilize programming file structure and file access for required resources;

(B) acquire and process information from text files, including files of known and unknown sizes;

(C) manipulate data using string processing;

(D) manipulate data values by casting between data types;

(E) use the structured data type of one-dimensional arrays to traverse, search, modify, insert, and delete data;

(F) identify and use the structured data type of two-dimensional arrays to traverse, search, modify, insert, and delete data;

(G) identify and use a list object data structure to traverse, search, insert, and delete data; and

(H) differentiate between categories of programming languages, including machine, assembly, high-level compiled, high-level interpreted, and scripted.

(5) Critical thinking, problem solving, and decision making. The student uses appropriate strategies to analyze problems and design algorithms. The student is expected to:

(A) develop sequential algorithms using branching control statements, including nested structures, to create solutions to decision-making problems;

(B) develop choice algorithms using selection control statements based on ordinal values;

(C) demonstrate proficiency in the use of short-circuit evaluation;

(D) demonstrate proficiency in the use of Boolean algebra, including De Morgan's Law;

(E) develop iterative algorithms using nested loops;

(F) identify, trace, and appropriately use recursion in programming solutions, including algebraic computations;

(G) trace, construct, evaluate, and compare search algorithms, including linear searching and binary searching;

(H) identify, describe, trace, evaluate, and compare standard sorting algorithms, including selection sort, bubble sort, insertion sort, and merge sort;

(I) measure time/space efficiency of various sorting algorithms, including analyzing algorithms using "big-O" notation for best, average, and worst-case data patterns;

(J) develop algorithms to solve various problems such as factoring, summing a series, finding the roots of a quadratic equation, and generating Fibonacci numbers;

(K) test program solutions by investigating boundary conditions; testing classes, methods, and libraries in isolation; and performing stepwise refinement;

(L) identify and debug compile, syntax, runtime, and logic errors;

(M) compare algorithm efficiency of linear, quadratic, and recursive strategies by using informal runtime comparisons, exact calculation of statement execution counts, and theoretical efficiency values using "big-O" notation, including worst-case, best-case, and average-case time/space analysis of search and sort algorithms;

(N) demonstrate the ability to count, convert, and perform mathematical operations in the decimal, binary, octal, and hexadecimal number systems;

(O) demonstrate knowledge of the maximum integer boundary, minimum integer boundary, imprecision of real number representations, and round-off errors;

(P) create program solutions to problems using a mathematics library;

(Q) use random number generator algorithms to create simulations;

(R) use composition and inheritance relationships to identify and create class definitions and relationships;

(S) explain and use object relationships between defined classes, abstract classes, and interfaces;

(T) create object-oriented class definitions and declarations using variables, constants, methods, parameters, and interface implementations;

(U) create adaptive behaviors using polymorphism;

(V) use reference variables for object and string data types;

(W) use value and reference parameters appropriately in method definitions and method calls;

(X) implement access scope modifiers;

(Y) use object comparison for content quality;

(Z) duplicate objects using the appropriate deep or shallow copy;

(AA) apply functional decomposition to a program solution;

(BB) create objects from class definitions through instantiation; and

(CC) examine and mutate the properties of an object using accessors and modifiers.

§127.791. Computer Science III (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Computer Science II, Advanced Placement (AP) Computer Science A, or International Baccalaureate (IB) Computer Science. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services such as laboratory and testing services and research and development services.

(3) Computer Science III will foster students' creativity and innovation by presenting opportunities to design, implement, and present meaningful programs through a variety of media. Students will collaborate with one another, their instructor, and various electronic communities to solve the problems presented throughout the course. Through computational thinking and data analysis, students will identify task requirements, plan search strategies, and use computer science concepts to access, analyze, and evaluate information needed to solve problems. By using computer science knowledge and skills that support the work of individuals and groups in solving problems, students will select the technology appropriate for the task, synthesize knowledge, create solutions, and evaluate the results. Students will gain an understanding of advanced computer science data structures through the study of technology operations, systems, and concepts.

(4) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(5) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(c) Knowledge and skills.

(1) Employability. The student identifies various employment opportunities in the computer science field. The student is expected to:

(A) identify job opportunities and accompanying job duties and tasks;

(B) examine the role of certifications, resumes, and portfolios in the computer science profession;

(C) employ effective technical reading and writing skills;

(D) employ effective verbal and non-verbal communication skills;

(E) solve problems and think critically;

(F) demonstrate leadership skills and function effectively as a team member;

(G) demonstrate an understanding of legal and ethical responsibilities in relation to the field of computer science;

(H) demonstrate planning and time-management skills; and

(I) compare university computer science programs.

(2) Creativity and innovation. The student develops products and generates new understandings by extending existing knowledge. The student is expected to:

(A) apply object-oriented programming, including data abstraction, encapsulation, inheritance, and polymorphism, to manage complexity;

(B) design and implement a class hierarchy;

(C) read and write class specifications using visual organizers, including Unified Modeling Language;

(D) identify, describe, evaluate, compare, and implement standard sorting algorithms that perform sorting operations on data structures, including quick sort and heap sort; and

(E) identify and use the appropriate abstract data type, advanced data structure, and supporting algorithms to properly represent the data in a program problem solution.

(3) Communication and collaboration. The student communicates and collaborates with peers to contribute to his or her own learning and the learning of others. The student is expected to:

(A) use networked tools for file management and collaboration; and

(B) work in software design teams.

(4) Data literacy and management. The student locates, analyzes, processes, and organizes data. The student is expected to:

(A) identify and use two-dimensional ragged arrays to traverse, search, modify, insert, and delete data;

(B) describe and demonstrate proper linked list management, including maintaining the head and safe addition and deletion of linked objects;

(C) create or trace program solutions using a linked-list data structure, including unordered single, ordered single, double, and circular linked;

(D) describe composite data structures, including a linked list of linked lists;

(E) create or trace program solutions using stacks, queues, trees, heaps, priority queues, graph theory, and enumerated data types;

(F) create or trace program solutions using sets, including hash and tree-based data structures;

(G) create or trace program solutions using map style data structures; and

(H) write and modify text file data.

(5) Critical thinking, problem solving, and decision making. The student uses appropriate strategies to analyze problems and design algorithms. The student is expected to:

(A) evaluate expressions using bitwise operators;

(B) evaluate expressions using the ternary operator;

(C) identify, trace, and appropriately use recursion in programming solutions, including processing binary trees;

(D) create or trace program solutions using hashing;

(E) explore common algorithms such as matrix addition and multiplication, fractals, Towers of Hanoi, and magic square; and

(F) create program solutions that exhibit robust behavior by recognizing and avoiding runtime errors and handling anticipated errors.

(6) Testing and documentation. The student demonstrates appropriate documentation and testing practices. The student is expected to:

(A) use appropriate formatting and write documentation to support code maintenance, including pre- and post-condition statements;

(B) write program assumptions in the form of assertions;

(C) write a Boolean expression to test a program assertion; and

(D) construct assertions to make explicit program invariants.

(7) Practical application of technology. The student utilizes technology concepts, systems, and operations as they apply to computer science. The student is expected to:

(A) analyze and create computer program workflow charts and basic system diagrams, documenting system functions, features, and operations;

(B) gather requirements, design, and implement a process by which programs can interact with each other such as using interfaces;

(C) create simple programs using a low-level language such as assembly;

(D) create discovery programs in a high-level language;

(E) create scripts for an operating system;

(F) explore industry best practices for secure programming; and

(G) explore emerging industry or technology trends.